'Crushing The Stress': An Experimental Study on the Positive Impact of Casual Video Games in Indian Context

Vibhuti Gupta[1], Sunil Gupta[2], Asmita Jain[3]

[1]*Assistant Professor, Faculty of Management Studies, University of Delhi, India*
[2]*Assistant Professor, Department of Psychology, Aryabhatta College, University of Delhi, India*
[3]*Assistant Professor, JSS Hospital and Medical College, India*
Corresponding Author: Vibhuti Gupta, Email: vibhutigupta@fms.edu

KEYWORDS
casual video games, cognitive benefits, stress relief, repeated measures design.

ABSTRACT
Research on Casual Video Gaming in the Indian context are focused on exploring the negative ramifications of gameplay such as addiction and sedentary lifestyle effects. With the rise of video game interventions and increased use of casual games for cognitive training and stress relief in applied settings, there is a need to analyze the positive ramifications of casual video games in India. In this research study, two positive benefits of casual games are looked at: stress relief and cognitive benefits. The research is a repeated measures experimental design study that aims to examine these positive effects in contrast to an assigned control task. 30 participants, between the ages of 18-28 years act as their own controls. The study analyzes the impact of popular American casual game, Bejeweled Classic on stress; measured through blood pressure, heart-rate and state anxiety; and reaction time through the Stroop Task. The data was analyzed using a paired sample t-test. Results did not support the first hypothesis that casual video games reduce stress. The second benefit, however, that of cognitive benefits of casual games, was found to be statistically significant by a p value of 0.01. The study is useful in contributing to the literature of Indian studies that examine positive ramifications of casual games.

1. Introduction

Casual video games are defined as "Games that generally involve less complicated game controls and overall complexity in terms of gameplay or investment required to get through the game" (Wallace et. Al, 2006). This definition encompasses not just casual gameplay but also the casual attitude of the player, otherwise referred to as a 'casual gamer.' The main motivations expressed for casual video game play include "stress relief, keeping one's mind sharp or as a distraction from chronic pain and/or fatigue" (Pop Cap Games, 2006). Casual games are different from core games. Core games are games that require practice and skill building over time, and have been defined as "games developed for and delivered on a dedicated game console (set-top or handheld) as well as CD-ROM or DVD that generally involve more complicated game controls and overall complexity in terms of gameplay or investment required to get through game." (Wallace et. al, 2006).

1.1 Casual video games in India

There has been a surge in popularity of video games over the years, and a report on the emerging digital trends in India reports that "gaming and entertainment revives have increased significantly in the past few months, with new users being added every month" (KPMG, 2018). The rise in gaming is seen particularly high amongst smartphone users. The rise of smartphone gaming amongst adolescents is attributed to several actors: improved Internet access, portable payment options, and the ability for young Indians to have access to gaming and entertainment of their individual preference, as opposed to the family. A survey on gaming in India reveals several interesting observations about an average Indian gamer. An average Indian gamer is under 24 males (nearly 60% of the gamers are under 24, and 83% were found to be males), is introduced to online gaming through their family, friends and peer group, is primarily engaged in gaming for relieving stress and prefers puzzle, action and adventure games.

For more than 75% of the gamers, stress relief and social interaction were the main motives for gameplay. A different study outlines that 69% of users play games using applications and 43% use social media platforms (Ajjar, 2010). Research on gaming in India has mostly centered on the negative implications of gaming such as addiction. A review of mobile games in the Indian context leads to studies that discuss the negative impact of gaming: aggressive behavior, gaming addiction, maladjustment are the common themes that come up while reviewing articles related to mobile gaming. In a survey of leisure and lifestyle patterns amongst adolescents in

India, it was found that 58% of adolescents resorted to video gaming as a leisure activity. This was taken as a concern for health as playing video games is a sedentary activity (Singh and Misra, 2015). Similarly, associations are made between gaming and obese/overweight adolescent population (Shokeen and Aeri, 2017).

Addiction has also analyzed in context of loyalty towards a particular game, In a study conducted on 430 students from two major Indian universities, it was found that loyalty is a key component in maintaining addiction to mobile games and motivates in-app purchase intention/behavior (Balakrishnan and Griffiths, 2018). Another study on the trend of online gaming reveals that mobile games are used as the main platform for playing, with over 76 % people using mobile phones for gaming. This negative perception of smartphone uses and addiction has also resulted in some educational institutes banning the use of smartphones completely. Cases in point include the banning of mobile phones across college campuses by Orissa Government (2008), and banning of mobile phones in schools and colleges by Gujarat Government in 2008 as well, citing educational reasons (Goswami and Singh, 2018) .

On reviewing articles that discuss casual gaming in a positive light, in terms of psychological implications, only one paper was found. This paper argues that casual gameplay has the potential to offer stress relief to women, particularly working women. According to this study, women make up 74% of the casual gaming population, and several factors are behind this including affordability and short duration of gameplay, which makes the game an effective break from routine, leading to effective relaxation. Games here are contrasted with other stress relieving activities such as yoga, meditation- which require time and commitment and thus not opted by working women. This study, however has not been substantiated with any experimental research. (Kathawala et. al, 2018). The paper highlights 3 PopCap games: Bejeweled 2, Chuzzle and Bookworm Adventures. An emphasis is also made on cognitive benefits of such games by highlighting the role games play in improving concentration, coordination (due to reliance on hand-eye movements), and strategic thinking.

1.2 **Stress and Casual Video Games**

A review of the effect of casual video games in rstress reduction brings up evidence in favor of the hypothesis. In a study conducted to analyze gaming activity in India by KPMG, titled "Online gaming in India: Reaching a new pinnacle" (KPMG, 2017) it was found that social interaction and relieved stress are the main reasons for playing online games' for 75% of gamers in India. The study further reveals that stress reduction was responsible for engagement levels of 42% of the gamers (Nielsen Primary Survey, 2016). The definition of stress has evolved over the years. Initially, stress was perceived to be a purely physiological phenomenon, as proposed by Hans Selye who defined stress as a 'non-specific response of the body to any demand' (Selye, 1976). A cognitive approach was also developed by Lazarus who emphasized on the cognitive appraisal of the threat/demand with which the body is faced. He also stressed the importance of the emotion of feeling 'not in control'. (Lazarus, 1966). Lazarus and Folkman have devised a coping theory for stress alleviation based on the cognitive theory of stress. The cognitive theory implies that the way a stimulus is appraised by an individual is significant in generation of stress. Successful coping strategies aim at a positive reappraisal of the situation. This is termed as the transactional theory of coping. According to the transactional theory, coping involves "constantly changing cognitive and behavioral efforts to manage external and/or internal demands that are appraised as taxing or exceeding the resources of a person" (Lazarus and Folkman, 1984).

Casual video games have: have clear goals and rules, (2) adjustable feature action, (3) feedback of performance success level, and (4) are rich in visual, audio and tactile information, which enhances concentration. (Sherry, 2004). All of these provide ideal conditions that enhance arousal (creating excitement) while at the same time providing relaxation over continued gameplay. This is achieved by stabilizing the excitement levels by making the player play at a consistent difficulty level for a period of time. Thus, Casual Video Games offer a right balance of challenge and balance through easy, progressive gameplay (Buncher, 2013). Another theory that attempts to explain the effect of videogames on stress attributes the stress relieving aspect of gameplay to 4 factors namely psychological detachment from work (Sonnentag& Fritz, 2007)., relaxation, mastery experience and perceived control (Reinecke, 2009).

In his study on 1614 students, Reinecke (2009) found that games are "systematically used by students for recovery after a stressful experience, and that recovery experience is a part of the gaming experience." Several researches have been conducted that prove the above conclusion. In a randomized control trial study on the effects of casual video gaming vs guided meditation on stress reduction on 51 participants, of which 39 were females and 12 males, it was found that casual video gaming effects are similar to meditation/guided relaxation

in affecting negative affect, physiological arousal and perceived control and confidence. It is also found that the gains of gaming for positive affect were greater than meditation/guided relaxation. (Stanhope et. Al, 2015)

In another randomized controlled study, the effects of casual video games on stress and mood were assessed by comparing people playing casual video games with control subjects under similar conditions. It was noted that changes in Electroencephalography (EEG) during gameplay were consistent with increased positive mood. Moreover, heart rate variability (HRV) changes were consistent with autonomic nervous system relaxation or decreased physical stress. These findings suggest that Casual Video Games have a relaxing effect on gamers, indicating potential for stress reduction. (Russionello, 2009). These physiological effects are supported by another study on casual video gameplay in autistic children, where it was found that casual video games distract cortisol response to psychosocial stress (Yui, 2014). Later studies have tried applying these findings in the clinical set-up. In a randomized controlled study, effects of casual video gameplay were studied on a population suffering from depression, by comparing individuals in the experimental group, who were prescribed a Casual Video Game (CVG) to utilize over a one-month period, with a no-treatment control group. The experimental group was asked to play casual video games for 30 minutes, three times a week, for a month. Results indicated that the intervention was effective in lowering anxiety amongst the depressed subjects in the treatment group. The State Trait Anxiety Test was used as a measure of anxiety pre and post-intervention. (Fish, 2011). Moderate videogame play can contribute to positive emotions (Allahverdipour et al, 2010; Kutner& Olson 2008; Ryan et al, 2006; Przybylski et al, 2009; Wang et al, 2008), Emotional stability (Przybylski et al, 2011) and reduce emotional disturbances in children (Hull, 2009).

Bejeweled is a puzzle game that is quite popular in American population, and several studies utilize the game as an intervention in their studies. In a randomized controlled study, participants were randomly assigned to two groups: one was given the intervention of playing Bejeweled II for 20 minutes and the other was asked to surf the internet in order to test the hypothesis that the game could reduce stress. Significant changes were noted in heartrate variability in all parameters, moreover a significant increase in mood was also reported. "Positive changes in Anger; Vigor; Emotional Fatigue and Confusion were all significant when compared controls." (Russoniello, 2009)

1.3 **Cognition and Casual Video Games**

Another review conducted by Rahmani and Boren (Rahmani and Boren, 2012) reveals that video games improve cognitive abilities and visuospatial cognition. Positive effects were found on the cognitive, emotional and social development of children. In addition to spatial skills, scholars have also speculated that video games are an excellent means for developing problem-solving skills (Prensky, 2012). In an analysis of motivations for playing casual video games, it was found that "in terms of perceived benefits, young adults reported that they experience the cognitive benefits of feeling ''sharper'' and having better memory." It was also found that with consistent gameplay, respondents reported improved cognitive function. (Whitbourne, 2013) Another study reported acute cognitive benefits, such as improved attention of playing casual games akin to exercises for ten minutes. It is argued that the novelty and challenge from playing multiple games may better lead to maximal engagement and gains in cognitive abilities(Green and Bavelier, 2008; Holmes et al., 2009; Schmiedek et al., 2010; Bavelier et al., 2012; Brehmer et al., 2012). Moreover, videogames demand execution of skills in a more 'externally valid' environment. Casual video games that use working memory or reasoning were found to be related to improvement in divided attention tasks. Casual games that use the above constructs were found to be highly related to fluid intelligence. More than working memory, fluid intelligence was seen as having a higher correlation with performance on these games, suggesting cognitive benefits in the realm of intelligence. (Baniqued, 2013)

Casual video games were also found to have transfer effects on visual search tasks, in particular 3 Match Games such as Bejeweled Blitz (Stroud, 2015). An analysis on the efficacy of casual video games on cognition analyzed the importance of the relaxation provided by casual video games in improving cognitive skills. Although the study did not focus on any specific game, a relationship was established between affective and cognitive restoration. It was found that Individuals in the relaxation condition showed decreased negative affect and distress and improved digit-span performance (Rupp et. al, 2017). Cognitive benefits of casual video games have been studied for their cognitive impact on older adults and children, as well as adults who are often fatigued and look to playing games for restorative purposes. A study on a group of Pakistani children reveals that gamers display better cognitive abilities specifically involving mathematical intelligence, reasoning (deductive), analogy and speed of processing, in comparison to children who are not involved in playing games. The sample

consisted of 171 students who were assessed using the Wonderlic Cognitive Ability Test (Hisam et. al, 2015). The impact of video gaming on cognition has also been studied using neural activity measures. A study found that playing video games over a longer duration is linked to a greater white matt in the greater-tier visual and motor pathways (Zhang et. al, 2015). In the Indian context, one study on 5 male participants studied the cognitive effects of gaming. It was revealed that action video games have a significant impact on attentional blink, processing speed, reaction time and reduce stress-level. This study utilized electroencephalography readings, by decomposing EEG data into intrinsic mode functions (Chandra et. al, 2016).

The purpose for this study builds on the above research. This work seeks to examine the positive impact of casual gameplay in the Indian context. These positive implications will be seen with respect to two factors namely stress alleviating and cognitive benefits of casual gaming.

There are thus two hypotheses that will be investigated in this study:

Hypothesis 1: Playing casual video games reduces stress

Hypothesis 2: Playing casual games can decrease reaction time

2. Method

2.1 **Design of the Study**

This study used a repeated measures design, i.e. the subject acted as their own control .Thus, two trials were conducted for each participant. Participants were randomly assigned an outcome, which could have been either the experimental or the control condition. For this study:

Outcome A: Experimental condition Outcome B: Control condition

These two outcomes were randomly assigned to each participant by the method of drawing lots. Since only random assignment of the condition was done, this research is a quasi-experimental design as random selection of the participants was not done. This design poses limitations for external validity.

2.1.1 **Independent variable:**

The experimental and the control condition were the independent variables of this study. 5 minutes of tasks was introduced to see its effect on the dependent variables.

The experimental condition chosen was a casual video game that has been researched and found significant in reducing stress: Bejeweled, by PopCap.

The control condition, on the other hand, was a 5-minute display of Apple screensavers. The screensaver was chosen because it is a neutral activity that has been proven to have no correlation with stress reduction.

The underlying rationale was thus that the gaming condition reduces stress significantly as opposed to a neutral activity like watching a screensaver.

2.1.2 **Dependent variables:**

This study consisted of 5 dependent variables.

The Dependent variables to assess effect of casual gaming on stress were:

- Diastolic blood pressure: The difference between the diastolic blood pressure before experimental/control condition and after.
- Systolic blood pressure: The difference between the systolic blood pressure before experimental/control condition and after.
- Heart rate: The difference between the heart rate before experimental/control condition and after.
- State Anxiety scores

The Dependent variables to assess effect of casual gaming on cognition were:

- Stroop effect (in milliseconds)

2.1.3 **Controls**

Controls were exercised on the sample so as to account for extraneous variables. Participants were matched with each other in terms of age, educational qualifications and so on. Based on the research that outlines that the major consumers of casual video games are young adults ranging from 20-25, an age limit of 28 was exercised, and the data was collected only from students currently enrolled in Delhi University.

2.2 **Sampling**

For this study, the method of purposive sampling was used. PA brief questionnaire was handed out to screen out desirable candidates.

The following was the criteria established for screening of the participants:

- The respondent should not play games frequently, all respondents who answered the question on frequency of casual gaming with answers more than monthly frequency were screened out)
- Respondents who expressed unwillingness to be a part of the experiment were screened out.
- Respondents over the age of 28 were screened out.

2.2.1 **Sample Size:**

The screening questionnaire was handed out to 100 students out of which the first 30 to meet the criteria suitable for the study were contacted. The final sample size was 30 respondents: 15 girls and 15 boys. Equal number of male and female participants were selected so that the results could be considered as equally applicable for both categories, and to avoid any skew because of gender bias.

2.3 **Tools Used**

1) **The Dual N-Back test:**

A test of working memory, the dual n-back test requires the participant to simultaneously keep track of visual and auditory stimulus, n trials ago. It has been defined as "a complex and adaptive working memory training program that simultaneously recruits auditory and visual attention, maintenance, and updating processes." (Savage and Goghari, 2016). To administer this task, an app called the Dual N-Nack Test, developed by Mikko Tyrskeranta (TYSRK) was used.

A round consisted of a simultaneously presented auditory letter and visual block in one of eight positions in a 3x3 space, every three seconds. The participant is asked to respond by button press after each trial ("eye" button for visual match and/or "ear" button for auditory match). One game round consisted of 20 + N flashing square positions and letter sounds. For example, if N= 1, the square positions and letter sounds would be flashed 21 times. After each round, N would increase by 1 if there were less than 3 mistakes for either criteria. On the other hand, N is decreased by 1 if there are more than 5 mistakes.

Mistakes were classified as two kinds:

a) Not pressing the eye or ear button when the participant should have.

b) Pressing the audio/ear button when the participant should not have.

The N-Back test was used in this experiment to induce stress in the participants. As simultaneous tracking of visual and auditory stimulus is a strenuous activity. The Task has been previously used in a similar experiment to analyze the efficacy of casual video games in stress reduction by Stanhope (Stanhope, 2012). Previous research has also shown N-back to be effective in reducing stress (Matthews & Campbell, 2009, 2010; Matthews, Campbell, Falconer, Joyner, Huggins, Gilliland, Grier, & Warm, 2002; Matthews, Emo, Funke, Zeidner, Roberts, Costa, & Schulze, 2006)

2) **Bejeweled Video Game:**

Bejeweled is a casual video game, first published in by PopCap. The game has been used in various studies to examine the role of casual video games in stress reduction (Fish, 2011, Russoniello,2009). For this study, Bejeweled Classic was used for its easy interface for a beginner. The game requires the participant to eliminate same colored gems in rows or columns of three or more. The game is progressively difficult, i.e., the challenges/goals increase in difficulty level with every level. Each level has a specific goal to be met, failing

which the participant is required to start the game over. The game is also loaded with feedback responses like 'Amazing', that are elicited with continuously good gameplay. Along with these feedback effects, the game is punctuated throughout with various sound effects making it an ideal game to play for a break.In India, a similar game exists called Candy Crush. The rules and interface of the two games are similar, the only difference being that gems are replaced by candies. However, to ensure non-familiarity with the gaming condition, Bejeweled was chosen in order to control for any side-effects of playing a popular game. Moreover, the validity of Bejeweled as a stress reducing games has already been established (Russoniello, 2009).

3) **Stroop task:**

The Stroop Task is a measure of selective attention, and is a cognitive task that creates interference by asking the participants to name the color in which the text appears, not the color mentioned in the text itself. The theory behind Stroop Effect dictates that a Stroop effect can be decreased by strength training. The review of literature suggests that casual video games improve attention and reaction time. Thus, the Stroop Task was considered ideal to analyze the relationship between casual video gaming and cognitive benefits. The Stroop Task for this experiment was taken from Psy Toolkit. Psy Toolkit is a website that contains validated psychological tasks and tests that can be used for quick and ready implementation, offline and online. Psy Toolkit is a recognized site for running experiments in the face of financial constraints as the material on the website is free to use, especially for educational set-ups. The Stroop Phenomenon is named after the researcher John Stroop and demonstrates that the difficulty to name the ink color of a color word if there is a mismatch between ink color and word. For example, the word GREEN printed in red ink. The original Stroop Task requires the participants to simply name the color, however, the version used in this study requires the participant to press the suitable key for each color, as follows: G for GREEN, R for RED, B for BLUE and Y for Yellow. The task consisted of 100 trials over 5 minutes. Feedback of WRONG/CORRECT was given after each trial. If the participant exceeded the response time given to press the key, the response was recorded as WRONG. The reaction time was measured in milliseconds. The reaction time for congruent (correctly matched) and incongruent (incorrectly matched) were subtracted from each other to calculate the Stroop Effect (in milliseconds). Research literature suggests that casual video games improve attention and reaction time, therefore a faster reaction time indicates the success of the gaming task in improving reaction time. According to MacLeod (1991), the Stroop Color-Word Test has reasonable reliability. In a study to examine the test-retest reliability for all adaptations of the original Strrop Task, including the computerized version used in this study, reliability was found to be between moderate and significant. For the Stroop Word Color Task, correlations between test and re-test performance were found to be significant with a p-value of 0.01.

4) **Screensaver**

For the control condition, a neutral condition was required that has no correlation with stress relief. In previous studies, the act of browsing the web was used. For this task, a neutral screensaver was chosen. A 5-minute video of Apple moving screensaver was chosen for this task. Sceneries of nature or pictures that were too disturbing were not selected. A literature review for the effects of screensavers was done, but no relevant study was found that could claim that screensavers reduce stress.

5) **State/trait anxiety inventory**

The State/Trait Anxiety Inventory is an instrument that is used to measure state and trait anxiety. Since the reduction of stress in this study is related to a task, the measurement of state anxiety by Scale Y (Scale Y) is considered to be a good measure of task-influenced anxiety levels. The State/ Trait Anxiety Inventory is a self-report measure that measures current symptoms of anxiety (state anxiety) and a generalized propensity for anxiety (trait anxiety) (Julian, 2014). State Anxiety is measured on the Y Scale whereas Trait Anxiety is measured on the X Scale. Both the scales consist of 20 items each. The purpose of using this scale in this study was to assess levels of stress after the gaming/ control condition was introduced. Therefore, only the Y Scale was used as only State Anxiety was relevant in this experiment. The item responses on the Y Scale are arranged on a 4 point Likert Scale ranging from 'not at all' to 'very much so.' The responses are scored from 1-4, except for reversely scored items which were scored from 4-1. The final score is the sum of all item scores. These raw scores can be translated into z-scores based on norms given in the manual, however, for this study, since the subject acted as their own control, only the raw scores were taken into account. According to the manual, The State – Trait Anxiety Inventory has a reliability ranging from 0.31-0.86 (test-retest). For content validity, the test was correlated with two similar measures, and was found to be 0.73 and 0.85 respectively.

6) **Sphygmomanometer**

A Blood Pressure Monitor was used to measure blood pressure and heart rate. Readings for systolic, diastolic blood pressure and heart rate were taken using this instrument. Blood pressure is directly correlated to levels of stress in the body. Research indicates that when under stress, the parasympathetic activation of the brain results in higher cortisol-resulting in greater pressure of the blood flow. Both diastolic and systolic pressure, when heightened, are indicative of stress.

7) **MI2 Fitness Band**

The MI2 Fitness Band is a pedometer that allows one to record pulse rate continuously. Developed by MI, the continuous heart rate can be measure in intervals of 10, 5 or 1 minute(s). The interval setting of 1 minute was chosen so as to better capture the variations in heart rate during the stress-inducing task and the gaming/control condition. The Band is synced with an app called MI Heart rate, which records the data per day and also shows it graphically. For the purpose of this study, the pulse rate closest to the condition was chosen. Heart rate, similar to blood pressure has a direct correlation to arousal and stress. A heightened heart rate is indicative of stress levels in the body.

2.4 **Procedure**

2.4.1 **Setting**

The experiment was carried out in a laboratory set-up. The participant was made comfortable and was seated opposite the researcher. All the materials required for successful conduction were laid out on the table. Care was taken to ensure that noise and other environmental variables do not influence the study. A uniformity of the conditions for all participants was ensured so as to control for extraneous variables.

2.4.2 **Conduction of the experiment**

The participant was introduced to the purpose of the study. A slight deception was used by not telling the participants that the study aims to study the effect of casual games on stress relief and cognitive abilities. This deception was deemed necessary so that the responses of the participants

were free of bias. They were then asked to sign the consent form. They were then asked to pick a piece of paper at random for the assignment of experimental/control task. The rest of the experiment was designed as follows:

a) Blood pressure and heart-rate reading in normal conditions

b) Dual N-Back test for 5 minutes

c) Blood pressure and heart rate readings after stress induction

d) Outcome A (Bejeweled) or Outcome B (screensaver) for 5 minutes

e) Blood Pressure and Heart rate readings after given outcome

f) Y-Scale State-Trait Anxiety Inventory was administered

g) Stroop Task for 5 minutes

For each participant, the sequence of two outcomes was randomly decided through draw of lots. The gap between the presentation of two outcomes(trials) was 7 days.

After successful completion of 2 trials, the participants were de-briefed about the objectives of the study and the deception used

3. Results

Since the design of this study was a repeated measures design, for statistical analysis, a paired t-test was used to compare the following variables:

a) Scores on STAI (State Trait Anxiety Inventory) Y Scale after the game, and after the screensaver

b) Difference in systolic blood pressure for the gaming and the control condition

c) Difference in diastolic blood pressure for gaming and control condition

d) Difference in heartrate for gaming and control condition

e) Reaction speed (in milleseconds) after the game, and after the screensaver

Table 1: A Table Comparing the Means of the Participants Across the Two Conditions: Gaming and Screensaver using paired sample t-test.

		t- value	Sig (p-value)	significant
Pair 1	Reaction Time in Game – Reaction Time in Screensaver	-2.703	.011	Yes
Pair 2	State Anxiety in Game – State Anxiety in Screensaver	-0.035	.972	No
Pair 3	Difference in Diastolic Pressure Game – Difference in diastolic pressure screensaver	-.342	.735	No
Pair 4	Difference in Systolic Pressure Game – difference in Systolic Pressure Screensaver	-1.092	.284	No
Pair 5	Difference in Heartrate Game – Difference in Heartrate Screensaver	.672	.507	No

The following observations can be made:

1. Taking a p-value of 0.01, only one parameter shows statistical significance, i.e. speed, which is related to performance on Stroop Task in both the conditions. Thus Hypothesis 2 Stating 'Playing casual games can decrease reaction time' is retained.

2. The three physiological parameters related to stress, i.e. difference in systolic blood pressure, difference in diastolic blood pressure and difference in heart rate showed difference in the means but it was found to not be statistically significant. The measure of state anxiety was found to have no difference, with p-value approximately 1. Thus, Hypothesis 1 stating 'Playing casual video games reduces stress' is rejected.

4. Discussion

According to the results of data analysis, the second hypothesis, i.e., casual video games improve reaction time, is retained. The result was found to be statistically significant at both 0.05 and 0.01 level. This shows us that casual video games have cognitive benefits such as improving attention, as compared to the control condition. This supports existing research that casual video games have cognitive benefits and useful in boosting attention. The Stroop Task is a cognitive task sensitive to the effects of training. Training van be achieved either through repeated administration of the Stroop Task, or through other cognitive tasks whose effect can be then showed in the Stroop Task performance. According to Cohen, Mclelland and Dunbar's parallel processing theory behind the interference caused between color names and print color, "processing pathways gain strength with practice, and relative strength determines likelihood and degree of interference" (Macleod 2015). It can thus be inferred that performance on Stroop task gets better with prior exposure to similar stimuli. Bejeweled is a 3 Match Game that requires the player to match three gems of the same color either horizontally or vertically. This can be suggested to create a priming effect for the player. Moreover, being a time restricted game, the game demands the player to seek a specific-colored gem quickly, thereby stimulating their visual attentional processes, especially in context to color. Thus, casual games that involve attentional demands such as Bejeweled can be assumed to have a positive impact on one's reaction time, as supported by this study.

This relationship was also seen in similar studies on casual video games and its cognitive benefits. A study where the Stroop Test was used as a measure of cognitive performance revealed that casual games have a systematic effect on cognitive performance (Gao, 2012). Similarly, another study used hemodynamic signals to investigate the impact of casual games on cognitive flexibility (measured by the Stroop Task), and the results showed significant for cognitive flexibility. Variations of Bejeweled such as Bejeweled II, Bejeweled Blitz were also used in other studies.

Although this study chose to focus only on the role of casual video games in improving attention, casual video games have been found to have a relationship with several cognitive tasks such as working memory, visuo-spatial skills, visual search task, divided attention and so on (Stroud, 2015, Baniqued, 2013). It was proposed that attentional benefits of such games arise from 'repeated exposure'. Video games were thus believed to have cognitive effects due to 'a near-transfer effect' and not due to training of broad cognitive functions such as executive functions (Oei and Patterson, 2013).

There exists a vast body of research on cognitive effects of video gaming that offers several interesting

implications, regarding cognitive training (Baniqued, 2013). Games such as Bejeweled can be used as cognitive training tasks to boost attention, visual search and other skills. In a controlled study conducted to analyze the efficacy of video games in training, it was found that video games were closely related to cognitive tasks in terms of performance and can be successfully used for cognitive training. Out of the three types of games studied, games related to working memory and reasoning, and some tasks from attentional games were found to be correlated highly to fluid intelligence and working memory measures.

The results of this study indicate no statistically significant difference between means of the two conditions: screensaver and gaming, across the four parameters related to stress. These four parameters were: systolic and diastolic blood pressure, heart rate, and state anxiety scores. Prior studies have established a positive relationship between casual video games and stress relief. However, the same results could not be replicated in this study. One reason, could simply be short duration of gameplay, however, another reason could be in the way the game design appeals to the Indian audience. Participants were asked for feedback in between sessions, and while many reported the casual video game to be 'fun,' there were some who preferred the more demanding N-Back task as a game since it was more intellectually challenging. Previously, Bejeweled was analyzed in the context of the American audience, and it is possible that the features of the game did not appeal to the Indian audience.

According to research done on the Indian rural population, it was found that conventional aspects of game design do not appeal to the Indian audience. Conventional game design is based on the concept of integrating Hard Fun and Alterative State keys of game design, keys that make the player focus on the task at the hand and seek to create alternate emotional mood states due to the gameplay (such as relaxation, positive affect and so on). A selection of Western games developed on the conventional game design model were introduced to rural kids, out of which only a few games fared well. The research concluded that Indian audience prefers colorful, 'Easy Fun games' that maintain a better flow experience. It was also recommended that players be allowed to control the aesthetics of the game, and that considering the hierarchical power structure of Indian communities, games should have "screens between levels can feature the player's performance and/or improvement over previous sessions prominently. A pause feature can also be added to allow players to show off their proudest moments to others." (Kam, 2007)

This feature of feedback of current performance was present in the N-back task but not in Bejeweled Classic. It was seen that after filtering 10 cases in which the N-back test was successful, the gaming condition made no difference to the three parameters used for analyzing stress relief- heart rate, blood pressure and State Anxiety.

Thus, aspects of game design can be suggested to play an important role in making a game appealing enough for the Indian audience. Less engaging gameplay will negatively impact the stress alleviating functions of a game. Moreover, flow experience has been stated to be a critical factor in explaining stress relief effects of a game. (Buncher, 2013) According to Game Design theory the following four keys are essential to the development of an engaging game:

a) Hard Fun: Gameplay experiences built on Hard Fun use the focusing of attention and rewards. Hard Fun is said to create emotion by structuring experience towards the pursuit of a goal.

b) Easy Fun: Gameplay experiences based on Easy Fun take into account ambiguity and details to create a sense of wonder and curiosity. This is the Immersion centered Key that aims to make the gameplay an engaging experience in itself

c) Altered States: Gameplay experiences built on this principle influence the player to change their internal state and "how aspects of the game external to the player create emotions inside player." Such games are often played for therapy or to avoid boredom. This Key is the most important for generating stress relief in an individual.

d) People: Gameplay experience designed with this key focus on player to player interaction and are often multiplayer games or games that allow you to build a sense of community. (Lazzaro, 2013)

Bejeweled is a game that can be seen as having utilized Hard Fun and Altered State Key but not Easy Fun. Easy Fun is essential in contributing to a flow experience that allows the player to relax, and was also found to be the most preferred key by Indian audiences. Thus it can be implied that Casual Games developed using the Easy Fun experience may be more effective in stress relief than a game like Bejeweled that offers only a sense of mastery and does not take into account other emotional experiences related to an engaging gameplay.

This study had some limitations like the N Back Test was not effective in bringing blood pressure and heart-rate up after the task. Since heart rate is a measure that can indicate both stress and arousal, it was not a very accurate measure of stress. The results of this study may not be applicable to naturalistic settings as the experiment was conducted in laboratory settings. The cognitive benefits observed may be acute and may not transfer to long-term gains in the field of cognition.

Future research can be conducted using a more effective stress induction method, and stress measurement method (as opposed to State Anxiety Inventory), in order to examine the same hypothesis. Research can also include other physiological measures beyond the scope of this study such as heartrate variability, EMG, EEG etc. This will prove useful in determining the efficacy of casual video games in therapeutic settings.

5. Conclusion

The results do not support the finding that casual video games can lead to stress reduction. However, it was found that the second hypothesis was confirmed, i.e. casual video games have cognitive benefits, in particular, attentional benefits. The study has implications for game design theory which indicate that games popular in America may not have the same effect in India since Indian players have different expectations of gameplay. The cognitive benefits of casual video games can be applied in the fields of cognitive training, especially with children and older adults. The games can also be used for cognitive assessment and thus have a high potential to be used in clinical set-ups, especially in the field of neuropsychology. Casual video games can thus be said to have positive effects, and there is a growing need to explore these benefits in the light of ongoing Western research on video game therapy.

References

[1] Ajjar, N. H. (2013). IMPACT OF ONLINE GAMES AMONG YOUNG PEOPLE IN INDIA. Research in Digital
Revolution and New India.
[2] Allahverdipour, H, Bazargan, M, Farhadinasab, A, & Moeini, B 2010, 'Correlates of videogames playing among adolescents in an Islamic country,' BMC Public Health, vol. 10, p. 286 http://www.biomedcentral.com/1471-2458/10/286
[3] Ang, C. W., Kramer, A. F., Lleras, A., Wang, F., Morrow, D. G., & Stine-Morrow, E. Cognitive training with casual video games: The effects of working memory and reasoning related games on the cognitive abilities of younger and older adults (Unpublished doctoral dissertation).
[4] Balakrishnan, J., & Griffiths, M. D. (2018). Loyalty towards online games, gaming addiction, and purchase intention towards online mobile in-game features. Computers in Human Behavior,87, 238-246. doi: 10.1016/j.chb.2018.06.002
[5] Baniqued, P. L., Lee, H., Voss, M. W., Basak, C., Cosman, J. D., Desouza, S., . . . Kramer, A. F. (2013). Selling points: What cognitive abilities are tapped by casual video games? Acta Psychologica,142(1), 74-86. doi: 10.1016/j.actpsy.2012.11.009
[6] Baniqued, Pauline & Kranz, Michael & W Voss, Michelle & Lee, Hyunkyu & D Cosman, Joshua & Severson, Joan & Kramer, Arthur. (2014). Cognitive training with casual video games: Points to consider. Frontiers in psychology. 4. 1010. 10.3389/fpsyg.2013.01010.
[7] Buncher, Michael W. W., "The Effects of Video Game Difficulty Selection on Flow Experience" (2013). ETD Archive. 374.https://engagedscholarship.csuohio.edu/etdarchive/374
[8] Calabrese (2012): The Stroop Task: Comparison Between the Original Paradigm and Computerized Versions in Children and Adults, The Clinical Neuropsychologist, DOI:10.1080/13854046.2012.713513
[9] Carras, M. C., Rooij, A. J., Spruijt-Metz, D., Kvedar, J., Griffiths, M. D., Carabas, Y., & Labrique, A. (2018). Commercial Video Games As Therapy: A New Research Agenda to Unlock the Potential of a Global Pastime. Frontiers in Psychiatry,8. doi:10.3389/fpsyt.2017.00300
[10] Chandra, S., Sharma, G., Salam, A. A., Jha, D., & Mittal, A. P. (2016). Playing Action Video Games, a Key to Cognitive Enhancement. Procedia Computer Science,84, 115-122. doi: 10.1016/j.procs.2016.04.074
[11] Fish, M. T., & Russoniello, C. V. (2011). A randomized controlled study of the effectiveness of casual video games in reducing symptoms of anxiety (Unpublished master's thesis).
[12] Gao, Y., & Mandryk, R. (2012). The acute cognitive benefits of casual exergame play. Proceedings of the 2012 ACM Annual Conference on Human Factors in Computing Systems - CHI 12. doi:10.1145/2207676.2208323
[13] Goswami, V., & Singh, D. R. (2016). Impact of mobile phone addiction on adolescent's life: A literature review. International Journal of Home Science 2016,2(1), 69-74.
[14] Hisam, A., Mashhadi, S. F., Faheem, M., Sohail, M., Ikhlaq, B., & Iqbal, I. (2018). Does playing video games effect cognitive abilities in Pakistani children? Pakistan Journal of Medical Sciences,34(6). doi:10.12669/pjms.346.15532
[15] Hull, K 2009, 'Computer/videogames as a play therapy tool in reducing emotional disturbances inchildren, A Dissertation

Presented in Partial Fulfillment Of the Requirements for the Degree Doctor of Philosophy,' Liberty University.
[16] Johnson, D, Jones, C, Scholes, L & Carras, M. (2013) Videogames and Wellbeing, Young and Well Cooperative Research Centre, Melbourne.
[17] Julian L. J. (2011). Measures of anxiety: State-Trait Anxiety Inventory (STAI), Beck Anxiety Inventory (BAI), and Hospital Anxiety and Depression Scale-Anxiety (HADS-A). Arthritis care & research, 63 Suppl 11(0 11), S467–S472. doi:10.1002/acr.20561
[18] Kam, M., Rudraraju, V., Canny, J., & Tewari, A. (2007). Mobile Gaming with Children in Rural India: Contextual Factors in the Use of Game Design Patterns. In Situational Play. DiGRA.
[19] Kathawala, K. A., & Chaplot, V. (2018). Casual Video Games: Stress Management Technique in Women. International Journal of Advance Research in Computer Science and Management Studies,6(3).
[20] Kim, J. J., & Diamond, D. M. (2002). The stressed hippocampus, synaptic plasticity and lost memories. Nature Reviews Neuroscience,3(6), 453-462. doi:10.1038/nrn849
[21] KPMG, & Google. (2017). Online gaming in India: Reaching a new pinnacle(Publication).
[22] KPMG. (2018, May). The Cognitive Benefits of Playing a Casual Exergame. India.
[23] Kutner L & Olson, C K 2008 Grand Theft Childhood: The Surprising Truth About Violent Video games and What Parents Can Do, Simon & Schuster, New York.
[24] Lawlor-Savage, L., &Goghari, V. M. (2016). Dual N-Back Working Memory Training in Healthy Adults: A Randomized Comparison to Processing Speed Training. Plos One,11(4). doi: 10.1371/journal.pone.0151817
[25] Lazarus, R. S. (1966). Psychological Stress and the Coping Process. New York: McGraw Hill Lazarus, R. S., and Folkman, S. (1984). Stress, Appraisal, and Coping. New York: Springer.
[26] Lazzaro, N. (n.d.). Why We Play Games: Four Keys to More Emotion in Player Experiences. XEODesign. Macleod, C.
M. (2015). The Stroop Effect. Encyclopedia of Color Science and Technology. Nielsen (2017). Primary Survey, Urban Online gamer(s)
[27] Oei, A. C., & Patterson, M. D. (2013). Enhancing Cognition with Video Games: A Multiple Game Training Study. PLoS ONE,8(3). doi: 10.1371/journal.pone.0058546
[28] Ouankhamchan, P., & Fujinami, T. (2018). Eects of Casual Computer Game on Cognitive performance through Hemodynamic Signals. Japan Advanced Institute of Science and Technology.
[29] Przybylski, A K, Ryan, R M & Rigby, C S 2009, 'The motivating role of violence in videogames,' Personality and Social Psychology Bulletin, vol. 35(2), pp. 243-259.
[30] Przybylski, A K, Weinstein, N, Murrayama, K, Lynch, M F & Ryan, R M 2011, 'The ideal self at play: The appeal of videogames that let you be all you can be,' Pscyhological Science, vol. 23, pp. 69-76.
[31] Rahmani, E., & Boren, S. A. (2012). Videogames and Health Improvement: A Literature Review of Randomized Controlled Trials. Games for Health Journal,1(5), 331-341. doi:10.1089/g4h.2012.0031
[32] Reinecke, L. (2009). Games and recovery: The use of video and computer games to recuperate from stress and strain.
Journal of Media Psychology, 21, 126-142. doi: 10.1027/1864-1105.21.3.126
[33] Rupp, M. A., Sweetman, R., Sosa, A. E., Smither, J. A., & Mcconnell, D. S. (2017). Searching for Affective and Cognitive Restoration: Examining the Restorative Effects of Casual Video Game Play. Human Factors: The Journal of the Human Factors and Ergonomics Society,59(7), 1096- 1107. doi:10.1177/0018720817715360
[34] Russoniello, C. (2009). The effectiveness of casual video games in improving mood and decreasing stress. Journal of Cyber Therapy and Rehabilitation ·,2(1), 53-66.
[35] Scarpina, F., &Tagini, S. (2017). The Stroop Color and Word Test. Frontiers in psychology, 8, 557. doi:10.3389/fpsyg.2017.00557
[36] Selye, H. (1976). Stress in Health and Disease. Stoneham, Massachusetts: Butterworth.
[37] Shafer, D. M., & Carbonara, C. P. (2015). Examining Enjoyment of Casual Videogames. Games for Health Journal,4(6), 452-459. doi:10.1089/g4h.2015.0012
[38] Sherry, J. (2004). Flow and media enjoyment. Communication Theory, 14, 328-347.
[39] Shokeen, D., & Aeri, B. T. (2017). Rising Incidence of Overweight and Obesity among Children and Adolescents in India. International Journal of Life-Sciences Scientific Research,3(5), 1392-1399. doi:10.21276/ijlssr.2017.3.5.22
[40] Singh, A. P., & Misra, G. (2015). Pattern of leisure-lifestyles among Indian school adolescents: Contextual influences and implications for emerging health concerns. Cogent Psychology,2(1).doi:10.1080/23311908.2015.1050779
[41] Sonnentag, S., & Fritz, C. (2007). The Recovery Experience Questionnaire: Development and validation of a measure for assessing recuperation and unwinding from work. Journal of Occupational Health Psychology,12(3), 204-221. doi:10.1037/1076-8998.12.3.204
[42] Stahlman, S. J. (2005). The Effects of Video Game Play on Blood Pressure and HeartRate. California State Science Fair.
State Trait Anxiety Inventory for Adults. Manual. Mindgarden
[43] Stroud, M. J., & Whitbourne, S. K. (2015). Casual Video Games as Training Tools for Attentional Processes in Everyday Life. Cyberpsychology, Behavior, and Social Networking,18(11), 654-660.

doi:10.1089/cyber.2015.0316

[44] Wallace, M., & Robbins, B. (Eds.). (2006). IGDA 2006 Casual Games White Paper. Retrieved March 29, 2007, from http://www.igda.org/casual/IGDA_CasualGames_Whitepaper_2006.pdf.

[45] Wang, C K, Khoo, A, Liu, W C & Divaharan, S 2008, 'Passion and intrinsic motivation in digital gaming,'CyberPscyhology & Behaviour, vol. 11(1), pp. 39-45.

[46] Whitbourne, S. K., Ellenberg, S., & Akimoto, K. (2013). Reasons for Playing Casual Video Games and Perceived Benefits Among Adults 18 to 80 Years Old. Cyberpsychology, Behavior, and Social Networking,16(12), 892-897. doi:10.1089/cyber.2012.0705

[47] Zhang, Y., Du, G., Yang, Y., Qin, W., Li, X., & Zhang, Q. (2015). Higher integrity of the motor and visual pathways in long-term video game players. Frontiers in Human Neuroscience,9. doi:10.3389/fnhum.2015.00098