

The Effects of Video Games on Aggression in Female University Students : Reward and Negative Mood

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Abstract

This study examined the effect of violent video games on the behaviors of 33 female university students and what moderates or mediates this effect, using a between-subjects design with three treatment conditions: (a) playing a video game in which violence was highly rewarded, (b) playing a video game in which violence was not highly rewarded, and (c) watching a movie that was not violent. Degree of hostility of feeling, negative mood, physiology indexes, and inactivity were subsequently measured after the participants played video games or watched a video. Each participant then had an opportunity to apply electrical current to other participants, so that aggressive behavior could be assessed. The results showed that playing violent video games increased aggressive behavior, and that reward moderated this effect. Negative mood and inactivity mediated the effect of violent video games on aggressive behaviors.

Key words: aggression, violent video games, reward, negative mood, inactivity

1. Introduction

Experiments have been conducted on the influence of violent video games on behavior since the late 1980s, based on research conducted on scenes of violence on TV. US investigators have come to an agreement that violent video games can incite violent behaviors, based on results including the meta-analysis conducted by Anderson & Bushman (2000). More recently, researchers have been trying to find out what characteristics of video games are the factors that incite aggressive behaviors.

Research into scenes of TV violence has clarified that learning of violent behaviors is increased if reward is given to a character behaving aggressively, while such learning is suppressed if punishment is applied to such a character (Paik & Comstock, 1994). Carnagey & Anderson (2005) compared video games in which the perpetrator of aggressive behaviors is rewarded with video games in which the aggressor is punished, and found that reward increased aggression in the person playing the game.

The present study first surveyed whether video games promoted aggressive behaviors in the players and, subsequently, whether rewards were effective in moderating such influence, as was shown in the research described above.

We then considered four factors that we suspected might mediate influences from video game playing and rewards, the first of which was feelings of hostility. Therefore, we considered whether playing a video game stimulates feelings of hostility and thus promotes aggressive behaviors. The second factor we examined was negative mood. Anderson & Ford (1986) pointed out that playing a violent video game stimulates anxiety and feelings of depression. It has also been asserted that anxiety and depression are related to aggression (Vitaro, Brendgen, & Tremblay, 2002). Therefore, our study surveyed whether playing a violent video game creates a negative mood, which can then promote aggressive behaviors. The third factor we assessed was physiological arousal. Sakamoto, Ozaki, Narushima, Mori, Sakamoto, Takahira, Ibe, Suzuki, & Izumi (2001) found that physiological arousal had no mediating effect, but we thought it worthwhile to examine this factor once more. Finally, the fourth potential mediating factor we studied was activity, which refers to a state of mind in which one is active and willing to take actions. Weber, Ritterfeld, & Mathiak (2006) found that playing a violent video game enhances activity. We considered the possibility that activity stimulates aggression, since, in a physiologically aroused state, one is expected to be more active than usual.

We initially conducted some preliminary research, for which we chose two video games, one showing high reward of aggression and the other depicting low reward for this behavior. Each participant in our experiment chose and played one of the two games. In addition, we set up another group of participants, a control group, who saw a neutral motion picture. Each participant was randomly allocated to one of these three groups, and we measured the physiological responses of every participant, before and after she played a video game or watched the movie. After playing a video game or watching the movie, each participant responded to a questionnaire that measured her feelings of hostility, negative mood, etc., and was then given an opportunity to apply an electric shock to someone else. The degree of electric shock each participant applied was employed as the index to her aggressive behavior.

Our experiment began with the following three hypotheses: Hypothesis 1 held that those participants who played a video game would show more aggressive behaviors than would the control group. Hypothesis 2 was that those who played the video game in which there was high reward for aggression would show more aggressive behaviors than would those who played the one showing low reward for aggression. Hypothesis 3 expected that those effects observed with respect to Hypotheses 1 and 2 would be mediated by feelings of hostility, negative mood, activity, and physiological arousal.

2. Preliminary research

We conducted preliminary research, using 11 video games¹⁻¹¹ (Table.1) with 14 female university students in order to choose the video games for use in our experiment. All 11 games were shooting games, with diversified levels of reward, as observed by the investigators who selected them. We used a JVC color

TV, Model AV-29P1, with a screen that was 42 cm high and 55 cm wide, and which was approximately 100 cm away from the eyes of each participant. We also prepared a questionnaire sheet, entitled "Questions on the Video game," which included, among others, some questions related to the level of reward in the game giving a total of nine questions in all. We evaluated the degree of reward given in each game on a scale ranging from 0 to 5, with 0 being "none" and 5 being "highest," in terms of eight items, such as "I gained an additional score," and "A new story or scene appeared," related to the aggressive behaviors each participant (the player) displayed when playing her game. The questionnaire also asked each participant to state the degree of reward used in the game she played as a whole, again using a scale of 0 through 5. We treated the total of the scores for those nine questions as the degree of reward score in each video game. The same questionnaire also measured the frequency of aggressive behaviors, in order to consider the effects that frequency per se may have on aggression.

The frequency of aggressive behaviors was evaluated using a scale from 0 to 7, with 0 being "very aggressive", 7 being "very weak," and covering both "volume (intensity) of aggression" and "severity (cruelty) of aggression." We treated the sum of these two scores as the aggression frequency score.

After playing every one of the 11 games for 15 minutes, each participant responded to the questionnaire with regard to each of the games played. We then obtained the average scores from the 14 participants for the 11 games, as listed in Table 1. Based on these results, we selected "Sol Divide" as the high-reward game and "Virtua Cop" as the game with low reward for use in our experiment, in order to set the reward score as the criterion of our game evaluation and to make the aggression frequency scores among the chosen games as close to each other as possible.

Table 1 Reward degree and aggression frequency scores of each of the video games surveyed

	Reward	Frequency of aggression
Space Invaders	25.64	5.86
Cotton Original	34.07	7.00
Bokan Desuyo	33.57	8.07
Omega Boost	27.64	8.36
Sol Divide	34.64	9.29
Gun Bullet	27.36	6.07
Ray Storm	29.50	8.93
Time Crisis	27.57	9.93
Seventies-style Robot Animation Get P-X	30.64	8.14
Virtua Cop	23.14	9.64
Virtua Cop 2	25.07	9.86

3. Method

3.1 Experimental design

Our experiment was a between-participants survey with two levels of degree of reward, high and low, in the experimental groups, and a single level in the control group. In short, our between-participants experiment was designed with a single factor and three levels in all. There were two video game conditions: high-reward and low-reward.

3.2 Participants

The participants were 33 female university students, who were randomly allocated to one of the three conditions, with each condition having 11 participants. Two of the participants in the low-reward group encountered a failure in the test equipment, and we were unable to collect their data. They were therefore excluded from our analysis.

3.3 Experiment stimuli

We employed the two games that we selected in the preliminary research. In the high-reward game, "Sol Divide," the player fights against numerous enemies as she tries to take revenge on the royal palace. This game offers many opportunities to gain reward. However, in the low-reward game, "Virtua Cop," the player acts as a police detective to protect the safety of citizens in a near-future city and shoots groups of terrorists. The TV set we used was a JVC color TV, Model AV-29P1, with a screen that was 42 cm high and 55 cm wide. We kept the TV screen approximately 100 cm away from the eyes of each participant.

We showed the first 15 minutes of a video movie titled "MARCO - Haha wo tazunete sanzenri (Traveling 3,000 miles in search of his mother)" to the control group. The color TV set we used was a Hitachi, Model C14-VT7B, with a screen 20 cm high and 30 cm wide. Again, the distance between the screen and the eyes of the participants was approximately 100 cm.

3.4. Questionnaire

In order to measure the level of previous exposure to video games, as well as belief regarding aggression, and mediating factors, such as feelings of hostility, mood, etc., in each participant, we used another questionnaire, entitled "Questions on mass media," which included the questions listed below. The participants replied to this questionnaire after they had played a video game or had watched the movie.

3.4.1 Exposure to video games

The questionnaire asked each participant about her frequency of previous exposure to video games, using a scale ranging from 1 to 5, with 1 being "I do not play videogames at all" and 5 being "I play video games

frequently." It also asked each participant about her exposure to games at home with her family and at the homes of her friends, again on a scale ranging from 1 to 5, with 1 being "I do not play video games at all" and 5 being "I play video games frequently." The questionnaire also asked each participant how often she played games in video game arcades, using the same scale. We standardized the replies of the participants to those four questions and obtained the total for each individual. This sum was considered to be the video game exposure score of each participant.

3.4.2 Belief regarding aggression in video games

The questionnaire contained eight questions, such as "I think children playing video games tend to grow into violent people, since many video games contain violence scenes" and "I think the spread of violent video games leads to more criminals," in order to find out whether each participant believed that playing video games could lead to more aggressive behaviors. Each participant replied to each of those questions using a scale ranging from 1 to 5, with 1 being "I do not think so at all" and 5 being "I think so very much." The total of the reply scores for each participant was treated as her score regarding her belief regarding aggression in video games. The higher the score is, the stronger the belief of the participant that aggressive video games can increase the aggression of those who play them becomes.

3.4.3 Hostile feelings, negative mood, and activity

We chose eight adjectives of hostility ("angry," "angered," "huffed," "mad," "exasperated," "irritated," "unpleasant," and "hostile") from the New Multiple Affective Adjective Check List, as well as eight other adjectives indicating negative mood ("disagreeable," "sick of," "blah," "abject," "melancholic," "critical," "worried," "cautious," and "cruel"), and five adjectives denoting activity ("lively," "tense," "excited," "vigorous," and "cheerful"). We used 24 adjectives in all, those mentioned above and some "filler" adjectives, in random order. Each participant was then asked to choose one from a scale ranging from 1 to 5, with 1 being "This does not apply to my current mood" and 5 being "This applies to my current mood," for each of the adjectives listed.

With the results obtained for the eight hostility adjectives, we conducted a reliability analysis ($\alpha = .94$), using the sum of the scores for all eight adjectives to give the feeling of hostility score. We also used a reliability analysis to assess the nine adjectives of negative mood ($\alpha = .80$) and, as a result, we excluded two of them, "melancholic" and "cautious" ($\alpha = .83$). We treated the sum of the scores for the remaining seven adjectives as the negative mood score. We also conducted a reliability analysis ($\alpha = .80$) using the five adjectives that formed the active mood factors and, as a result, removed "cheerful" ($\alpha = .82$). We then took the sum of the scores of the remaining four adjectives as the activity score.

3.5. Measurement of aggressive behaviors

Under the title “Negative influences that electric current has on the ability of the investigators to solve problems,” we gave each participant an opportunity to apply some electric shock to “something else.” In order to do this, we employed a device manufactured by DKH (Denki Keisoku Hanbai K.K.), to make the participant believe that some electric current was actually running. This device has a lever and if someone pulls this lever down, the device shows the intensity of the electric current in a scale of five lights, although no current is actually running, it only appears to be. Using this device, we used the intensity of the current applied to “something else” by each participant as the index to her aggressive behavior. We measured 10 sets of this “imaginary current test,” with each set lasting for 20 seconds. Since every move of the lever changes the intensity of the imaginary electric current, we measured the current each participant applied at 5 seconds, 10, 15, and 20 seconds into each set. Then we obtained the average of current intensity and employed the average as the representative value.

3.6. Procedure

Our experiment consisted of two sessions and used two experiment rooms. We also used a cover story, so that none of the participants could find out what was actually happening in the experiment (see below).

3.6.1. Session 1: Working with the experimental conditions

We took each participant into Experiment Room A. We explained to each participant who was to play a video game that the experiment was “intended to find out how much playing a video game changes some physiological responses.” After this explanation had been given, we measured the maximal and minimal blood pressure of each participant with a blood-pressure gauge, and corresponding pulses with a pulsimeter. Following this measurement of physiological indices, the participants in the video game groups played their games for 15 minutes, and the control participants watched the movie. We subsequently measured the physiological responses of participants in all groups. We then told them a cover story in which we said that it would be necessary to measure their physiological responses again 30 minutes later, and asked them to fill out the questionnaire and join yet another experiment, while they waited for the next physiological measurement. After the participants filled out the questionnaire, “Questions on Mass Media,” we took the participants, after obtaining consent, into the corridor.

3.6.2. Session 2: Measurement of aggression

Each participant met a fellow participant (a conspirator with the study investigators), who acted like a study investigator in front of Experiment Room B, and the two

then entered the room. A study investigator explained to the two why it was necessary for one of them to operate an electric current, using a cover story that the experiment was “intended to find out the negative influences that an electric current has on the ability of an investigator to solve problems.” The conspirator acted bewildered with regard to the use of electric current. While the conspirator, wearing electrodes, was trying to solve a problem, the participant was instructed to move the lever of the electric device to apply some electric shock, in response to cues from the investigator. It was also explained to the participant that she was free to decide whether or not to apply electric shock, and the degree of its intensity, for a time period of 20 seconds. The participant was also asked to behave as naturally as possible. The investigator explained the relationship between the indication of the device and the electric current intensity to the participant, and confirmed that she had no further questions. A screen divided the room into two sections, so that the participant was unable to tell that no current was actually running to the conspirator. They repeated 10 sets of the experiment, with each set lasting for 20 seconds. When the 10 sets were finished, the participant was taken back to Experiment Room A once more, where her physiological responses were again measured and she received a debriefing giving the true objective of the experiment. The investigators apologized to the participant for not telling her the true experimental objective, and told her that no current actually ran to the conspirator. The investigators also asked whether the participant thought there was any relationship between the experiments in Room A and Room B, as well as whether she thought there was any objective other than the ones she had been informed of. If the participant thought of any such objective, she was asked what it was. To conclude the study, the investigators asked the participant to keep silent with regard to what happened in the experiment.

Table 2. Averages and standard deviations in aggressive behavior of the three groups

	High-reward group	Low-reward group	Control group
<i>m</i>	81.84	42.63	39.78
<i>sd</i>	17.46	14.61	7.57

4. Results

4.1. Homogeneity among the conditions

The participants in the three different conditions, high-reward, low-reward, and control, should be of a homogeneous nature, and this was confirmed by comparing their scores in the surveys of exposure to video games, belief regarding aggression, and physiological responses, which they gave before the

experiment. We observed no significant difference between the three groups in exposure to video games or belief regarding aggression ($F(2, 30) = 2.11, ns$; $F(2, 30) = 4.29, ns$). Meanwhile, with regard to the physiological responses we measured *before* the experiment, although we found no significant difference in maximal blood pressures and pulses ($F(2, 30) = .30, ns$; $F(2, 30) = .30, ns$), we did recognize a significant difference in minimal blood pressures ($F(2, 30) = 3.91, p < .05$) between the control and the high-reward groups, as a result of multiple comparison. Thus, since we did not confirm homogeneity of the different groups with minimal blood pressures, as we considered our hypotheses we also conducted an analysis in which the minimal pressure treated as a covariate.

4.2. Considering our hypotheses

Table 2 lists the averages and the standard deviations in aggressive behavior of the three different groups.

4.2.1. Hypothesis 1

In Hypothesis 1 it was expected that the groups who played video games would show more aggressive behaviors than would the control group. We found a significant difference between the two video game groups and the control group, using a t-test in aggressive behaviors ($t(29) = 3.72, p < .01$). We also conducted a

covariance analysis with either the video game groups or the control group as independent variables, and the maximal blood pressure as the covariate, and obtained a similar result ($F(1, 26) = 14.90, p < .01$). Thus, Hypothesis 1 was supported.

4.2.2. Hypothesis 2

In Hypothesis 2, it was assumed that the group who played the high-reward video game would show more aggressive behaviors than would the one who played the low-reward game. We observed a significant difference between the high-reward video game group and the low-reward group in aggressive behavior, using a t-test with aggressive behavior as the dependent variable ($t(18) = .09, p < .01$). We also conducted a covariance analysis, with either the high-reward group or the low-reward group as the independent variables, and the maximal blood pressure as the covariate, and obtained a similar result ($F(1, 19) = 8.62, p < .05$). Thus, Hypothesis 2 was supported.

4.3. Consideration of mediating effects

We conducted path analyses on whether the significant effects we found in Hypotheses 1 and 2 were mediated by hostile feelings, negative mood, physiological arousal, and/or activity, based on Figure 1. Physiological arousal was defined as the differences between the physiological response values (maximal blood pressure, minimal blood

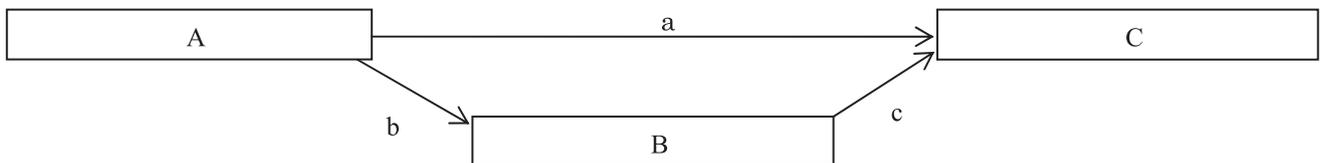


Figure 1. Model of our path analyses

Table 3. Standardized coefficients related to the mediating effect of Hypothesis 1

	Path a	Path b	Path c
Hostile feeling	.57**	.39*	.12
Inactivity	.57**	.81**	.41*
Negative mood	.57**	.39*	.35 †
Maximal blood pressure	.57**	.05	.45*
Minimal blood pressure	.57**	-.21	.02
Heart rate	.57**	-.03	-.16

Table 4. Standardized coefficients related to the mediating effect of Hypothesis 2

	Path a	Path b	Path c
Hostile feeling	.70**	-.05	.12
Inactivity	.70**	-.06	.41*
Negative mood	.70**	.24	.35 †
Maximal blood pressure	.70**	.38 †	.45*
Minimal blood pressure	.70**	.14	.02
Heart rate	.70**	-.19	-.16

pressure, and pulses) measured after the experiment minus those measured before the experiment, respectively.

In the path analysis of Hypothesis 1, we placed the factor of the video game groups or the control group in the "A" of Figure 1, and in Hypothesis 2, we placed the factor of high-reward or low-reward in the same "A." We then placed hostile feeling, activity, negative mood, and physiological arousal (maximal blood pressure, minimal blood pressure, and pulses) in each "B." If both Path b and Path c turn out to be significant, some mediating effect is proven. Table 3 shows the standardized coefficients of the respective paths for Hypothesis 1 and Table 4, the paths for Hypothesis 2.

For Hypothesis 1, the results were significant, with activity in both Path b and Path c. Thus, it has been shown that activity mediates the influences exerted from playing a video game. With regard to negative mood, Path b was significant and Path c was marginally significant. Thus, we see that there is a possibility that negative mood mediates the effects of video games.

For Hypothesis 2, Path b was marginally significant for maximal blood pressure and Path c was significant for maximal blood pressure. Therefore, we can see that maximal blood pressure may mediate the effects of reward. As observed so far, Hypothesis 3 was partly supported. Those results remained comparable with another analysis we conducted, in which the minimal blood pressure of the participants was treated as a covariate.

5. Discussion

Our experiment supported Hypothesis 1 and therefore the results suggest that playing video games can promote aggressive behaviors, which is similar to the results obtained by Sakamoto et al. (2001), Carnagey & Anderson (2005), and others. Therefore, our study has provided another piece of evidence that playing video games can promote aggressive behaviors in female university students over a short period.

The results of our study also supported Hypothesis 2, suggesting that reward can promote aggressive behaviors, which is again similar to what was found by Carnagey & Anderson (2005). Thus, our results suggest that the moderating effects of reward can be generalized beyond the software employed by Carnagey & Anderson (2005).

With regard to Hypothesis 3, our study considered the effects of several parameters. First, feelings of hostility showed no mediating effect in terms of the influences of playing a video game or from reward. Researchers have been divided over feelings of hostility, with Anderson & Dill (2000) claiming that playing a video game enhances such feelings and Anderson & Ford (1986) negating such

enhancement. Thus, its mediating effects might not be simple, and further research should be conducted to assess this.

Conversely, our study has shown that negative mood can mediate the influences of playing a video game. Yukawa & Yoshida (2001) showed that such playing could enhance some negative feelings, such as depression and anxiety, while Takeda (2000) pointed out a relationship between depression and aggressiveness in children, although this was not the result of an experiment. Our findings are consistent with these previous studies. The general model of aggression proposed by Anderson & Bushman (2002) assumed three stages in the occurrence of an aggressive action, namely, an input, a path, and a result. In this general model, emotions play their roles in the path, with feelings of hostility and discomfort being especially believed as prone to invite aggressive actions. The results of our experiment have added to this by suggesting that negative mood can also be among those feelings that affect aggressive behaviors.

In accordance with Sakamoto et al. (2001), our study showed no mediating effect of physiological arousal, except that maximal blood pressure can mediate the effects of reward. Felsten & Leitten (1993) reported some relationship between hostile feelings and maximal blood pressure, while they saw no relationship between such feelings and minimal blood pressure. Thus, the physiological response with the most affinity with aggressive behaviors seems to be maximal blood pressure. However, it remains unknown as to why mediation was observed with maximal blood pressure alone and not with any other physiological responses. For us to be convinced of mediation by maximal blood pressure, we consider it necessary that such mediation is confirmed in the future and its process is sufficiently explained.

Finally, our study has suggested that activity has a mediatory effect on aggressive behavior. Our finding that playing a video game increases activity is similar to that of Anderson & Ford (1986). Although no similar previous research has considered the relationship between activity and aggressive behaviors, our study has suggested that such behaviors are further stimulated by activity. Therefore, in an experiment to measure aggressive behaviors, the true mechanism of effect might be that playing a video game enhances the activity of the participants, which, in turn, results in more active operations of the device that measures their aggressive behaviors, leading to higher measurement values of aggression. If this is the case, then it is not certain that a video game increases aggressiveness of the players, resulting in aggressive behaviors. We should be aware that this interpretation is possible from the results of relevant research conducted so far. However, many existing studies, including the panel study conducted by

Ihori, Sakamoto, Shibuya, & Yukawa (2008), have provided evidence that supports the effects that playing video games exert on behaviors in terms of aggression. Even if the issue with activity holds true with some studies and experiments, the effects of the activity are expected to be limited. Note that the results of our experiment cannot be explained in terms of activity, since Path a, a path related to activity, has a significant effect, and the effects of playing the video games are evident regardless of activity, as shown in Table 3. Furthermore, with respect to the mediation by negative mood, our experiment found that some participants, after playing a video game, operated the device to give some electric current to another party, although they were in a negative, feckless mood. This fact cannot be explained in terms of activity.

As stated, we conclude that the factor of reward can enhance the influences of playing video games on behaviors in terms of aggression. In addition, the experiment has examined some mediating factors and found that some of these exert effects. The examination of moderating and mediating factors is important if we hope to clarify the mechanism by which playing video games enhances aggressive actions, so we need some further research of this nature in the future.

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Notes

1. Space Invaders, TAITO, TAITO, 1997. (PS)
2. Cotton Original, SUCCESS, SUCCESS, 1999. (PS)
3. Bokan Desuyo, BANPRESTO, BANPRESTO, 1998. (PS)
4. Omega Boost, Sony Computer Entertainment, Sony Computer Entertainment, 1999. (PS)
5. Sol Divide, ATLUS, ATLUS, 1998. (PS)
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Acknowledgements

This article was translated from a Japanese paper whose bibliographical information was as follows: Kumazaki (Yamaoka), A., Kobayashi, S., Mouri, M., & Sakamoto, A. (2010) 'The Effects of Video Games on the Aggressive Behavior of Female University Students: Reward and Negative Mood', *Journal of Digital Games Research*, 4: 81-89.

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PROCEEDINGS 17

February 2012

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