THE IMPACT OF CASUAL VIDEOGAMES ON COMPETENCY, AUTONOMY, AND MOOD STATE

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ABSTRACT

Videogames have been historically known for causing negative mood states in players, but there is still more research to be done about the potential for videogames to alleviate these induced negative mood states. Using an online repeated measures survey design, participants were asked to play a game with an impossible difficulty curve unbeknownst to them. They were then instructed to play one of three casual videogames (CVGs). It was hypothesized that increased levels of competency and autonomy would lead to a decrease in participants' negative mood state as per Self-Determination Theory. In addition, the act of playing CVGs was also predicted to decrease participants' negative mood state as per Mood Management Theory. To test for this, participants were asked questions regarding their feelings of competency, autonomy, and overall mood state throughout the experiment. Support was not found for competency and autonomy helping alleviate negative mood states, but support was found for CVGs and their healing potential towards negative mood states. The implications of these results as well as the potential for future research is discussed.

Keywords: mood management theory, self-determination theory, mood state, competency, autonomy, casual videogames

THE IMPACT OF CASUAL VIDEOGAMES ON COMPETENCY, AUTONOMY, AND MOOD STATE

Whether you call yourself a fully-fledged gamer or find yourself casually browsing your phone's app store, chances are that you have experienced the same four specific elements in the games selected: conflict, rules, required player ability, and a valued outcome. Simply put, in order to be considered a game there must be a determinant of what can and cannot be done against an opponent or given circumstance. Because of these structures put in place, some form of ability ranging from strategy to luck must be enacted in order to achieve an agreed upon victory condition (Wolf 2008). Videogames were created as an additional form of entertainment media and have since evolved to induce some sort of emotion in players (whether it be positive, negative, or neutral in nature). The combination of those four elements can give players feelings of determination or frustration, excitement or apathy.

Consider the popular game *Mario Bros.* as an example of these concepts in action. Playing as the titular mustached plumber Mario, a player is tasked with rescuing Princess Peach from the evil Bowser. Once the conflict has been established, players then learn the rules of Mario's main abilities which include jumping, stomping on enemies, and collecting various power-ups. Players must demonstrate proper gaming ability to navigate through many levels before they get to face off against Bowser himself to achieve the valued outcome of the game: saving the princess. The first *Mario Bros.* game was created in 1985 and yet, even as an early entry to the gaming community, it perfectly demonstrates the four elements necessary to be a successful game. It also helps exemplify the potential players have to feel a wide range of emotions during their gameplay experience.

Videogames, especially those involving action or violence, have been compared to aggressive behavior in players for years. One such example is the *Mortal Kombat* series which is known for its near-excessive amount of blood and gore. In fact, after controversy surrounded the game in 1994 due to its violent content, big-name studios such as Nintendo adopted the Entertainment Software Ratings Board (ESRB) to clearly mark a content warning for young players (Fahs 2012). Though studies have found little to no support for videogames having a direct correlation with negative behaviors, many people still view them as more harmful than beneficial (Bushman & Anderson 2015). To add further support to the notion that videogames have significant emotional healing potential, the current study asserts that videogames may lead to a negative mood state in players but also have the potential to reduce and alleviate that same negative mood state.

Emotion and Mood

Games like *Mario Bros.* and *Mortal Kombat* are just a couple of many examples of videogames that elicit some form of emotional response from their players. Whereas a lack of an emotional response would result in a neutral mood state, experiencing any sort of emotional response can be viewed as positive or negative in nature and thought of as part of a continuum (Broome & Carel 2009; Broome et al. 2015). When an emotional response is felt from exposure to videogame play, one of two scenarios can occur. In the first scenario, a positive emotion is felt. Examples of positive emotions include feelings of inspiration, determination, alertness, and excitement. Once one or more positive emotions are experienced, they are placed onto the continuum of a positive mood state. The term itself can be thought of as a broad definition of experiencing one or multiple positive emotions at a given time. The second scenario has a similar set-up except a negative emotion is instead experienced. Examples of negative emotions can span

from hostility and aggression to frustration and irritation. Once a negative emotion is felt, it can theoretically be placed onto the continuum that constitutes a negative mood state in which the individual may be experiencing one or multiple negative emotions at a given time. For the purposes of this study, the negative mood state was selected as the main focus.

Concepts of emotion and mood can be quite complex and have been a major part in the fields of psychiatry, psychology and communication studies among others. There are many nuances to the concept, and authors have debated definitions regarding specific terms for years (Broome et al. 2015; Rieger et al. 2015; Yeo et al. 2020). To simplify as well as focus on my main concerns, I chose to develop a very simple and straightforward understanding of the terms emotion and mood. An emotion is experienced when exposure to a certain stimuli occurs, and it can be either positive, neutral, or negative in nature. From that emotion, a mood is then experienced based off of the type of emotion that was felt. This leads an individual into the continuum of a positive, neutral, or negative mood state which is the focus of this experiment; how can an individual who has entered a negative mood state be taken out of that feeling?

In this paper, I will begin with an overview of Mood Management Theory and Self-Determination Theory, mood and motivation theories used to guide my research. I will explain each theory's history, then explain its significance to the gaming world. Next I will discuss research that has already combined these theories and propose my hypotheses. After that I will describe the present study conducted utilizing these theoretical lenses. I will detail participants' demographics, the materials chosen, and explain the experiment's procedure. Finally, I will describe the results of my study and continue with a discussion of its future implications both within and outside the gaming community.

Mood Management Theory

In 1985, Dolf Zillmann coined the Theory of Affect-Dependent Stimulus Arrangement. He based his proposal after Festinger's theory of Selective Exposure and, after several years of working with it, changed its name to Mood Management Theory (MMT). Zillmann described his theory as "projecting message choices as a function of affective states and for the purpose of regulating these states, and it does so without stipulating that individuals necessarily comprehend the utility of their choices" (Zillmann 1988, p. 328). Simplified, human beings will attempt to balance their various positive and negative mood states in a conscious—and sometimes unconscious—manner. From there, Zillmann's work became a staple in a wide array of fields, most notably media effects research. His theory was utilized everywhere from television to music, and movies to videogames (e.g., Knobloch-Westerwick 2007; Strizhakova & Krcmar 2007; Carpentier et al. 2008; Rieger et al. 2014).

As more theorists began utilizing MMT in their studies, a plethora of ways to define the theory came about. Scholars described the theory as "a temporal state susceptible to environmental influence and potentially under an individual's control, or management" (Bowman & Tamborini 2012, p. 1340), or the assumption that "individuals prefer an intermediate level of arousal that is experienced as pleasant" (Bartsch 2012, p. 269). When researching these different definitions, one characterization of MMT stood out; Rieger et al. described MMT as "…humans have a hedonic motivation to terminate negative and to strive for more positive moods" (Rieger et al. 2015, p. 139). Simply put, humans choose to avoid strife and instead seek out ways to feel uplifted. As an example, imagine going out on a first date. If that person is rude to the waiter, on their phone the entire time, and rolls their eyes constantly, it would be highly unlikely to want to continue the date to another location after dinner. However, keeping the same scenario in mind, if that person is instead demonstrating kind-hearted and compassionate traits, then it would be much more likely

to want to bring that person to a movie after the dinner concludes. This is exactly what MMT asserts, that people want to continue feeling good about something while minimizing anything that makes them feel bad.

In more recent literature, the polarized notion of people seeking pleasure and avoiding strife has been challenged. Studies have cited the concept of Eudaimonia as opposing the traditional hedonistic viewpoint of MMT; theorists have stated that "individuals' media preference are driven by not only by pleasure-seeking, as theories like mood management argue, but also a search for meaning, insight, and self-actualization" (Kim 2020, p. 695). The idea that individuals blindly seek out positivity without any other considerations is outdated, and scholars have proven that a more nuanced consideration process can occur. Keeping this idea in mind paints a clearer picture of how MMT has transformed over the years. To more accurately describe how the theory is used in current research, it can be thought that individuals select media content "in order to alter negative moods or states and to create or maintain a more positive one" (Bailey & Ivory 2018, p. 131). For the purposes of this study, the more straightforward assumption that individuals would seek out pleasure after enduring a negative induced experience was considered.

Application to Videogames

As was mentioned earlier, MMT is a major player in videogame research. Two well-known gaming scholars in the field, Bowman and Tamborini, used MMT to demonstrate mood repair and its effects on stressed versus bored individuals. Using a 2x3 experimental design, participants were placed into either a boredom or stressful condition and then given one of three computer game task demands (low, moderate, or high). Having been given a flight simulator to play, participants in the low task demand category had the game on autopilot. The moderate category was given flight control but had avionics on auto, and the high demand group had complete control of the game's

features. Their study found that those in the boredom condition showed the best instances of mood repair in the moderate condition whereas those in the stressed condition instead demonstrated the best results in the high task demand group (Bowman & Tamborini 2012). Their study demonstrates a strong example of various negative mood states as well as their theoretical implications when considering a videogame context.

Another study conducted by Russoniello and her colleagues used stress as a variable to test whether casual videogames (CVGs) had potential to positively impact one's overall mood state. The authors used three different CVGs for this task: Bejeweled 2, Peggle, and Bookworm Adventures. Bejeweled 2 is a jewel-matching game, Peggle is a pinball-type game, and Bookworm Adventures is a crossword-type puzzle game. Participants were allowed to choose which of these three games they wanted to play and researchers analyzed the results of their activity through use of an electroencephalography (EEG). They found that, aligned with their initial hypothesis, the use of CVGs were found to combat feelings of stress in their participants. In particular, anger scores showed a significant decrease between all three CVGs (Russoniello et al. 2009). From their study, it was clear that CVGs had the potential to alleviate one's negative mood state.

Ferguson and Rueda continued some of the ideas present in Russoniello et al.'s study with a study of their own. The authors utilized a frustration task called the Paced Auditory Serial Addition Task **(**PASAT) to put their participants into a negative mood state. After taking an initial measure of participants' feelings of depression and hostility, participants were randomly assigned to one of four conditions: an antisocial violent videogame (*Hitman: Blood Money*), a prosocial violent videogame (*Call of Duty 2*), a nonviolent videogame (*Madden: 2007*), or a no-game control group. Once gameplay—or lack thereof—concluded, participants were then instructed to engage in a modified version of the Taylor Competitive Reaction Time Test (TCRTT). A second measure

of participants' feelings of depression and hostility was taken before the study concluded and a debriefing occurred (Ferguson & Rueda 2010). The authors found support against the common myth assuming violent videogames lead to increased feelings of hostility. Additionally, their data found support that mood management principles through videogame play helped decrease induced negative emotions in their participants.

Self-Determination Theory

Keeping in mind MMT's principle to increase good feelings and decrease bad feelings, Self-Determination Theory (SDT) builds from that model. Edward L. Deci and Richard Ryan theorized SDT in their book *Self-Determination and Intrinsic Motivation in Human Behavior* first published in 1975. The theory expands on three key components necessary in one's daily life: competency, autonomy, and relatedness. These elements are crucial "for facilitating optimal functioning of the natural propensities for growth and integration, as well as for constructive social development and personal well-being" (Ryan & Deci 2000, p. 68). In particular, competency refers to one's belief of possessing a certain level of skill, autonomy relates to one's feeling of being in control over their own actions, and relatedness is the communal sense of belonging one feels when they are among those with similar views or beliefs (Mills et al. 2018). Each of these terms stand as an umbrella for a wide array of concepts to fall underneath. Competency can be linked to ideas such as perceived player ability, feelings of control mastery, and the balance of challenge. Autonomy is the overall term used to describe phenomenon such as player motivation, control over a story's narrative, and creativity. Ideas such as multiplayer experiences, feelings of comradery, and forming long-term relationships fall under the idea of relatedness (Przybylski et al. 2010). For the purposes of this study, feelings of competency and autonomy were focused on in particular since this experiment did not possess a relational aspect.

Application to Videogames

Though SDT is typically utilized within social psychology or education fields, many communication scholars as well as those studying media effects have worked with the theory. Aspects of both competency and autonomy can be seen as a pivotal requirement for media. Technology has historically been shown to have an impact on one's mood state, so therefore theory regarding one's motivation in whether or not they continue interacting with a form of media should be considered (Peters et al. 2018). Sepehr and Head studied SDT's connection to videogames with an in-person experiment. Participants were asked to play a simple typing game called TypeRacer in which they were assigned to one of "four competition modes: (1) no competition, (2) competition with the computer, (3) competition with a human stranger opponent, and (4) competition with a human friend" (Sepehr & Head 2018, p. 412). After each of five total rounds were completed, participants were instructed to fill out a brief survey regarding their experiences as well as the level of challenge they were experiencing. The authors found that the competitiveness of the game increased player arousal, a direct connection to one's feeling of both competency and autonomy in the game they played (Sepehr & Head 2018). Through using competitiveness as a motivator, feelings of competency and autonomy were both shown to correlate to that motivation variable. The possibility of competency and autonomy relating to other motivating variables is also quite likely.

Przybylski and his colleagues also studied negative feelings of aggression in their participants by utilizing 7 different studies; they "examined the effects of competence deprivation using specific designs that compared games varying in their violent content (Studies 1 and 7), that explicitly manipulated violent content (Studies 2 and 5), or that had nonviolent content (Studies 3, 4, and 6)" (Przybylski et al. 2014, p. 444). Study 2 demonstrated supportive results that players who reported a low level of game mastery (a form of player competence) reported increased

aggressive feelings. Study 4 found that players who experienced competence need satisfaction reported decreased feelings of aggression and increased feelings of enjoyment. Results from Study 5 linked motivation in gameplay (a form of player autonomy) with proper competence need-satisfaction (Przybylski et al. 2014). Considering the authors' findings, there is prior support for the notion that a negative mood state has the chance to be alleviated through increased feelings of competency and autonomy. This finding along with ideas discussed in MMT demonstrates two potential solutions to alleviate negative mood states in individuals.

Prior Research Combining These Theories

SDT has been paired alongside MMT in quite a bit of gaming research. Reinecke worked alongside Bowman, Tamborini, and other colleagues to bring these theories together and study the effects of satisfying intrinsic needs with mood repair practices. Participants were placed into a 3x2 experimental design in which they were made familiar with three different user demand conditions (low, medium, or high) for a flight simulator computer game. This was paired with random assignment between one of two false-feedback conditions (positive or negative). After playing through the game, participants were then instructed to play it once more while choosing one of the three user demand conditions they had been exposed to. Their findings indicated that mood management in particular was an important predictor of enjoyment as well as feelings of competency and autonomy (Reinecke et al. 2012). Keeping in mind their theoretical findings, I propose the following hypotheses:

H1: Increased feelings of *competency* will be related to a decrease in negative mood state.

H2: Increased feelings of *autonomy* will be related to a decrease in negative mood state.

Another study using MMT in particular looked at the effect of in-game success and need satisfaction on mood repair and enjoyment. The authors attempted to answer the question of how in-game success, one of many potential motivators in videogames, can serve as a prerequisite for overall feelings of satisfaction and mood repair. Participants were invited into a lab and given an impossible task to complete (unbeknownst to them but well-known by the researchers). After assessing that their method had worked properly with various questionnaires, participants were then told to play two races of Mario Kart, a popular racing game on the Nintendo Wii console. Finally, they were given a posttest to determine whether or not their negative mood had been alleviated. Their study found that playing Mario Kart was able to promote positive mood aspects and bring participants out of their induced negative mood state (Rieger et al. 2014). Serving as significant inspiration for this study, I propose the following additional hypothesis for consideration:

H3: CVG play through computer games will lead to a decrease in the negative mood state of participants.

METHODOLOGY

Procedure

This study took place entirely virtually via Purdue's SONA system. Participants were given a brief description of the study as well as an eligibility requirement to have zero experience playing the games Bejeweled Stars, Peggle Blast, and Tumble Bees. After signing up for the study and before beginning, participants were requested to take the study on a computer and not a smartphone. This was done to prevent possible issues with the Flow Project Game as well as the CVGs. Participants were then met with the first check within the study; they were asked if they had any experience playing Bejeweled Stars, Peggle Blast, or Tumble Bees. Those who answered "Yes" to any of those questions were immediately taken to the end of the study whereas participants who answered "No" to all three questions were allowed to continue. Those who passed the first check were then met with an initial round of questions asking about their videogame experience, general mood state, and demographic information (see Appendix A). As a within-subjects study design, all participants were exposed to the same conditions throughout the experiment. This was done in order to collect responses regarding competency, autonomy, and general mood state throughout the study within the same set parameters of all other participants.

Participants were then instructed to play the Flow Project Game for a period of 5 minutes (Sherrick 2020; Sherrick et al. 2020). A timer was set on the screen so that participants were not allowed to move forward until the minimum 5 minutes had passed. A short explanation of how to play as well as the goal of the game was given, and the game began at a very doable difficulty. Soon after participants became comfortable with the game's mechanics, the difficulty ramped up to an impossible level of challenge.

Figure 1. Examples of the Flow Project Game

Note. The left image demonstrates typical gameplay with the red objects representing asteroids to be avoided and the white object representing a star to be collected. The right image gives an example of a positive message being sent to the player throughout their gameplay progress.

Once participants finished playing by failing their in-game mission, they were given their first posttest regarding their current mood state as well as their experience with the game (see Appendix B). Once finished, participants were then given a short explanation of three different CVG options: Bejeweled Stars, Peggle Blast, or Tumble Bees. They were instructed to select one of the three games and to play it for 10 minutes. Similar to before, a timer was set on screen that would not allow participants to continue the study until the minimum 10 minutes had passed[1]. They were told to take a screenshot of their highest game score and to upload that screenshot to the webpage once the timer ran out. This acted as the second round of checks to ensure participants were actually playing one of the three selected games and demonstrating progression in their chosen game. After answering which of the three CVGs they had selected, participants were given the second posttest regarding their current mood state and experience with the game (see Appendix B and note that, in order to avoid practice effects, questions were given in a randomized order). Once participants

[1] This amount of time was selected based off of Rieger et al.'s study of a similar design in which Mario Kart was used as the task to alleviate participants' negative mood states. In their study, two races were performed in which each race lasts between 5-6 minutes depending on the skill of the player (Rieger et al. 2014). Because of this, it was decided to have participants play their chosen CVG for a period of 10 minutes.

finished answering, they were thanked for their time and informed that they would be receiving the proper research credit via the SONA system for their participation.

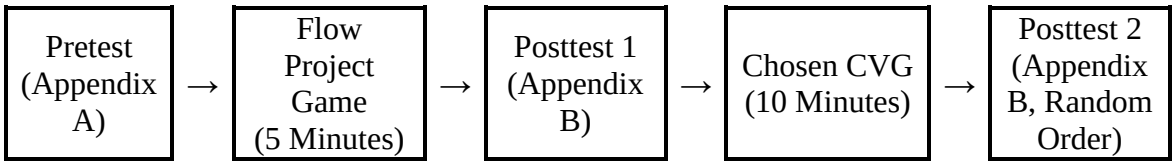

Figure 2. Flowchart of the Study's Procedure

Stimuli and Materials

In order to test the asserted hypotheses, participants were required to be put into a negative mood state with a specific task. A customizable videogame called The Flow Project Game was decided to be used as that task. The game uses a computer's left and right arrow keys to move around a spaceship on a preprogramed path. The player must use the arrow keys to avoid asteroids and collect stars. The game can be programmed to contain as many or as few asteroids and stars as needed, and can therefore increase its level of challenge as the game continues. There is also a function where the game presents the player text in between game levels, and this text helped strengthen the negative mood state manipulation. Participants were told the average amount of stars they should have by that point in the game which could be seen as a way to give encouragement throughout the process. However, with the difficulty ramped up to an unachievable level unbeknownst to them, participants were never able to hit that average amount. Even those with a high amount of gaming experience were unable to achieve the averages the game specified. Therefore, the supposed words of encouragement were actually meant to highlight the participant's lackluster performance. This manipulation was meant to put participants into a negative mood state which then cued the next part of the study.

To act as a way to alleviate the negative mood state induced in participants, three CVGs were selected for participants to choose from: Bejeweled Stars, Peggle Blast, and Tumble Bees. These choices were inspired from Russoniello et al.'s successful mood manipulation in their study detailed above, though the games were updated to match more recent releases (Russoniello et al. 2009). Keeping in mind the three variants in games that Russoniello et al. utilized (a matching game, a pinball game, and a word game), each game was chosen from one of those same categories. Both Bejeweled Stars and Peggle Blast were updated varieties of the games Russoniello et al. used, but Tumble Bees was a bit of a deviation from the original Bookworm Adventures game. While Bookworm Adventures was more of a crossword puzzle game, Tumble Bees is instead a speed-based word-forming game. This choice was made to keep all three game options exceptionally simplistic with very little learning needed in order for participants to successfully play any game selected. Participants were provided with a link to their chosen CVG through use of the website Pogo.com which offers free gameplay for each CVG option.

Participants

It was decided that Purdue's SONA system would be used to recruit undergraduate students and that the study would be conducted entirely virtually. Certain communication courses offer extra credit to their students by completing a certain amount of SONA studies which acted as an incentive for participants to get involved. In total, 214 responses were recorded. The data was first sorted by "Progress" in which any progression less than 100% was deleted (48 responses). Because of the importance of gathering data throughout the experiment and the focus on moods at particular points in time, those who did not complete the survey in its entirety would have insufficient numbers. The data was then analyzed based off of the two systems of checks inserted into the study. Data was sorted by the first three questions that asked participants if they had played the

games Bejeweled Stars, Peggle Blast, or Tumble Bees before. Participants were instructed not to participate if they had experience with these games, so the answer "Yes" to any of these three questions took them directly to the end of the survey. Participants who answered "Yes" to any of these three questions were deleted (32 responses). This was done in order to avoid previous experiences with any of the games impacting the results of the current study. The next check after the study's second posttest asked participants to upload a screenshot of their highest score in their chosen CVG. Participants who did not upload a proper screenshot were removed from the data pool (1 response). This left 133 responses overall (N = 133).

The study only accepted undergraduate students over the age of 18 in order to comply with IRB protocol because those under 18 are federally considered children, falling under a different set of rules and regulations (Special Protections for Children 2016). The age distribution for participants in this study were 52.6% at 18-19 years old, 39.8% at 20-21 years old, and 7.5% at 22-23 years old. Participants labeled themselves as 37.6% freshmen, 16.5% sophomores, 24.8% juniors, and 21.1% seniors. Participants identified their gender with a distribution of 54.9% women, 43.6% men, 0.8% non-binary, and 0.8% other. When asked to identify their race, participants responded with 70.7% White, 21.8% Asian, 3.8% Black/African American, and 3.8% Hispanic/Latinx.

Measures

In order to properly work with the data, a reliability analysis was conducted through SPSS to create four new indices. The first two indices were measures of competence taken from the first and second posttest of the study in which three items were asked during both posttests to measure participants' feelings of competency. Participants were asked if they felt competent at the game they had just played, if they felt capable and effective while playing, and if their ability to play the

game was well-matched with the challenges the game provided (Ryan et al. 2006). From the first posttest, N_{valid} was 98 (73.7%) and $N_{excluded}$ was 35 (26.3%). Participants who did not answer the majority of the posttest's questions were excluded (see *Limitations* for more detail). Cronbach's α was 0.89, so a good amount of internal consistency was demonstrated (M = 3.21 and SD = 1.09). For the second posttest, N_{valid} was 124 (93.2%) and $N_{excluded}$ was 9 (6.8%). Cronbach's α was found to be 0.87, another instance of good internal consistency (M = 4.46 and SD = 1.19).

The second two indices created by utilizing the reliability analysis were measures of autonomy taken from the first and second posttest in which three items were asked to participants during both posttests regarding their feelings of autonomy during their gaming experiences. Questions regarding the level of interesting options and choices the game provided, the game's ability to allow the player to do interesting activities, and the amount of freedom the player experienced were asked (Ryan et al. 2006). For the first posttest, N_{valid} was found to be 70 (52.6%) and $N_{excluded}$ was 63 (47.4%). Once more, participants who did not answer the majority of the posttest's questions were excluded (see *Limitations* for more detail). Cronbach's α was calculated to be 0.89, a good measure of internal consistency regarding the Likert scale items participants were asked (M = 2.49 and SD = 1.14). The second posttest found N_{valid} to be 120 (90.2%), $N_{excluded}$ to be 13 (9.8%), and Cronbach's α to be 0.88. This was therefore another example of good internal consistency (M = 4.21 and SD = 1.48).

In addition to these indices, three measures of overall mood were taken throughout the experiment (at the end of the pretest, first posttest, and second posttest). A one-item measure was taken asking participants to rate their current overall mood. The answers were recorded on a 7-point Likert scale with 1 indicating poor and 7 indicating excellent. The one-item measure was initially created to be used in tandem with other measures of emotion but, after significant holes

in the data were discovered, the one-item measure became the primary focus (see *Limitations* for more detail). From the pretest, $M = 4.74$ and $SD = 1.02$. The first posttest yielded results of $M = 4.58$ and $SD = 1.08$. At the end of the second posttest, $M = 5.03$ and $SD = 1.08$.

RESULTS

Correlations

Before analyzing the hypotheses, a bivariate correlation was conducted to test the relationship between each variable when not controlling for other variables. As can be seen in the tables below, competence and autonomy taken at both the first and second posttest were highly correlated at the 0.01 level. Competence and autonomy were also highly correlated with overall mood measurements taken after the second posttest (at the 0.01 level), but only competence saw a correlation with overall mood after the first posttest (at the 0.05 level). The only variable without a correlation to note aligns with the $N_{excluded}$ value of 63 (47.4%)—autonomy at time 1—mentioned in the *Measures* section of this paper, so therefore the reason for a lack of correlation can potentially be contributed to this area of missing data (see *Limitations* for more detail).

Table 1. Correlations between Competence, Autonomy, and Overall Mood at Time 1

		Competence_1	Autonomy_1	Overall_Mood2
Competence_1	Pearson Correlation	1		
	N	116		
Autonomy_1	Pearson Correlation	0.37**	1	
	N	98	101	
Overall_Mood2	Pearson Correlation	0.22*	0.12	1
	N	115	100	130

Note. ** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

Table 2. Correlations between Competence, Autonomy, and Overall Mood at Time 2

		Competence_2	Autonomy_2	Overall_Mood3
Competence_2	Pearson Correlation	1		
	N	131		
Autonomy_2	Pearson Correlation	0.48**	1	
	N	127	127	
Overall_Mood3	Pearson Correlation	0.25**	0.25**	1
	N	130	126	131

Note. ** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

Hypothesis Testing

H1 and H2 proposed that an increase in competence and autonomy would lead to a decrease in participants' negative mood state. In order to analyze whether these hypotheses found support, two multiple regressions were conducted. The first one analyzed feelings of competence and autonomy after playing the Flow Project Game and predicted a decrease in these values. Competence and autonomy were used to predict overall mood because, according to SDT, an increase in these aspects leads individuals to feel a better sense of personal well-being (Ryan & Deci 2000). This translates into a decrease in negative mood state or, as per the chart below, an increase in overall mood (see table 3).

Table 3. Regression Predicting Overall Mood 2 with Competence and Autonomy at Time 1

Model Summary			
R Square	Adjusted R Square	F	Sig.
0.03	0.01	1.64	0.20

Coefficients					
Model		Unstandardized B	Standardized Coefficients Beta	t	Sig.
1	Competence_1	0.14	0.15	1.42	0.16
	Autonomy_1	0.05	0.06	0.53	0.60

For the standardized coefficients beta, $B = 0.15$ for competence and 0.06 for autonomy. In regard to significance, competence was at 0.16 and autonomy was at 0.60. Since both values were above 0.05, neither was found to be statistically significant.

The second multiple regression regarding H1 and H2 used feelings of competence and autonomy after playing the chosen CVG to predict overall mood in which an increased value was speculated (see table 4).

Table 4. Regression Predicting Overall Mood 3 with Competence and Autonomy at Time 2

Model Summary					
R Square	Adjusted R Square	F	Sig.		
0.08	0.07	5.65	0.00		
Coefficients					
Model		Unstandardized B	Standardized Coefficients Beta	t	Sig.
1	Competence_2	0.13	0.16	1.63	0.11
	Autonomy_2	0.13	0.18	1.84	0.07

For the standardized coefficients beta, $B = 0.16$ for competence and 0.18 for autonomy. When considering significance, competence was at 0.11 and autonomy was at 0.07. Though autonomy came close in this instance, both numbers were ultimately above 0.05 and therefore not statistically significant. Based off of these results, no support was found for H1 or H2.

To evaluate H3, a within-subjects repeated-measures ANOVA was conducted through SPSS. The IV was the time at which the measure was taken and the DVs were each of the three mood measurements taken between the pretest, first posttest, and second posttest (see table 5).

Table 5. Mood and Time

Mood_Time	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	4.76	0.09	4.59	4.94
2	4.59	0.10	4.40	4.77
3	5.04	0.10	4.85	5.23

The F statistic was found to be ($F = 12.98$, $p < 0.05$) as calculated through Wilk's $\lambda = 0.83$. This demonstrates that the group of variables chosen were jointly significant and that the outcome from this study design could reasonably be expected to occur once more in a replication. Regarding partial eta squared, ($\eta p^2 = 0.17$) since 0.17 is significantly greater than 0.09, this demonstrates that an effect occurred when comparing each of the three time periods to each other. The "guidelines for small (0.01), medium (0.09), and large (0.25) effects…apply to experiments and social/clinical areas of psychology" (Tabachnick & Fidell 2013, p. 55). Mean differences between each mood condition regarding pairwise comparisons were all shown to be statistically significant at the 0.05 level as well with standard error values between 0.07 and 0.09. This means significant differences were recorded in overall mood throughout the experiment, with a decrease occurring as part of the CVG intervention, so therefore H3 was supported.

DISCUSSION

General

Hypotheses 1 and 2 predicted that increased feelings of competency and autonomy would result in a decrease in negative mood state. After conducting two multiple regressions on these variables, the ideas of competency and autonomy working as a solution for a negative mood state did not find support. Hypothesis 3 predicted that CVG play through computer game titles would result in a decrease in negative mood state. After conducting a within-subjects repeated-measures ANOVA, CVG play demonstrated support in reducing negative mood states. As an added bonus, participants saw an increase in their initial mood state (taken at the pretest) when compared to their mood state at the end of the study (taken at the second posttest). Concepts regarding MMT were shown to have a stronger connection to these variables than the elements of SDT. Therefore, when considering the data gathered, H1 and H2 were not supported whereas H3 was supported.

Future Implications

Through these results, there is clear support showing that CVG play through computer games leads to a decrease in the negative mood state of the player. Data for the hypothesis regarding autonomy and competence may have not found support, but CVG play as a potential intervention for a negative mood state was demonstrated as a viable solution. Rieger et al.'s study supported this concept through an unachievable task paired with a CVG whereas this experiment utilized an impossible gaming task and a CVG (Rieger et al. 2014). The key ingredient in alleviating a negative mood state is with some form of distraction from the aggravating task. Game creators can take this lesson to heart when crafting their own gaming experiences to try and lessen negative emotions in their players during prolonged gaming experiences. Though some games gain

popularity over the internet for intentionally inducing negative mood states—an example being *Getting Over It with Bennett Foddy* which intentionally taunts the player for poor gameplay decisions—most games do not benefit from exploiting this emotional state.

An example of a gaming genre that could benefit from this study's findings would be roguelike games. Roguelikes are defined as "a game that features both procedural generation and permadeath [permanent death] as core elements of gameplay" alongside exploration and a combat element (Saltzman 2021). These types of games have a large range of difficulty and an expectation that the player will replay the game many times in order to truly progress. However, between battle segments, some games allow the player a distraction from what may become an increasingly negative mood state whereas other games force the player to continue without it. In the game *Nuclear Throne* for instance, players are expected to continuously gun down enemies and are then immediately teleported to the next level once all enemies have been defeated. The game only pauses when the player unlocks an upgrade they can choose from, but these upgrades are few and far between. Besides those brief moments, gameplay is constant until the player wins or dies trying.

The Binding of Isaac, another roguelike title, operates a bit differently; the game allows players much more downtime as well as distractions from stressful events. The goal of the game is to progress through various floors and beat a final boss (though there are many routes within the game and, depending on your progress, the final boss may take place on deeper floors). Once a room is cleared, players can backtrack to that cleared room without expecting any enemies to appear for the remainder of the floor. Players are allowed to take their time during the game, and the only requirement for progression is to defeat each floor's boss since it spawns a trapdoor to the next floor. Additionally, there are other gameplay mechanics that allow for progression without involving primary gameplay functions such as combat. One example is an arcade that is earned

every other floor where players can gamble with the coins they collected throughout their run. Though the game has the ability to induce a negative mood state, several elements have been added to try and lessen that those emotions.

Ultimately though, emotional fluctuations can vary between players. Some players, especially those who actively pursue achievement-hunting, may still find themselves experiencing negative emotions despite mechanics being put into place to try and reduce it. Game creators looking to create a new experience should consider adding engaging mini-games to their projects that serve as a way to decrease negative (or increase positive) emotions in players. The game *Enter the Gungeon*, another roguelike, builds on this idea by creating rooms within the game that allow players to spend in-game currency to potentially earn prizes. While regular gameplay consists of traversing an expansive dungeon, shooting enemies, and fighting bosses, mini-games include both puzzles and target practice. This type of gameplay allows players a moment of rest before jumping back into the hectic main-game mission. Outside game mechanics and mini-games give the illusion of a CVG and allow players the ability to decrease negative emotional build-up so that, even with the potential for negative emotions to be induced through gameplay, an extreme negative reaction can be successfully avoided.

Limitations

A couple limitations of this study must be noted; first, this study took place during the global COVID-19 pandemic. Because of this, multiple procedures were changed as a result to comply with COVID-19 guidelines. It was decided that the study would take place entirely virtually rather than in a lab setting due to worries about potential exposure to the virus. Since the study took place in a virtual setting, directions could not be verbally clarified to participants which led to some miscommunications. One example took place during the second check of the

experiment where participants were asked to submit a screenshot of their highest score after playing their chosen CVG for a period of 10 minutes. Instead of sending screenshots of numeric values, some participants who chose to play Bejeweled Stars or Peggle Blast submitted an image of the game's overworld instead. Though it lacked consistency between other participants' screenshots, it was still seen as a demonstration of game progression and therefore those participants' data was included in the final results.

Another consideration should be the amount of missing data within the experiment. Participants ended up skipping over some questions which left certain holes in the data. This can be seen in the reliability analysis where index 3 (autonomy at time 1) had a $N_{excluded}$ value above 40%. This could be due to several factors including the way the survey was formatted, a lack of clarity with instructions, or pandemic-related fatigue. Since questions were created using matrixes rather than individualized items, it is very possible that the main causes were formatting and lack of clarity. Regardless, certain results that found significant values in other studies were found to be insignificant in this study (Russoniello et al. 2009; Rieger et al. 2014). It is possible that this is due to holes in the data, so a follow-up study should be considered before results regarding H1 and H2 are truly considered statistically sound. Other measures of negative emotion were included in the experiment but not in the results for a similar reason. Along with areas of missing data, conceptual differences were noted in which it was decided that the focus would be on participants' overall mood state rather than their specific emotions.

Future Research

Because of limitations mentioned above, findings for H1 and H2 were not statistically sound and therefore cannot be properly evaluated. In reviewing past literature with similar concepts and study designs, a key difference stood out between other studies and this one: an in-

person versus virtual experimental design (Russoniello et al. 2009; Ferguson & Rueda 2010; Bowman & Tamborini 2012; Reinecke et al. 2012; Rieger et al. 2014; Sepehr & Head 2018). In line with the proposed limitations of this study, other researchers did not report similar issues with their data when conducting an in-person experimental design. Therefore, as the main difference between this and other studies, it stands to reason that the virtual nature of the survey design was a likely contender for why such issues were present. Additionally, checks and clarifications were made verbally to avoid situations where decisions were left to the opinion of the individual participant (see details regarding the second check in the *Limitations* section for further insight). A follow-up study should be considered to try and improve results by creating an in-person experimental design outside of pandemic-related circumstances.

Despite the lack of support for H1 and H2, H3 demonstrates that CVG play has the potential to help alleviate negative mood states in individuals. Therefore, by utilizing principles of MMT, researchers have the opportunity to impact an individual's mood for the better. This study serves as another clear example of videogames and their healing potential in individuals experiencing negative mood states regarding another gaming experience. The idea that people seek out ways to feel better and attempt to avoid things that make them feel worse has been supported by the literature in the past and continues to demonstrate support in the present study. Even without explicit usage of CVGs, instances of gameplay mechanics from CVGs can continue this trend of alleviating players' negative mood states. Videogames can be more than an instigating issue; they can act as the solution as well.

CONCLUSION

Videogames and mood management go hand-in-hand with some individuals choosing a CVG to calm them down whereas others may select a high-intensity roguelike title. Regardless of the game chosen, CVG elements can be incorporated into any game to help decrease the potential of a negative mood state in the player. *The Binding of Isaac*'s ability to backtrack peacefully as well as *Enter the Gungeon*'s inclusion of mini-games makes some of the toughest roguelike titles into a pleasant romp. CVGs have demonstrated their calming potential through this experiment, and further inclusion of the games themselves and their gameplay mechanics can significantly impact players for the better. Game designers should take this message to heart when creating their own titles, and game players should utilize these methods to successfully avoid entering a negative mood state.

REFERENCES

Bailey, E. J., & Ivory, J. D. (2018). The moods meaningful media create: Effects of hedonic and eudaimonic television clips on viewers' affective states and subsequent program selection. *Psychology of Popular Media Culture*, *7*(2), 130–145. https://doi.org/10.1037/ppm0000122

Bartsch, A. (2012). Emotional Gratification in Entertainment Experience. Why Viewers of Movies and Television Series find it Rewarding to Experience Emotions. *Media Psychology*, *15*(3), 267–302. doi: 10.1080/15213269.2012.693811

Bowman, N. D., Jöckel, S., & Dogruel, L. (2015). "The app market has been candy crushed": Observed and rationalized processes for selecting smartphone games. *Entertainment Computing, 8*, 1-9. doi:10.1016/j.entcom.2015.04.001

Bowman, N. D., & Tamborini, R. (2012). Task demand and mood repair: The intervention potential of computer games. *New Media & Society*, *14*(8), 1339–1357. doi: 10.1177/1461444812450426

Broome, M. R., & Carel, H. (2009). The Ubiquity of Moods. *Philosophy, Psychiatry, & Psychology*, *16*(3), 267–271. https://doi.org/10.1353/ppp.0.0246

Broome, M. R., Saunders, K. E., Harrison, P. J., & Marwaha, S. (2015). Mood instability: Significance, definition and measurement. *British Journal of Psychiatry*, *207*(4), 283–285. https://doi.org/10.1192/bjp.bp.114.158543

Bushman, B. J., & Anderson, C. A. (2015). Understanding Causality in the Effects of Media Violence. *American Behavioral Scientist*, *59*(14), 1807–1821. https://doi.org/10.1177/0002764215596554

Carpentier, F. R. D., Brown, J. D., Bertocci, M., Silk, J. S., Forbes, E. E., & Dahl, R. E. (2008). Sad Kids, Sad Media? Applying Mood Management Theory to Depressed Adolescents Use of Media. *Media Psychology*, *11*(1), 143–166. doi: 10.1080/15213260701834484

Fahs, T. (2012, June 14). *The History of Mortal Kombat*. IGN. https://www.ign.com/articles/2011/05/05/the-history-of-mortal-kombat.

Ferguson, C. J., & Rueda, S. M. (2010). The Hitman Study: Violent Video Game Exposure Effects on Aggressive Behavior, Hostile Feelings, and Depression. *European Psychologist*, *15*(2), 99–108. https://doi.org/10.1027/1016-9040/a000010

Kim, D. D. (2020). The Search for Pleasure and Meaning on TV, Captured In-App: Eudaimonia and Hedonism Effects on TV Consumption as Self-Reported via Mobile App. *Journal of Broadcasting & Electronic Media*, *64*(5), 693–713. https://doi.org/10.1080/08838151.2020.1849702

Knobloch-Westerwick, S. (2007). Gender Differences in Selective Media Use for Mood Management and Mood Adjustment. *Journal of Broadcasting & Electronic Media*, *51*(1), 73–92. doi: 10.1080/08838150701308069

Mills, D. J., Milyavskaya, M., Mettler, J., & Heath, N. L. (2018). Exploring the pull and push underlying problem video game use: A Self-Determination Theory approach. *Personality and Individual Differences, 135*, 176-181. doi:10.1016/j.paid.2018.07.007

Peters, D., Calvo, R. A., & Ryan, R. M. (2018). Designing for Motivation, Engagement and Wellbeing in Digital Experience. *Frontiers in Psychology, 9*. 1-15. doi:10.3389/fpsyg.2018.00797

Przybylski, A. K., Deci, E. L., Rigby, C. S., & Ryan, R. M. (2014). Competence-impeding electronic games and players' aggressive feelings, thoughts, and behaviors. *Journal of Personality and Social Psychology*, *106*(3), 441–457. https://doi.org/10.1037/a0034820

Przybylski, A. K., Rigby, C. S., & Ryan, R. M. (2010). A Motivational Model of Video Game Engagement. *Review of General Psychology*, *14*(2), 154–166. https://doi.org/10.1037/a0019440

Reinecke, L., Tamborini, R., Grizzard, M., Lewis, R., Eden, A., & Bowman, N. D. (2012). Characterizing Mood Management as Need Satisfaction: The Effects of Intrinsic Needs on Selective Exposure and Mood Repair. *Journal of Communication*, *62*(3), 437–453. doi: 10.1111/j.1460-2466.2012.01649.x

Rieger, D., Frischlich, L., Wulf, T., Bente, G., & Kneer, J. (2015). Eating ghosts: The underlying mechanisms of mood repair via interactive and noninteractive media. *Psychology of Popular Media Culture*, *4*(2), 138–154. doi: 10.1037/ppm0000018

Rieger, D., Wulf, T., Kneer, J., Frischlich, L., & Bente, G. (2014). The winner takes it all: The effect of in-game success and need satisfaction on mood repair and enjoyment. *Computers in Human Behavior*, *39*, 281–286. doi: 10.1016/j.chb.2014.07.037

Russoniello, C. V., O'Brien, K., & Parks, J. M. (2009). The Effectiveness of Casual Video Games in Improving Mood and Decreasing Stress. *Journal of Cybertherapy and Rehabilitation*, *2*(1), 53–66.

Ryan, R. M., & Deci, E. L. (2000). Self-Determination Theory and the Facilitation of Intrinsic Motivation, Social Development, and Well-Being. *American Psychologist, 55*(1), 68-78. doi:10.1037/0003-066x.55.1.68

Ryan, R. M., Rigby, C. S., & Przybylski, A. (2006). The Motivational Pull of Video Games: A Self-Determination Theory Approach. *Motivation and Emotion, 30*(4), 344-360. doi:10.1007/s11031-006-9051-8

Saltzman, M. (2021, June 2). *The Best Roguelike Games*. IGN. https://www.ign.com/articles/top-10-roguelikes.

Sepehr, S., & Head, M. (2018). Understanding the role of competition in video gameplay satisfaction. *Information & Management*, *55*(4), 407-421. doi:10.1016/j.im.2017.09.007

Sherrick, B. (2020). The Flow Project Game (3.0) [Videogame]. Brett Sherrick.

Sherrick, B., Smith, C., Kao, D., & Mousas, C. (2020, November). Using real-time, in-game measures to evaluate game difficulty. Paper presented at NCA, Indianapolis.

Special Protections for Children as Research Subjects. (2016, March 30). Retrieved from https://www.hhs.gov/ohrp/regulations-and-policy/guidance/special-protections-for-children/index.html

Strizhakova, Y., & Krcmar, M. (2007). Mood Management and Video Rental Choices. *Media Psychology*, *10*(1), 91–112. doi: 10.1080/15213260701301152

Tabachnick, B. G., & Fidell, L. S. (2013). Effect Size. In *Using Multivariate Statistics* (6th ed., pp. 54–55). essay, Pearson.

Wolf, M. J. (2008). Part 1 Looking at Video Games. In *The Video Game Explosion: A History from Pong to PlayStation and Beyond* (pp. 3-7). Westport, CT: Greenwood Press.

Yeo, N. L., White, M. P., Alcock, I., Garside, R., Dean, S. G., Smalley, A. J., & Gatersleben, B. (2020). What is the best way of delivering virtual nature for improving mood? An experimental comparison of high definition TV, 360° video, and computer generated virtual reality. *Journal of Environmental Psychology*, *72*, 1–13. https://doi.org/10.1016/j.jenvp.2020.101500

Zillmann, D. (1988). Mood Management through Communication Choices. *American Behavioral Scientist*, *31*(3), 327–340. doi: 10.1177/000276488031003005

APPENDIX A PRETEST QUESTIONS

- Please rate your current overall mood on a scale of 1-7 (1 being poor, 7 being excellent):
  - 1 – 2 – 3 – 4 – 5 – 6 – 7
- What types of videogames do you have experience playing (select all that apply)?
  - PC
    - (a computer game such as Overwatch, Minecraft, or League of Legends)
  - Console
    - (a gaming system such as an Xbox, PlayStation, or Nintendo Switch)
  - Smartphone App
    - (a phone game such as Candy Crush Saga, Pokémon GO, or Words with Friends)
  - None of the above
- On a typical day, how often do you play **PC** videogames?
  - Less than 1 hour a day
  - 1-2 hours a day
  - 3-4 hours a day
  - 5-6 hours a day
  - More than 7 hours a day
- On a typical day, how often do you play **console** videogames?
  - Less than 1 hour a day
  - 1-2 hours a day
  - 3-4 hours a day
  - 5-6 hours a day
  - More than 7 hours a day
- On a typical day, how often do you play **smartphone app** videogames?
  - Less than 1 hour a day
  - 1-2 hours a day
  - 3-4 hours a day
  - 5-6 hours a day
  - More than 7 hours a day
- How would you rate your skill level at videogames?
  - Poor
  - Below Average
  - Average
  - Above Average
  - Expert
- How old are you?
  - Less than 18 years old
  - 18-19 years old
  - 20-21 years old
  - 22-23 years old
  - More than 23 years old
- What year are you (by credits)?

    - Freshman
    - Sophomore
    - Junior
    - Senior
    - Other
- How would you identify your race?
    - White
    - Asian
    - Hispanic/Latinx
    - Black/African American
    - Other
- What is your gender?
    - Male
    - Female
    - Non-binary
    - Other

APPENDIX B POSTTESTS 1 AND 2 QUESTIONS

- Please rate your current overall mood on a scale of 1-7 (1 being poor, 7 being excellent):
  - 1 – 2 – 3 – 4 – 5 – 6 – 7
- Please rate the following statements on a scale of 1-7 (1 being strongly disagree, 7 being strongly agree):
  - I enjoyed the game I just played.
    - 1 – 2 – 3 – 4 – 5 – 6 – 7
  - I would play this game again by choice.
    - 1 – 2 – 3 – 4 – 5 – 6 – 7
  - I experienced a fair amount of challenge from this game.
    - 1 – 2 – 3 – 4 – 5 – 6 – 7
  - This game was very engaging to me.
    - 1 – 2 – 3 – 4 – 5 – 6 – 7
  - I achieved the average amount of collected stars easily.
    - 1 – 2 – 3 – 4 – 5 – 6 – 7
  - This game made me feel good about myself.
    - 1 – 2 – 3 – 4 – 5 – 6 – 7
  - This game made me feel good about my gaming abilities.
    - 1 – 2 – 3 – 4 – 5 – 6 – 7
  - I would recommend this game to a friend.
    - 1 – 2 – 3 – 4 – 5 – 6 – 7
- Reflect on your play experiences and rate your agreement with the following statements[2]:
  - I feel competent at the game.
    - 1 – 2 – 3 – 4 – 5 – 6 – 7
  - I feel very capable and effective when playing.
    - 1 – 2 – 3 – 4 – 5 – 6 – 7
  - My ability to play the game is well matched with the game's challenges.
    - 1 – 2 – 3 – 4 – 5 – 6 – 7
  - The game provides me with interesting options and choices.
    - 1 – 2 – 3 – 4 – 5 – 6 – 7
  - The game lets you do interesting things.
    - 1 – 2 – 3 – 4 – 5 – 6 – 7
  - I experienced a lot of freedom in the game.
    - 1 – 2 – 3 – 4 – 5 – 6 – 7

[2] This is Ryan et al.'s Player Experience of Need Satisfaction (PENS) scale regarding competence and autonomy taken from:

Ryan, R. M., Rigby, C. S., & Przybylski, A. (2006). The Motivational Pull of Video Games: A Self-Determination Theory Approach. *Motivation and Emotion, 30*(4), 344-360. doi:10.1007/s11031-006-9051-8