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User Demand and Mood Repair: The Intervention Potential of Video Game Interactivity

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Abstract

It is argued that video games, because they place higher demand on users' attentional resources than other forms of media, have a greater potential to intervene in noxious mood states. From mood management theory, this increased intervention potential should result in video games being particularly strong at mood repair. To test this assertion, a study was conducted that varied levels of user demand in a video game to examine mood repair for bored and stressed individuals. Results show that (a) increasing the amount of control an individual has over a mediated environment increases that medium's intervention potential, (b) this increase in intervention potential results in an enhanced ability to relieve boredom and stress, (c) too much user demand has a detrimental effect on mood repair, and (d) the ability of video games to repair negative affect is a function of increased user demand, and not simply increased arousal.

THE EFFECT OF DEMAND ON USER ATTENTIONAL RESOURCES ON MOOD REPAIR

The ability of entertainment media to serve as a regulator of one's mood state was proposed by Zillmann and Bryant (1985). Their affective-dependent theory of stimulus arrangement – known today as mood management theory – explains that individuals are motivated to dissipate noxious mood states whenever possible, and will make media choices in line with this motivation. The result of this selective exposure is mood repair, a marked shift in mood state from noxious to optimal. This process has been tested with a variety of entertainment media, including television and film (Bryant & Zillmann, 1984), music (Knobloch & Zillmann, 2002), and Internet browsing behavior (Mastro, Eastin, & Tamborini, 2003). However, it has not been examined in any great detail with video games.

Entertainment scholars assert that the experience of video game play is unique among other media forms, and that features of technology responsible for this uniqueness afford video games great mood management potential. Grodal (2000) suggests that video games differ significantly from 'passive' media such film and television viewing in part because of the increased attention and physical engagement required for game play. To play a video game, users have to pay careful attention to the game, make mental maps of game environments, make note of objects and landmarks for future reference, and coordinate visual attention with motor behavior (Grodal, 2000). Unlike more passive media such as film, a video game proceeds only through the player's motivation to continue; this continuation requires a user's focused attention (Tamborini et al., 2004).

The present investigation begins by asserting that the unique demand on a user's attentional resources thought to occur during video game play is in part responsible for the mood management potential of video games. For individuals in a noxious state, playing video games that place a greater demand on user attentional resources should result in greater mood repair. The study reported examines this assertion in greater detail, specifically looking at how one key dimension of the mood management process – intervention potential – can be used to explain why some media forms might have a greater capacity to influence mood repair than others.

Selective Exposure Theory & Mood Management Theory

Bryant and Davies (2006) recognize four dimensions mood management that include as arousal regulation (via the principle of excitatory homeostasis), behavioral affinity, hedonic valence, and intervention potential. Understanding the nature of these dimensions can help us comprehend how different media vary in their intervention potential. As such, each is discussed here.

Arousal regulation is understood as the ability for a medium to increase or decrease an individual's felt arousal. With respect to media, it refers to the tendency of individuals to choose media that will help them achieve an optimal level of arousal. Bryant and Zillmann (1984) showed evidence of this concept by experimentally inducing boredom or stress in a group of undergraduate students before affording them an opportunity to watch a series of television programs. Consistent with their predictions, participants in the boredom induction chose to watch exciting programming (e.g., highlights from a football game, an action-adventure show, and a game show) whereas participants in the stress induction chose to watch more relaxing programming (e.g., segments of a travel documentary, orchestra concerts, and a nature program). Recent work by Mastro, Eastin, and Tamborini (2002) replicated these results with Internet search behavior, finding that bored individuals tended to surf the Internet more rapidly than stressed individuals, and interpreting this behavior as consistent with the notion that bored participants engaged in more highly interactive sessions that afforded greater stimulation.

Behavioral affinity refers to similarity between message content and one's current affective state. For example, if an individual was in an aggressive (perhaps even hostile) mood state, a violent boxing match would be understood to have a high level of behavioral affinity, whereas a romantic comedy would have a relatively low level of behavioral affinity. Selective exposure logic would predict that individuals in an aggressive mood would avoid watching the boxing match, preferring the romantic comedy in hopes of dissipating their noxious mood state. Work by Zillmann, Hezel, and Medoff (1980) found support for this claim, reporting that study participants who were provoked prior to viewing television (thus creating negative affective states) avoided watching situational comedies that featured tendentious humor, and action drama programming.

Hedonic valence is understood to be the general pleasurable or unpleasurable tone of a message. One can point to the prototypical Hollywood 'buddy comedy' (e.g., *Turner and Hooch*) as a genre with a generally pleasurable tone, and the blood-soaked 'slasher' film (e.g., *Friday the 13th*) as a genre with a generally unpleasurable tone. Similar examples of pleasurable and unpleasurable tone can be easily thought of in music. The of Knobloch and Zillmann (2002) on music preferences perhaps demonstrates this element most clearly, as participants induced into bad moods chose to listen to music rated as 'energetic-joyful'. Thus, the tone of a message can be understood to influence media choice based on one's current mood state.

Although the above-listed dimensions are important to understanding the mood management process, the most central dimension to the current study is *intervention potential*, defined as a medium's ability to capture an aroused individual's attentional resources (Bryant & Davies, 2006). Generally, it is argued that messages with higher intervention potential are more likely to distract an individual from the root cause of their noxious mood state, thus hastening the mood repair process. Prior research examining mood repair has demonstrated that the extent of media exposure's intervention potential is influenced by attributes found in message content such as hedonic valence of news photography (Zillmann, Knobloch, & Yu, 2001; Knobloch, Hastall, Zillmann, & Callison, 2003), but no known research has examined how exposure's intervention potential might be influenced by specific attributes of different media forms – in this case, attributes that differ inherently between video games and television.

Intervention Potential in Different Media Forms

Both Bryant and Davies (2006) and Grodal (2000) maintain that the highly interactive nature of video games and the level of user involvement required for the production of this technology's dynamic content demands more of a user's attentional resources than other media forms, such as television or film. If this is true, mood management logic would suggest that this increased demand on a user's attentional resources should results in greater intervention potential. As such, we might expect the user involvement required by video games to increase the medium's ability to intervene in noxious mood states, and therefore aid in the mood repair process. Vorderer (2000) offers a similar claim, arguing that video games demand greater cognitive and tactile engagement from the user. Likewise, Klimmt and Hartmann (2006) note that video games are specifically designed to demand input from the user in order for the game to progress, increasing their intervention potential relative to less demanding media such as television. Beyond simply turning on the television device, one is hard-pressed to identify another point at which a standard television program requires or demands any real-time input on behalf of the user. Tamborini and Bowman (in press) advance similar logic with regard to the presence enhancing attributes of video game technology. They hold that the vividness and interactivity inherent in video game technology makes playing games an engaging and absorbing experience. For example, while traditional narrative media such as television and film require the user only to set the TV tuner on a particular channel or start a VHS or DVD in order to view a complete narrative, video games require near-constant user feedback from one point to the next. This engagement not only prompts experiences of presence, but also results in a high capacity for the video game to intervene in rumination, thus increasing its intervention potential.

Although these and other scholars have speculated that attributes of video game technology afford it greater intervention potential than media such as television, neither the claim of video game’s inherent superiority to television nor the processes claimed to underlie this superior intervention potential have been empirically demonstrated. Toward this end, the current study varies levels of user demand to examine the effect of user demand on mood repair. The study examines the claim that video games are superior to television in their mood repair capacity, and that this superior capacity results from the increased demand on attentional resources created by the need to actively engage in video game play. Conceptually, intervention potential is a corollary to the level of demand placed by the medium on the user’s attentional resources.

Hypotheses

Our logic begins with the assumption that video games have a higher user demand than television (cf. Klimmt & Hartmann, 2006). From this, we examine existing claims that the heightened user demand in video games increases their mood repair capacity, controlling for other mood management-relevant factors. As a result of the intervention potential created by demand on a user’s attentional resources, we predict the following (Figure 1, H1):

> H1: People in noxious mood states (boredom or stress) will experience greater mood repair as the user demand increases from low to high.

When examining the effect of user-demand produced intervention potential on mood repair, it would be imprudent to ignore the possibility for other recognized dimensions of mood management, such as arousal regulation, to affect mood repair. Though somewhat peripheral to the user demand hypotheses central to our study (H1), the potential influence of physical engagement and arousal regulation should not be overlooked. When manipulating the attentional resources required to play the game by varying user demand, there is a natural confound between physical and attentional resources. Game play that requires more actions should also be expected to increase an individual's felt arousal. As such, we will measure and control for felt arousal in tests of H1. This becomes important specifically when considering the nature of boredom and arousal, the two noxious moods states under investigation in the current study.

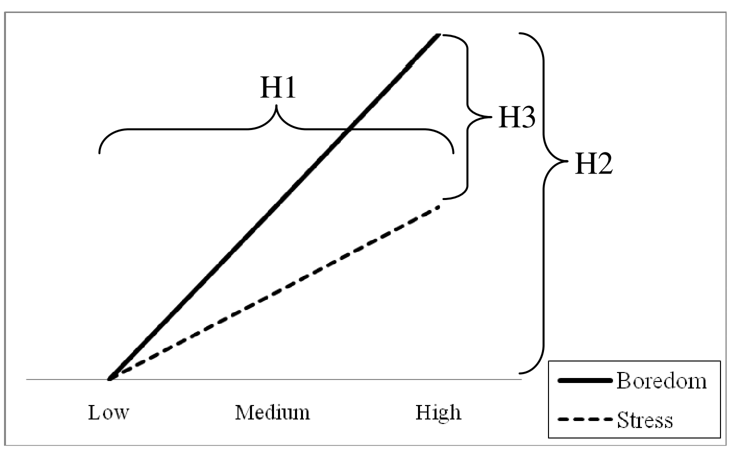
As boredom is a noxious state caused by very low levels of arousal, we expect that any increase in felt arousal resulting from the higher levels of physical engagement produced by a game requiring an increased number of actions should produce a more positive effect on mood repair for those in a state of boredom than those in a state of stress. Thus, bored individuals will experience a positive effect on mood repair as a result of the intervention potential produced by heightened user demand as well as a positive effect on mood repair resulting from arousal regulation. Conversely, since stress is a noxious state from elevated levels of arousal, though stressed individuals should experience the same positive effect on mood repair resulting from intervention potential, they should not experience the same a positive effect on mood repair resulting from arousal regulation. Thus, we tender the following hypothesis (Figure 1, H2):

> H2: Overall, mood repair will be greater for those in a boredom condition than for those in a stress condition.

Notably, H2 predicts only a main effect for noxious state such that mood repair is greater for bored individuals than it is for stressed individuals. Because the comparatively greater mood repair predicted for those in the boredom condition results from elevated arousal, the degree to which mood repair in the boredom condition surpasses repair in the stress condition should mirror levels of arousal created by the game play conditions. As such, because physical activity and its resultant arousal should increase as user demand increases, the extent to which mood repair in boredom conditions exceeds repair in stress conditions should also increase as user demand condition increases. This leads to our third hypothesis (Figure 1, H3):

> H3: For those in a noxious mood state condition (i.e., boredom or stress), there will be a disordinal, nonsymmetrical interaction between mood state and user demand on mood repair. The increased mood repair predicted as user demand condition goes from low to high will be greater for those in the boredom condition than those in the stress condition.

Figure 1. Predicted pattern mood repair scores as a function of user demand condition, split by mood manipulation with specific hypotheses labeled.



Finally, there is reason to suspect that the beneficial effect of user demand on mood repair will peak at the point where a game becomes too demanding, and frustration starts to set in (cf. Wolf & Perron, 2003). If this is the case, we might expect extreme levels of user demand to counter-act the mood repair process. Yet the point at which user demand becomes noxious and starts to outweigh the mood repair benefits of intervention is difficult to predict, as available research offers no insight on this matter. This makes it is hard to predict where or if this point would be reached in any experimental induction of user demand. As such, we began our research with the above model predicting positive linear effects of user demand, but we recognize the potential curvilinear influence of user demand on mood repair and its possible effect on our predictions. This potential relationship will be examined in our hypothesis testing.

METHOD

Participants

Participants were recruited from a large, Midwestern university and offered course credit and the chance for a $100 cash prize for participating in the study. A sample size of N = 172 was obtained for this study[1]. The sample contained 79 males and 93 females, with an average age of 21 years, five months. Notably, data collection was restricted here to a convenience sample of college students; however, because the study examines how media exposure impacts mood repair in people experiencing common noxious mood states (in this case, boredom and stress), we have no reason to believe that this population possesses any unique elements that would be expected to have an extraneous effect on the proposed hypotheses. In fact, an argument could be made that college students would a more applicable population than others, as this population represents a substantial portion of the gaming community (Jones, 2003).

Design and Procedure

The study experimentally manipulated the intervention potential of media exposure by way of user demand (i.e., the extent to which the user is required to physically manipulate a video game's controls) and observed subsequent differences in mood repair on respondents placed in noxious states (conditions of boredom or stress). In a 2 (mood state) x 4 (user demand) between-subjects experimental design, participants were randomly assigned to conditions of boredom or stress, and then asked to play a flight simulator video game programmed to vary (low, low + cognitive task, medium, high) in user demand.

Upon entering the lab, participants first reviewed and signed the informed consent form, next completed a questionnaire measuring perceived video game skills and demographic characteristics, and then played or viewed the flight simulator for five minutes (in there assigned condition) to become familiar with the game. Following this session, participants were subjected to either the boredom or stress mood induction. After the induction, participants completed a mood measure (as an induction check) and then played (or viewed) the video game for approximately two to three minutes. During game play, user demand was measured with a distractor task. Once game play was finished, participants completed another set of mood measures (to measure change in mood since induction). Finally, participants completed a questionnaire containing measures of perceived user demand and overall game evaluation before being fully debriefed; these measures were part of a separate data collection and thus are not discussed further in this manuscript. The study lasted about one hour in total.

The four levels of user demand (low, low+, medium, high) were created by varying the number of actions required to play the video game. In the low demand condition, game play was set at auto-pilot on to simulate watching a television program (i.e., no actions required). In the medium demand condition, play was set at auto-pilot half on (i.e., some actions required). In the high demand condition, play was set at the auto-pilot off (i.e., full actions required). Finally, concern that participants in the low user demand condition would simply ignore the video game entirely led to the inclusion of a fourth condition labeled low+ user demand, in which a cognitive demand element was added to the low demand condition described above. The logic for the addition of the low+ demand condition was as follows. The goal of the low user demand condition was to simulate the level of demand found in television viewing[2]. If participants exposed to video game play in demonstration mode simply ignored the game, this would not be an accurate corollary to television viewing, which surely contains a cognitive or information processing element (cf. Lang, Bolls, Potter, & Kawahara, 1999). The inclusion of the low+ condition was intended to add such a cognitive processing element to the low demand condition.

Stimuli/Materials

Mood inductions. Consistent with prior research (Bryant & Zillmann, 1984; Mastro et al., 2002), participants were induced into either boredom or stressful affective states. Each induction required participants to perform a particular task for 20 minutes. For the boredom induction, participants were given a large box of metal washers, and asked to thread the washers onto a length of string. For the stress induction, participants were asked to complete a booklet of difficult logic puzzles designed to exceed the talents of the participants. Furthermore, participants in the boredom induction were left to their own volition, whereas participants in the stress induction were under constant pressure from an experimenter to perform better.

Video game. The video game played in this study was *Lock-On: Modern Air Combat*, released by Ubisoft in November 2003 and promoted as "an ultra-realistic [combat flight] simulator with faithfully rendered physics, weather, and avionics" (Gametap, 2009). The game is played using the Saitek X36F flight stick and X35T throttle in tandem with a standard PC keyboard and mouse, based on how the game's controls are configured. *Lock-On* was particularly well-suited for this study for two reasons: the game has fully programmable flight controls (which allow the experimenter to turn on or off any number of game controls) and variable auto-pilot capability (which allow the experimenter and the user to give varying amounts of game control to the video game itself).

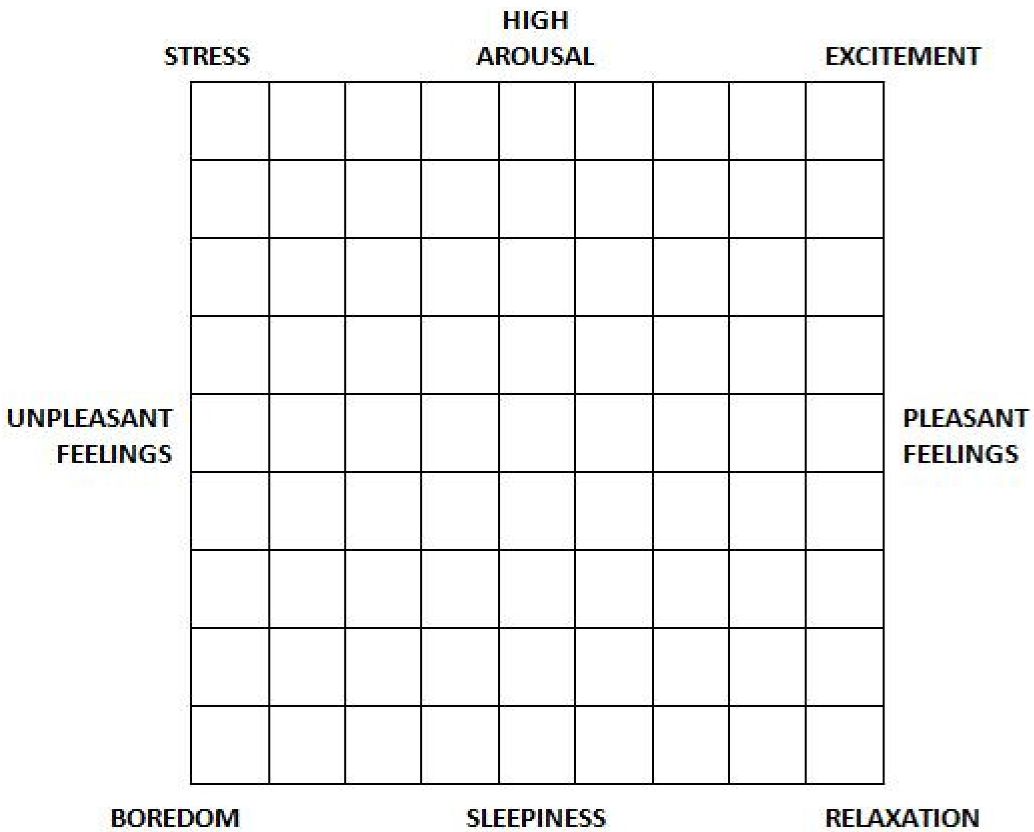
User demand induction. All participants began playing the flight simulator game at the same starting point, with the aircraft configured for a final approach toward the landing strip. For the low user demand condition, participants played the game with full auto-pilot engaged and all user controls turned off; that is, the game did not require any input from the user in order to progress from flight to landing, akin to television viewing. For the medium user demand condition, participants were in command of the flight controls used to control the speed and direction of the plane (the joystick, throttle, and rudder), while the simulator automatically controlled all other avionics for the participant. These avionics include the landing gears (used to safely land the plane on a landing strip), landing flaps (used to help increase drag to bring the plane to a safe landing speed), airbrakes (used to help bring the plane to a safe ground speed by increasing drag), wheel brakes (used to help slow the speed of the plane once on the landing strip), and drogue chute (a small parachute used to aid in slowing the plane on the ground). For the high user demand condition, participants were in control of all simulator flight controls, with no assistance from the computer. As discussed earlier, the low+ user demand condition was simply a replication of the low user demand condition with the addition of a memorization task intended to increase cognitive demand without having participants increase their interaction with the video game. This memorization task required participants to take mental note of all of the avionic settings in the aircraft to prepare for an exam on aircraft landing techniques to be taken at the end of the study; the exam was never actually administered.

Measures

Distractor task. User demand was measured using a distractor task consisting of a small black box with a red button and red LED. Participants were asked to press a red button in response to an audio cue to activate the LED, and their response time was measured to a precision of 1/100 of a second. Slower reactions were indicative of greater user demand placed on the participant. Similar distractor tasks have been used in research on driver safety (Strayer & Johnston, 2001; Nunes & Recarte, 2002) in which research participants respond to a visual distraction, such as a blinking light. However, as video game play has been shown to increase one's ability to pay attention to visual distracters (e.g., Green & Bavelier, 2003), participants in our study were asked to respond to an audio cue. The audio cue technique has been used successfully in research on cognitive capacity in response to media messages (e.g., Lang, Bradley, Park, Shin, & Chung, 2006). The audio cue was played eight times during game play, and the reliability of measurement for these reaction time responses was $\alpha = .812$.

Mood repair. Mood repair was measured using a pre-test and post-test administration of and adapted version of the Affect Grid (Russell, Weiss, & Mendelsohn, 1989), see Figure 2. The scale asks participants to visually map their current mood state in the semantic space between positive and negative affect (the x-axis) and high or low arousal (the y-axis) using a 9 x 9 grid, with the square the center of the grid representing a "neutral, average, everyday feeling" (Russell et al., 1989, pp. 501). The scale has been validated in prior research as a measure of mood and affect (Russell et al., 1989; Killgore, 1998; Swindells, MacLean, Booth, & Meitner, 2007), and the pre-test/post-test implementation of the scale has been established as a valid measure of mood change (e.g., De Petrillo & Winner, 2006; Eich & McCaulay, 2000).

Figure 2. Russell et al. (1989) Affect Grid metric, adapted for use in the current study.



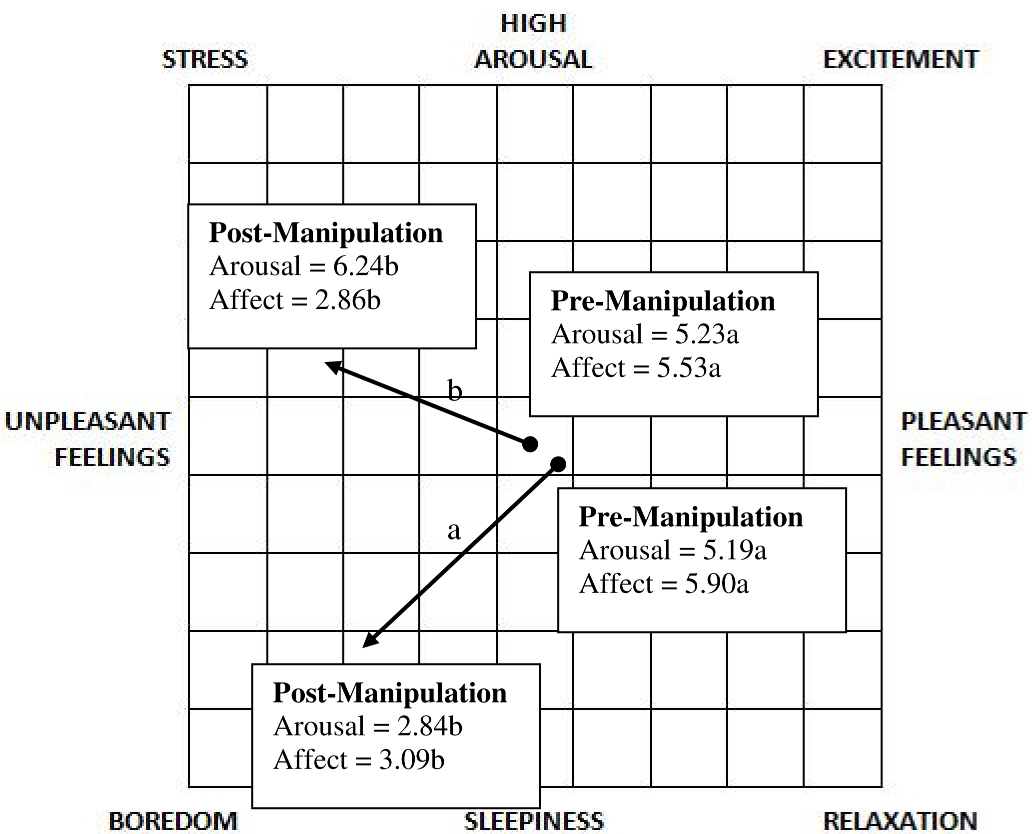
Video game skill. Participant's perceived video game skill was assessed using the 10-item, seven-point Likert-scaled Game Playing Skill scale (GaPS; Bracken & Skalski, 2006). Sample items from this scale were: "I am a good video game player" and "I often win when playing video games against other people." The reliability of this 10-item scale was $\alpha = .967$. Sample mean for GaPS was $M = 3.67$, $SD = 1.59$, and an unexpected significant difference was found across user demand conditions, $F(3,168) = 2.706$, $p = .047$, $\eta^2 = .046$. Tukey's honest significant difference (HSD) test reported that participants in the low demand condition ($M = 3.11$, $SD = 1.62$) self-reported a lower level of game skill than participants in the high demand condition ($M = 4.02$, $SD = 1.51$). Thus, video game skill was used as a covariate in subsequent analyses.

RESULTS

Induction checks

Mood. The mood inductions used in this study were found to significantly affect arousal and affect levels in the predicted direction[3]. The means are reported in Figure 3. For participants in the boredom condition, the induction produced the expected significant shift in both arousal, $t(109) = 12.0$, $p < .001$, and affect, $t(109) = 11.4$, $p < .001$. For participants in the stress condition, the induction again produced the expected significant shift in both arousal, $t(112) = -3.88$, $p < .001$, and affect, $t(112) = 12.1$, $p < .001$. Thus, we conclude that our mood manipulations were successful in inducing feelings of boredom and stress in our participants.

Figure 3. Induction check: Arousal and affect means for mood groups, pre and post induction.



a = boredom, b = stress
Note: Means with different subscripts differ significantly at p = .05 or greater.

User demand. An induction check was also performed on the user demand conditions using scores from the distractor task measure. For the distractor task, a univariate analysis of variance (ANOVA) reported a significant difference between user demand condition and response time, $F(3,168) = 20.2$, $p < .001$, $\eta^2 = .27$. As expected, participants in the low user demand condition had the fastest reaction times to the distractor task ($M = 1.74$ seconds, $SD = .41$), followed in order by those in the low+ ($M = 2.58$, $SD = 1.48$), medium ($M = 2.81$, $SD = 1.69$), and high user demand conditions ($M = 4.48$, $SD = 2.48$); this trend followed a linear pattern , $F_{linear}(1,168) = 53.2$, p < .001. Although differing significantly from the low and high user demand conditions, post-hoc analyses using Tukey's HSD test found that reaction times for participants in the low+ and medium user demand conditions did not differ significantly from each other. This suggests that the added cognitive demand from viewing video game footage with a memorization task was not significantly more distracting than playing the video game with a moderate level of control; nonetheless, both conditions were retained in data analysis.

Hypothesis testing

Our hypotheses predicted that (H1) increased user demand will result in greater mood repair for those in noxious mood states (H2) mood repair would be greater for bored participants than for stressed participants, and (H3) a significant interaction between mood induction and user demand conditions would exist such that mood repair would be greater for bored participants than for stressed participants. To examine these, an omnibus 2 (mood manipulation) x 4 (user demand condition) ANCOVA was performed with post-game play affect as the dependent variable, and post-game play arousal and perceived video game skill as covariates[4]. ANCOVA results are presented in Table 1, descriptive statistics for mood repair as a function of mood manipulation and user demand condition are presented in Table 2, and resultant pattern of means by mood manipulation and user demand condition are plotted in Figure 4.

Table 1. Results of 2 (mood manipulation) x 4 (user demand) ANCOVA on mood repair.*

	SS	*df*	*MS*	*F*	*p*	η^2
Video game skill	14.9	1	14.9	4.53	.035	.027
Post-game play arousal	7.35	1	7.35	2.23	.137	.014
User demand	24.6	3	8.20	2.49	.062	.044
Mood manipulation	15.0	1	15.0	4.56	.034	.027
User demand * mood manipulation	10.6	3	3.52	1.07	.362	.019
Error	533.1	162				

**covariates in this analysis are post-game play arousal and perceived video game skill*

Table 2. Descriptive statistics for mood repair by mood manipulation and user demand condition.

	User demand condition							
	Low		Low+		Medium		High	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Boredom	4.31a	1.83	5.39b	1.39	5.83c	2.09	5.56b	1.91
Stress	4.47a	1.72	4.63a	1.66	5.22b	1.91	4.36a	2.04

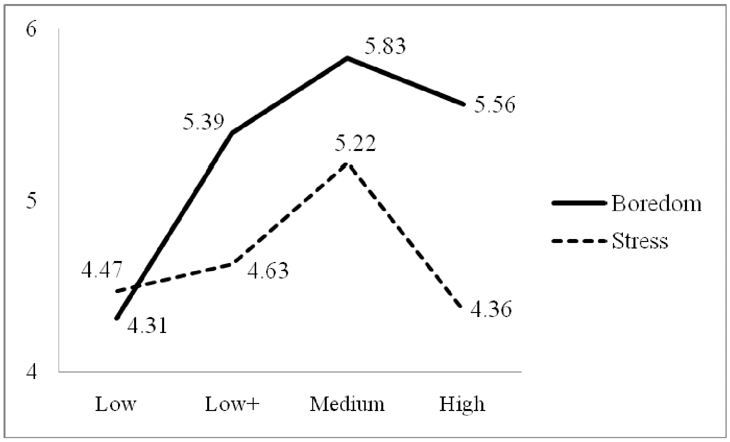
**means with different subscripts per row differ at p < .05 level or greater.*

Our first hypothesis predicted that increased user demand will result in greater mood repair for those in noxious mood states. Results from the ANCOVA analysis show that the effect of user demand approaches significance but fails to meet the $p < .05$ criterion, $F(3,162) = 2.49$, $p = .062$, $\eta^2 = .044$, thus suggesting that support was not found for H1. However, as suggested in the introduction, there was reason to suspect that the influence of user demand on mood repair might be nonlinear, as too much user demand might become frustrating (cf. Wolf & Perron, 2003). The possibility that video games with very high user demand may be counter-productive to the mood repair is suggested in the present data by the pattern of mood repair means across conditions of user demand. To examine this, tests were conducted to investigate the potential for a quadratic relationship between user demand and mood repair, and indeed a significant curvilinear relationship was found (k matrix p_{linear} = .096, $p_{quadratic}$ = .035, p_{cubic} = .442). The pattern of means shows that levels of mood repair increased from low (*M* = 4.05, *SD* = 1.75), to low+ (*M* = 5.05, *SD* = 1.55), to moderate levels of user demand (*M* = 5.50, *SD* = 2.00), at which point it peaked and subsequently declined for users in the highest user demand condition (*M* = 4.92, *SD* = 1.05)[5]. Thus, there is support for H1 to the extent that increased user demand has a significant positive effect on mood repair up to a point before dropping off at the highest level of user demand.

Our second hypothesis predicted that mood repair would be greater for bored participants than for stressed participants. The ANCOVA analyses show support for this hypothesis, as a significant difference was found in mood repair between mood manipulation conditions, $F(1,162) = 4.56$, $p = .034$, $\eta^2 = .027$. Although post-game play affect (*M* = 4.96, *SD* = 1.88) was significantly greater than pre-game play affect (*M* = 3.02, *SD* = 1.65) for all participants, $t(171) = -11.9$, $p < .001$, the increase for bored participants ($\Delta M = 2.20$) was greater than the increase for stress participants ($\Delta M = 1.80$), and these differences were significant from one another, $t(170) = 2.27$, $p = .024$. Overall, mood repair was greater for bored participants than it was for stressed participants when controlling for arousal and video game skill, thus showing support for H2.

Our third hypothesis predicted that a significant interaction between mood induction and user demand conditions would exist such that the impact of user demand on mood repair would be greater for bored participants than for stressed participants (H3). Results from the ANCOVA analysis showed that the interaction of user demand and mood manipulation was not significant, $F(3,162) = 1.07$, $p = .362$; thus, H3 is not supported. There is no evidence to suggest that a disordinal, nonsymmetrical interaction between mood state and user demand on mood repair is apparent in this data.

Figure 4. Observed relationship between mood state and user demand on mood repair.



It should be noted that an unpredicted, significant effect was found for video game skill on mood repair, $F(1,162) = 14.9$, $p = .025$, $\eta^2 = .027$. The partial correlation was calculated between video game skill on mood repair, controlling for arousal, was $r = .177$, $p = .021$. This small-but-significant correlation suggests that individuals with higher self-reported video game skill reported greater mood repair regardless of user demand or mood manipulation. Implications for this unexpected finding are discussed below.

DISCUSSION

Our study examined the effects of increased user demand on mood repair for bored and stressed individuals. All participants in the study regardless of user demand condition or mood induction experienced some form of mood repair post-game play, but bored individuals experienced significantly more mood repair than stressed participants. At the same time, user demand increased mood repair up to a point, beyond which too much user demand had a counter-productive effect of mood repair regardless of mood condition. This was evidenced by a significant curvilinear relationship reported for mood repair scores as a function of increased user demand. Finally, there was not a significant interaction between mood manipulation and user demand condition on mood repair. Data from this study show that (a) increasing the amount of control an individual has over a mediated environment – such as increasing the number of control inputs a user has in a video game – significantly increases that medium's intervention potential, (b) this increase in intervention potential results in an enhanced ability for that medium to relieve boredom and stress, (c) too much user demand can have a detrimental effect on mood repair, and (d) the significant ability of video games to repair negative mood states is a function of increased user demand, and not simply increased arousal.

Perhaps the most notable finding in ours study is that the effect of user demand on mood repair was observed after controlling for felt arousal. That is, we found that the ability of video games to repair negative mood states associated with boredom and stress was a function of increased user demand afforded by the interactive environment, and not simply increased arousal as is commonly suggested in the literature (cf. Bryant & Davies, 2006; Raney, Smith, & Baker, 2006). Of course, this is not to say that the arousal capacity of video games is not an important contributor to their mood management capacity; in fact, for individuals experiencing low levels of arousal, video games might prove to be a most attractive media choice for helping one return to an optimal level of arousal. However, it is important theoretically to demonstrate that intervention potential and arousal regulation are separate constructs that can have differential effects on mood repair, even in situations such as video game play in which it has been previously assumed that both variables are increased as a function of increased control and interactivity. Moreover, binding this added intervention potential to features of interactivity (in this case, control inputs) demonstrates how unique features of video games distinguish user experiences with video games from television and other less interactive media. Not only do these data show that demand on attentional resources contribute to the mood management process, they also show how unique features of video games contribute to user demand.

Limitations

This study shows the relative effect of user demand on mood repair processes in media consumption. Although we are confident in these findings, our study examined mood repair resulting from experimentally-controlled levels of user demand, which may not hold much ecological validity or practical application. Recall that the central concern of mood management and selective exposure theory is media choice (Zillmann & Bryant, 1985); that is, the theory is designed to explain why people make the media choices that they do. Thus, although we show evidence suggesting that mood repair will result from an optimal pairing of noxious mood and user demand levels, our study did not look at whether or not individuals would choose media lower or higher in user demand based on their current mood state. Future research in this area should be expanded to study media choice, perhaps adopting a methodology similar to that of Bryant and Zillmann (1984) in which participants are provided with video game choices that vary in user demand, and game play following a mood induction is monitored for predicted choice. In addition ecological validity concerns, our operational definition of user demand in this study is limited to manipulating features of technology. Future research may consider measuring user behaviors, such as eye gaze or controller manipulations, as proxy measures of user demand.

Another consideration that should be noted is that the length of game play in this study was rather short. At most, game play following mood manipulation lasted no longer than three minutes. Although results were found even with this relatively limited length of game play, future research might consider varying lengths of game play to see the how this might affect intervention. For example, one could argue that length of game play might lessen user demand as the player becomes accustomed to the game controls. At the same time, one could also argue that length of game play might increase user demand as the video game becomes more complicated as it progresses. Future research should take careful consideration of how time spent playing a video game might be expected to affect user demand and resultant mood repair.

We began our study with a concern related to our manipulation of user demand. Our low and low+ user demand conditions simulated television viewing by having participants witness a video game playing in demonstration mode rather than providing participants with actual television programming to watch. This was done to control for the potential that systematic differences in television and video game content could account for observed effects, and to increase our ability to attribute any observed effects to manipulations of user demand. For example, controlling content allows us to dismiss claims that observed effects resulted from group differences in the hedonic valence and behavioral affinity of media content. That being said, we acknowledge that a 'pure' television viewing condition was not used in this study, and replication of this study would benefit by incorporating an actual television viewing condition in order to more completely capture nuanced differences between user demand in these media forms. Related to this, future research might consider differences in user demand between other forms of entertainment media beyond television and video games.

Finally, we do not have an explanation for the unexpected relationship between self-reported video game skill and mood repair. We had hoped that random assignment to conditions would control for skill differences, but this was not the case. Participants in the high user demand condition had higher self-reported game skill than those in lower demand conditions. Notably, these measures were taken at the start of the study, so this finding is unlikely to be the result of a testing effect. Upon further review, it might not be surprising that game skill and mood repair are positively related. One possible explanation is that highly skilled gamers are more comfortable with increased user demand and thus more involved in the video game. At the same time, our analyses controlled for video game skill, and it seems unlikely that our data were not adversely affected by these game skill differences. Nonetheless, future studies should carefully consider how video game skill is related to both user demand and mood repair.

Future Research Direction

We have highlighted some limitations of our study that should be addressed in replication, but there are also some areas of research beyond the scope of the current study that our data might inform. In terms of mood states, our study considered only two noxious moods: boredom and stress. Future research should expand beyond these moods to consider others. When considering the number video game researches examining media violence and aggression, one mood domain rife for replication of this study would be anger. Also, we made no attempt to measure behavioral affinity or hedonic valence as relevant dimensions of mood management, which might be considered to be characteristics of media content as mentioned earlier. In our study, message content was kept constant in all four conditions by carefully programming and controlling the flight simulator video game to present the same on-screen content in all experimental trials. However, as we have argued earlier in this paper, part of active involvement in video games involves the user being involved in the creation of dynamic content. In other words, one must consider in any video game the relative constancy of video game content, when even the slightest user input can drastically affect what is displayed on screen. One example would be an individual who successfully lands the flight simulator as compared to an individual who does not. The successful landing might be thought to have greater hedonic valence and – based on the cause of one's current mood state – might or might not also have greater hedonic affinity. We are confident that content differences across all user demand conditions were kept to a minimum, but this would need to be considered in replication.

CONCLUSION

It has been suggested that the experience of playing video games is qualitatively different than consuming other forms of media. In terms of mood management and mood repair, it has been proposed that video games – due to their increased demand on user attentional resources – should result in greater mood repair than other forms of media, even when controlling for the effects of arousal and perceived video game skill. By experimentally assigning bored or stressed individuals to various user demand conditions designed to simulate television viewing or video game play, data from this study supports the assertion that greater user demand is related to greater mood repair so long as demand is not too high. This study provides some empirical support for the assertions regarding the nature of video game play and intervention potential as applied to mood management theory.

Endnotes

[1] An optimal *a priori* sample size of N = 160 was determined using effect size measures from prior research on mood repair resulting from media use. A meta-analysis of affect regulation research by Augustine and Hemenover (2008) provides us with an overall effect size calculation for pleasant distraction mood repair strategies – such as those specified by mood management research according to Parkinson and Totterdall's (1999) affect regulation strategy taxonomy – as $d = .41$, which corresponds to an effect size f of .19 (effect size f is the proper measure of effect size for ANOVA testing, such as the analysis performed in this study). Cohen (1992) would classify this as a small-to-moderate effect size. However, this effect size measure was calculated from mood management research that uses what would be classified in the current study as low demand medium – such as magazine articles, music, and television – which would be expected to have a lesser effect on mood repair than high demand medium such as video games. Although research involving higher demand media is sparse, recent unpublished data (data from a manuscript currently under review) using video games as an agent for mood repair provides an average effect size for change in positive and negative mood after game play of f = .31; this effect size measure was used to determine the sample size needed for the current study. When comparing eight experimental groups using analysis of variance techniques with $\alpha < .05$, one-tailed, and a statistical power of $\beta = .80$, a minimum of 20 participants were needed per condition to achieve the optimal N = 160; after all data was collected, a final sample size of N = 172 was achieved.

[2] Some might question why a video game set on auto-pilot was used to simulate television viewing in the low user demand condition instead of merely showing similar footage from a television show. Both options were considered but, ultimately, the auto-pilot setting was used for the low-demand condition for two reasons. First, the use of a television viewing condition with unique content would introduce unwanted content differences in the experimental conditions. Second, although it can be argued that playing a game in auto-pilot is not the same as watching television, the level of user demand required to play the game in auto pilot can be equated with the user demand required for viewing television (discussed later in the manuscript). As such, use of the auto pilot condition allows us to test claims that user demand increases intervention potential of game play over media experience that closely simulate television viewing.

[3] Notably, there was no significant difference in either pre-induction arousal, $t(221) = -.118$, *ns*, or pre-induction affect, $t(221) = 1.46$, *ns*, between mood conditions.

[4] Note that pre-game play affect was not used as a covariate, as these scores did not differ significantly across user demand conditions, $F(3,162) = 1.95$, $p = .124$ or mood manipulation conditions, $F(1,162) = .128$, $p = .721$. These ANCOVA analyses considered video game skill and pre-game play arousal as covariates. Full ANCOVA tables and descriptive statistics for this analysis can be provided by authors upon request.

[5] In fact, if we remove the high user demand condition from the ANCOVA analysis, the main effect for user demand on mood repair is significant, $F(2,123) = 3.19$, $p = .045$, $\eta^2 = .053$, and linear (k matrix $p_{linear} = .013$, $p_{quadratic} = .864$).

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