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# The differences between watching and playing violent video games: The effects of play style and game impression on aggression-related reactions

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This study investigates the effects of violent video games on cognitive, affective, physiological, and behavioral reactions related to aggression in terms of play style and impression. We also examine the effects of participation in the video games (playing vs. watching). The results show that violent video games increase aggressive thoughts and negative affects, but not physiological reactions and aggressive behavior compared to a nonviolent control video game. When analyzed in terms of participation level (playing or watching), the results revealed that aggressive thoughts are activated by stimulus-reaction and by the graphic violence of video games only in the playing condition, while negative affects are aroused by graphic violence in both the watching and playing conditions, and that aggressive behavior is facilitated by graphic violence only in the watching condition.

**Key words:** Aggression, Video Games, Play Style, Impression, Participation

Recently in Japan, newspapers and television have devoted unprecedented coverage to violent crime. In the wake of a series of atrocious homicide and violent abuse cases involving teenage boys, youth crimes in particular have assumed the importance of a major social problem. In one extremely brutal crime in Kobe City, Hyogo Prefecture, in May 1997, an elementary school boy was murdered, and his head was cut off and left in front of the gate of the junior high school that the murderer attended. Identified as a junior high school boy who had been the victim's friend, the murderer was found to like horror movies and to be absorbed in a world of violent imagination. In another case in February 1998, in Tokyo, a junior high school boy attacked a policeman with a butterfly knife in order to steal his gun. In its assessment of the cause, the family court confirmed the influence of violent video games on the offender. A later incident (August, 2000, Oita Prefecture) involved a 15 year-old male high school student attacking a family of six, killing some and wounding others. Reaching its decision, the family court also highlighted the influence of cruel video games and movies on the boy offender. In response to such violent crimes, educational experts and authorities have sought causes and speculated about the sudden impulsive expression of anger in school children, known in Japanese as *"kireru* (break out)" (Miyashita & Ohno, 2002; Tokyo Metropolis, 1999).

## Effects of Video Game Violence

The influence of media violence, i.e., the violence depicted in movies and video games, has often been put forward as an underlying factor for such crimes. Although this influence has been extensively researched since the 1960's in the United States of America and Europe, social psychology in Japan has only recently begun to take up violence and aggression as a social problem in need of deeper understanding. This delay can be attributed to two general sociological

facts. First, Japan is a comparatively nonviolent society in terms of its violent crime rate. Japan's annual homicide rate (the number of homicides for every 100,000 people) is 7–8 times less than that of The United States, and the rate of brutal crimes in Japan has steadily decreased since the end of World War II. Second, the post-war economic recovery and social transformation of Japan were further characterized by the popularity of 'noble hero' programs for children as well as *samurai* dramas in television and print media between the 1960's and 1970's, where good commonly triumphed with evil ritually defeated and punished. So stylized did the portrayal of moral battles become that the sword fights in *samurai* dramas were seen more as highly developed art than actual violent encounters. Thus, violence has been perceived as extremely rare in contemporary Japanese society. This has generally led to a much lower awareness of issues concerning aggression and media violence in Japan than in the West. More specifically, social and cultural support for the immediate need to research aggression and media violence has been limited. However, since youth violence became the focus of public concern in the 1990's, media violence has now gained attention as a possible important underlying cause.

Despite this change of awareness, empirical literature on aggression and media violence in Japan still remains extremely sparse. In spite of a body of research in the Western countries carried out into this very phenomenon, we have nevertheless to be careful in automatically generalizing such findings to the specific context of Japan. A first step in researching the influence of media on aggressive behavior in Japan thus involves empirical investigation of whether media violence increases aggression in Japan as it has been found to do in the West.

The focus of such empirical research about media violence can be narrowed to video games. Although violent audio-visual media such as TV programs and movies initially constituted the central concern of such research (Bushman & Huesmann, 2001), violent video games have gained increased attention in recent years (Anderson & Bushman, 2001). Compared to watching violent videos, playing violent video games may have stronger effects on the player (Anderson & Dill, 2000; Dill & Dill, 1998). This is for several reasons. First, while playing video games, players can experience aggression both positively and directly through opportunities to attack voluntarily and behave aggressively. The second reason is that aggression as a behavioral repertoire can be easily and directly modeled, rehearsed, and reinforced while playing video games. Third, it is increasingly easy to transfer aggressive behavior into real life because recent developments in graphic technology allow the video game world to simulate real world ever more closely. The final reason is that video game players may quickly identify with the role of an aggressor and be absorbed in the violent world of the video game.

As for player identification with a character, we would like to emphasize in this paper that there are different stages of identification in terms of the degree of player involvement in the fictitious (media) world. Naturally, the level of involvement in the media world, that is, identification or synchronization with the role of a video game character and absorption in the media world, will be higher in playing video games that require the player to actively manipulate characters rather than merely to watch a video. Some features of video game can also be expected to affect to different degrees the level of involvement in the media world. Although there are various types of violent video games, Role Playing Games (RPGs) that require players to assimilate themselves into the role of a hero will induce deeper involvement than video games such as Shooting and Action that simply require players to react to a given stimulus.

## Experimental Research on Video Game Violence

The findings of experimental studies into violent video games since the latter half of 1980's produce consistent findings (Anderson & Bushman, 2001; Anderson, 2004). Anderson and Bushman (2001) and Anderson (2004) concluded from their meta-analytic review of the video game research

literature that violent video games increase aggressive behavior, physiological arousal, and aggression-related thoughts and feelings. The General Aggression Model (GAM; Anderson & Bushman, 2002), which is the most recent theory of aggression, suggests that aggressive cognition and emotion (affect and arousal) lead to aggressive behavior. Specifically, Bushman & Anderson (2002) argue that "recent exposure to violent media can cause short-term increases in aggression through its impact on a person's present internal state, represented by cognitive, affective, and arousal variables" (p. 1680). In short, GAM is the most useful framework for grasping the effects of violent video games. According to this GAM, the first hypothesis in the present study was as follows:

*Hypothesis 1.* Violent video games will lead to a greater increase in aggressive cognition, emotion (affect and arousal), and behavior than nonviolent video games.

However, we would like to focus attention on several problems about research design and method in previous studies.

### *Game Types*

First, the violent video games used in experiments of previous studies differ from one study to another, but apparently violent and aggressive video games such as Shooting (Cooper & Mackie, 1986; Silvern & Williamson, 1987), Action (Irwin & Gross, 1995; Schutte et al., 1988), and Fighting (Anderson & Murphy, 2003; Ballard & Lineberger, 1999; Bartholow & Anderson, 2002; Kirsh, 1998) have been predominantly used as a stimulus. These video games require the player to demonstrate a simple but accurate skill in reacting to a stimulus (stimulus-reaction) by shooting down monsters or invaders that appear one after another, or punching and kicking an adversary while all the time defending against the adversary's successive counter-punches and kicks. In fact, for the simple reason that violent video games differ in terms of graphics, content, operation, and story, using only one type of video game for empirical investigation cannot provide a valid basis for inferring that violent video games lead to aggression. For instance, Role Playing Games (RPGs), a mainstream video game genre, involve identifying with the character in the video game, i.e., taking on the role of the hero and advancing the story on a journey to fight and defeat bad characters (role-identification). Similarly, a recent video game called Action RPG (ARP) with both RPG and Action game features has been gaining popularity. In examining the effects of violent video games, it is thus necessary to consider different genres or features of game.

Yukawa and Yoshida (2001) conducted a preliminary investigation of how to estimate violent video games in terms of the play style. They divided violent video games into six genres[1)] (RPG, ARP, Action, Fighting, Shooting, and Gun-shooting) in advance, and asked 25 undergraduate students to rate the play style of 12 popular video games selected from each genre on 11 items. A factor analysis of the items indicated that such video games could be classified into two types, namely "stimulus-reaction type" and "role-identification type." The stimulus-reaction type requires a manipulation technique, reflexes, concentration, action and active movement, whereas the role-identification type depends on thinking and behavior selection, contains adventure and story, providing a context in which the player can easily identify (synchronize) with

1) Violent video games can be roughly divided into six genres according to their content and purpose. In "RPG (Role Playing Game)," players become a hero and advance on their journey through the story by defeating bad characters and helping other(s) (usually a princess) in distress. In "Action," players have to clear several stages by maneuvering a character through various actions such as jumping, running, and attacking. "ARP (Action Role Playing)" contains both elements of RPG and Action. In "Fighting," players maneuver a martial artist's punches and kicks in fights with other characters. In "Shooting," players clear several stages by piloting a jet fighter to escape from constant enemy attack and to shoot down the enemy planes. In "Gun-shooting," players operate a gun-shaped control device aimed at the screen and snipe at the enemies shown. One of the most famous violent video games in the West, Wolfenstein, must belong to Action or ARP. Another famous game, Mortal Kombat, is a typical Fighting game. But these two games are not well-known or popular in Japan.

the character or have empathy for the character.

Deeper involvement in the media might lead to more aggression. As mentioned earlier, the level of involvement in the media world will be deeper where video games include significant role-identification. It is also said that violent video games have stronger effects on aggression than violent videos (Anderson & Dill, 2000; Dill & Dill, 1998). One of the reasons is supposed to be that video game players may quickly identify with the role of an aggressor and be absorbed in the violent world of the video game (Anderson & Dill, 2000; Dill & Dill, 1998). We therefore contend that violent video games that can induce deep involvement (absorption) in the media world and easy identification (synchronization) with the character will increase aggression-related reactions easily. In consideration of the theoretical background based on GAM (Andreson & Bushman, 2002; Bushman & Anderson, 2002), we may assume that the reason of the possibility that aggressive behavior could be facilitated when role-identification games are used is that the aggressive cognition and emotion evoked by role-identification games will be more activated and consequently lead to aggressive behavior easily. Then, the second hypothesis in this study was established as follows:

*Hypothesis 2.* Greater degree of role-identification will lead to a greater increase in aggressive cognition, emotion (affect and arousal), and behavior.

Violent video games can be classified not only by the play style, but also by the impression that the games make on the player. For example, video games that depict violence in a realistic, cruel, and shocking manner differ in the impressions that they impart from video games presenting violence in a fictional, artistic and fantastic way. Yukawa and associates (Yukawa, Endo, & Yoshida, 2001; Yukawa & Yoshida, 1999) examined the effects of violent videos on aggressive behavior from the perspective of "Graphic," i.e., cruel and shocking impressions, and "Fantasy," i.e., fictional and artistic impressions. Their findings suggest that graphic violent videos facilitate aggressive behavior only when anger is evoked by provocations prior to watching the videos. If we interpret these results on the basis of GAM, aggressive cognition and emotion caused by "graphic violence" in violent videos and supplemented by provoked anger led to aggressive behavior. Thus, it is predicted that the influence of media violence will vary in accordance with the impression received from video games. Therefore, the third hypothesis in the presents study was:

*Hypothesis 3.* Greater degree of graphic violence will lead to a greater increase in aggressive cognition, emotion (affect and arousal), and behavior.

***Participation***

The second major factor with an important effect on aggressive behavior is participation in video games. Here we differentiate between merely watching a video game being played and actually playing the video game. Most media violence studies that have focused on violent videos (Buhsman & Huesmann, 2001) have examined a passive, one-way influence of the media. The critical difference between only watching video games and playing video games lies in the fact that in actual playing players participate in the fictional and virtual world of the game, identify (synchronize) with the character, and are interactively involved in the media world by means of voluntary thinking and judging. From this, we conjecture that the degree of involvement in the media world may be different between merely watching video games and playing video games. In turn, this difference between playing and watching video games may lead to different effects on aggression-related reactions.

Only two studies have examined participation in violent video games, but neither found any difference between playing and watching (Cooper & Mackie, 1986; Graybill et al., 1987). However, both studies placed the subjects observing the game next to the subjects who were playing the video game. In other words, the experimental manipulations of the two conditions (watching and playing) were operated at the same time. At first sight, this procedure appears to be efficiently directed toward examining participation by controlling the stimulus picture between the watching and playing conditions (i.e., the subjects were

exposed to the same visual input in both conditions). However, in this experimental situation, inevitable interactions between the two groups of subjects provide a confounding variable. Cooper and Mackie (1986) permitted the subjects in the watching condition to give advice and encouragement to the subjects in the playing condition as long as they did not touch the video game device. Although Graybill et al. (1987) instructed the observers not to talk to the players, there is still a high possibility that implicit interaction may have taken place. The subjects in the playing condition are likely to be physiologically aroused and socially facilitated by the presence of another person observing their playing. Furthermore, if the observer gives the subjects any advice and encouragement, the players and observers will feel a sense of mutual participation. On the other hand, it is certain that the subjects in the watching (observing) condition will feel as if they are also playing the video game at the same time, this being caused by the presence of another person absorbed in the video game. In short, the two people in this situation seem to have a common experience of participating together in the game. Because of the confounding effect of such interaction, it is not absolutely clear whether the results can be attributed to the effect of participation only. It is thus necessary to operationalize these two conditions separately. On top of that, the yoked control technique, in which the subjects of the watching and playing conditions are exposed to the same visual material, must be used in order to control the stimulus picture between conditions.

As previously described, the media effects of facilitating aggression-related reactions will be stronger when people are absorbed in the media world or when they identify (synchronize) with the character easily (Anderson & Dill, 2000; Dill & Dill, 1998). In accordance with GAM, we can also assume that the aggressive cognition and emotion evoked by media violence will be probably more strongly activated and connected to aggressive behavior when people experience violence as a player in person than when they observe violence as a bystander. It's because playing can lead to more increase in absorption and identification (synchronization) than watching. Thus, we can predict that the actual playing of a violent video game may increase aggression more than the mere watching of the game played. Hence the forth hypothesis in the present study was as follows:

*Hypothesis 4.* Playing violent video games will lead to a greater increase in aggressive cognition, emotion (affect and arousal), and behavior than watching violent video games.

### Purpose of the Present Research

As has been contended above, it is necessary to examine the effects of violent video games on aggression by taking game types and participation into account. Then, we aim to investigate the effects of violent video games empirically by means of testing the four hypotheses given. The present study is divided into two studies. Study 1 estimates violent video games. Using the results of Study 1, these four hypotheses presented are examined in Study 2.

## STUDY 1: ESTIMATE OF VIOLENT VIDEO GAMES

### Purpose

In Study 1, we attempted to estimate violent video games in terms of the play style (stimulus-reaction or role-identification) and the impression (graphic violence or fantasy violence) of games.

### Method

Prior to the study, violent video games were divided into six genres; RPG, ARP, Action, Fighting, Shooting, and Gun-shooting. We selected 14 violent video games by choosing best-selling software (Karitajian, 1998; Media Create, 1999) from each genre. Forty (32 male, 8 female) undergraduates from the University of Tsukuba participated voluntarily in this study. The participants were asked to rate the play style and impression of the games that they had played before on a 5-point scale (1 = *strongly disagree* to 5 = *strongly agree*) for the 14 video games. The

play style rating scale consists of 11 items. These are: "It has a story," "It contains active movement," "It is possible to select the behavior of the character," "It requires reflexes," "It requires thinking," "It requires manipulation technique," "It is easy to identify (synchronize) with the character," "It contains action," "It is easy to empathize with the character," "It requires concentration," and "It contains adventure." The impression rating scale contains 9 items: "violent," "real," "fictional," "cruel," "shocking," "artistic," "entertaining," "terrifying," and "realistic." The total number of games (total responses) that the participants had played was 197.

## Results

### *Play Style of Violent Video Games*

Factor analysis (principal factor method) was performed for the 11 items regarding the play style by combining all responses to the 14 games (total responses = 197). Two factors were extracted. The varimax rotated factor loading matrix is shown in Table 1. As shown in Table 1, the first factor was interpreted as the "stimulus-reaction" factor, because it has high factor loadings on items such as "it requires manipulation technique," "it requires reflexes," "it contains action," "it requires concentration," and "it contains active movement." On the other hand, the second factor was interpreted as the "role-identification" factor. This is because it has high factor loadings on items such as "it is easy to identify (synchronize) with the character," "it is easy to empathize with the character," "it requires thinking," "it contains adventure," "it has a story," and "it is possible to select the behavior of the character." The results were consistent with the findings of Yukawa and Yoshida (2001) who classified violent video games in terms of play style.

Table 2 displays the average factor scores of each 14 video game. The video games with high stimulus-reaction (SR) were "BIOHAZARD 2," "CRASH BANDICOOT," "SUPER MARIO 64," "TEKKEN 3," "STREET FIGHTER ZERO 2," "VIRTUA COP 2," and "THE HOUSE OF THE DEAD 2," whereas the video games with high role-identification (RI) were "FINAL FANTASY VII," "FINAL FANTASY VIII" and "BIOHAZARD 2."

### *Impression of Violent Video Games*

We performed factor analysis (principal factor method) for the 9 items on the impression of video games by combining all responses for the 14 games (total responses = 197). Again, two factors were extracted. The varimax rotated factor loading matrix appears in Table 3. A glance at Table 3 reveals that the first factor was interpreted as the "graphic violence" factor, because it has high factor loadings on items such

Table 1 Factor loading Matrix of Play Style of Violent Video Games

| Item | Factor loading | | Communality |
|---|---|---|---|
| | Factor 1 | Factor 2 | |
| It requires manipulation technique. | *.89* | −.02 | .79 |
| It requires reflexes. | *.86* | −.15 | .76 |
| It contains action. | *.80* | .07 | .64 |
| It requires concentration. | *.71* | .09 | .51 |
| It contains active movement. | *.68* | .14 | .48 |
| It is easy to identify (synchronize) with the character. | .04 | *.77* | .59 |
| It is easy to empathize with the character. | −.11 | *.69* | .49 |
| It requires thinking. | −.01 | *.68* | .46 |
| It contains adventure. | .10 | *.49* | .25 |
| It has a story. | −.39 | *.48* | .38 |
| It is possible to select the behavior of the character. | .21 | *.38* | .18 |
| Factor contribution (Sum of squares) | 3.36 | 2.19 | |

*Note.* Factor 1=Stimulus-reaction, Factor 2=Role-identification.

as "cruel," "violent," "terrifying," "shocking," "real," and "realistic." The second factor was interpreted as the "fantasy violence" factor, since it has high factor loadings on items such as "artistic," "fictional," and "entertaining." This result was consistent with the finding by Yoshida and Yukawa (2000) concerning the impression of violent videos.

The average factor scores for each game are presented in Table 2. The video games with high graphic violence (GV) were "BIOHAZARD 2," "PARASITE EVE," "VIRTUR COP 2," and "THE HOUSE OF THE DEAD 2." The video games with high fantasy violence (FV) were "FINAL FANTASY VIII" "STREET FIGHTER ZERO 2," and "RAYSTORM."

## STUDY 2: EXPERIMENTAL TEST OF VIOLENT VIDEO GAMES

### Purpose

In Study 2, we selected different types of violent video games in terms of the play style (stimulus-reaction or role-identification) and the impression (graphic violence or fantasy violence) of games and examined the effects of violent

Table 2 Average Factor Scores of Play Style and Impression of Violent Video Games

| | | Play style | | Impression | |
|---|---|---|---|---|---|
| Genre | Game | SR | RI | GV | FV |
| RPG | FINAL FANTASY VII | −1.15 | .46 | −.47 | .14 |
| | FINAL FANTASY VIII | −1.50 | .50 | −.31 | .78 |
| | SAGA FRONTIER | −1.67 | .19 | −.89 | −.77 |
| ARP | BIOHAZARD 2 | .45 | .71 | 1.27 | −.33 |
| | PARASITE EVE | −.45 | .26 | .81 | −.46 |
| Action | CRASH BANDICOOT | .64 | −.48 | −1.00 | .01 |
| | SUPER MARIO 64 | .40 | −.18 | −.92 | .15 |
| Fighting | TEKKEN 3 | .72 | −.17 | .21 | .22 |
| | STREET FIGHTER ZERO 2 | .56 | −.22 | .13 | .53 |
| Shooting | RAYSTORM | .24 | −.91 | −.20 | .30 |
| | ACE COMBAT | .23 | −.51 | −.51 | −.19 |
| Gun-shooting | VIRTUA COP 2 | .44 | −.55 | .43 | −.11 |
| | TIME CRISIS | .36 | −.37 | .03 | −.39 |
| | THE HOUSE OF THE DEAD 2 | .43 | −.11 | 1.24 | .16 |

*Note.* SR=stimulus-reaction; RI=role-identification; GV=graphic violence; FV=fantasy violence.

Table 3 Factor loading Matrix of Impression of Violent Video Games

| | Factor loading | | |
|---|---|---|---|
| Item | Factor 1 | Factor 2 | Communality |
| Cruel | *.82* | −.03 | .67 |
| Violent | *.81* | .05 | .67 |
| Terrifying | *.77* | −.18 | .62 |
| Shocking | *.71* | .12 | .52 |
| Real | *.64* | −.14 | .43 |
| Realistic | *.59* | −.09 | .35 |
| Artistic | .16 | *.82* | .69 |
| Fictional | −.06 | *.40* | .16 |
| Entertaining | −.08 | *.36* | .14 |
| Factor contribution (Sum of squares) | 3.22 | 1.03 | |

*Note.* Factor 1=Graphic Violence, Factor 2=Fantasy Violence.

video games on cognitive, affective, physiological, and behavioral reactions related with aggression. We also investigated the effects of participation in video games by dividing participants into two groups: A group who actually played the video games and a group who merely watched the video games being played.

## Overview

One hundred male undergraduates individually participated in the experiment with a confederate. First of all, participants' baselines of physiological reactions (systolic and diastolic blood pressure, and pulse rate) were measured. Next, the provocation manipulation was performed for all participants in the form of a teacher-learner paradigm. After this, half of participants played a video game (i.e., the playing condition), while the other half of them merely watched the video recording of the game being played by a participant in the playing condition (i.e., the watching condition). Participants played or watched either one of 5 violent video games that varied in terms of play style and impression or a nonviolent (control) game. Immediately after being exposed to the video game, participants' physiological reactions were measured. Then, participants freely described their thoughts that occurred while being exposed to the video game (cognitive reactions), and also rated their affective reactions toward the video game on twenty 6-point uni-polar scales. Subsequently, participants' aggressive behavior was measured by means of the teacher-learner paradigm. At the last of this experiment, participants' baselines of physiological reactions were measured again.

## Method

### *Participants and Video Games*

One hundred and twenty male undergraduates from University of Tsukuba, who did not major in psychology and were naïve to a psychological experiment, participated voluntarily in the experiment. Ten participants were randomly assigned to either play or watch one of 5 violent video games or a nonviolent game. Only males were included in the experiment because males more easily facilitate aggressive behavior after playing violent video games than females (Bartholow & Anderson, 2002) and also usually have more experiences of playing video games (Anderson & Dill, 2000).

On the basis of the results of Study 1, we selected 5 violent video games from the 14 games used in Study 1, which varied in terms of play style and impression: "RAYSTORM," "FINAL FANTASY VIII," "PARASITE EVE," "THE HOUSE OF THE DEAD 2," and "BIOHAZARD 2." "LET'S GO BY TRAIN! 2," which is a railroad operation simulation game, was employed as a nonviolent (control) game.

### *Procedure*

Participants individually took part in the apparent experiment called "a study of the effects of video games on thoughts and creativity" with a male confederate posing as another participant. Participants and the confederate were seated with a partition between them. In advance of some experimental manipulations, participants' baselines of physiological reactions (systolic and diastolic blood pressure, and pulse rate) were measured using an automatic electro-sphygmomanometer (OMRON HEM-609) positioned on the non-dominant arm after they were inactive for 3 minutes.

First, each participant was provoked to boost the level of anger. The provocation manipulation was performed according to a "learning task (teacher - learner paradigm)" (Geen & Berkowitz, 1966; Berkowitz & Alioto, 1973) in which a person in the teacher's role evaluated the problem-solving ideas of a person in the learner's role. The learning task is one of the typical standard methods generally used to measure aggressive behavior (Baron & Richardson, 1994). In this study, we adopted this learning task for the reason that the provocation manipulation before the exposure of video games and the measurement of aggressive behavior after the exposure make a set in the learning task. The task employed was called "the creativity task." Here, the female experimenter explained that the task tested the effects of video games on the creation of ideas. Next, the participants were informed that

one of them (i.e., the participant or the confederate) would take the role of a learner creating ideas before the exposure of video games in order to investigate the difference between before and after the exposure. Participants first became the learner by pre-arranged lot drawing, and then described their solutions to 5 problems, before the confederate as the teacher evaluated each solution one by one out of 10 points. According to previous studies (Geen & Berkowitz, 1966; Berkowitz & Alioto, 1973), the problems that participants solved were such as "What would you do to raise the record of the door-to-door sales of some health improving equipments?" All 5 problems employed are shown in the Appendix. The experimenter also explained that the reason why the teacher evaluated was to pressure the learner by punishment in order to facilitate the creation of ideas.

Describing the solution was limited to one minute. Five solutions of participants were then evaluated as 4, 3, 2, 2, and 3 points respectively. Based on these points, participants were given 7, 8, 9, 9, and 8 noise blasts (the sound pressure level was about 90 *dB*) through headphones. After finishing the task, the experimenter asked participants and the confederate about their impressions of the task. To verbally provoke the participants as well, the confederate asked, "Is it OK even if his solutions are so poor?"

After the participants had been provoked, they were exposed to a video game. Half the participants played the video game (i.e., the playing condition). Specifically, first, the experimenter read aloud a brief commentary on the background and purpose of the video game, before explaining how to play it carefully. After the participants had practiced playing the game for 5 minutes, they then played the video game for 10 minutes. The picture of the video game played by each participant was recorded on videotape. The other half of the participants watched one of these recorded videos (i.e., the watching condition). That is, after reading about the background and purpose of the video game, the experimenter instructed the other half of the participants to watch the video recording (10 minutes) of the video game played by a participant in the playing condition. This was based on the yoked control technique in which only one participant in the watching condition watched the video recording of only one participant in the playing condition. The video game being played was shown on a 25-inch square color screen that was about 5 feet away from the participants. The video game device used in the playing condition was *Playstation* (SONY SCPH-5500) or *Dreamcast* (SEGA HKT-3000). In this game session, the confederate was apparently exposed to (watching or playing) the same video game as the participants did.

After exposure to the video game, the experimenter measured the reactions of participants. First of all, post-game physiological measures were taken immediately after the participants completed playing or watching the video game. Next, in order to measure the cognitive reactions, the experimenter distributed a form (which contains 32 (8 × 4) matrices) and asked the participants to describe in words within 3 minutes the thoughts that they had had while being exposed to the video game (thought-listing technique: Cacioppo & Petty, 1981). This technique is a typical method to measure cognitive reactions. We used it as the index of cognitive reaction, following previous studies (Bushman & Geen, 1990; Calvert & Tan, 1994) that had examined the effects of violent videos or violent video games on cognitive reactions. Then, participants were asked to rate their affective reactions regarding the video game on 20 items, using a 6-point uni-polar scale ranging from 1 (*not feel*) to 6 (*strongly feel*). Based on the research of Yukawa and Yoshida (2001), we employed the following items: "refreshed," "frightened," "vacant," "angry," "happy," "gloomy," "powerless," "hostile," "fine," "disgusted," "empty," "hateful," "annoyed," "uneasy," "irritated," "depressed," "disturbed," "vexed," "sad," and "throbbing."

After responding to the above-mentioned questions, the experimenter employed the learning task again to measure the aggressive behavior of participants. This time the roles were reversed. In other words, participants as the teacher were given the chance to evaluate the problem-solving ideas of the confederate as the learner, and to deliver noise blasts to him according to the

evaluations. The confederate was give problems and prepared solutions such as "What would you do to attract many customers to an inconveniently located supermarket?" (the problem) and "Launch a big advertising campaign " (the solution). The answers of the confederate were the same for all conditions. All 5 problems and the solutions were shown in the Appendix.

After finishing the task, participants were asked to evaluate the play style and impression of the video game. The items about play style and impression used here were same as Study 1: The play style scale consists of 11 items and the impression scale contained 9 items. At this point, participants were instructed to rate four questions; absorption, fun, difficulty, and familiarity. The rating of absorption into the video game (identification or synchronization with a character of the video game) was on 6-point scale (1=*strongly disagree* to 6=*strongly agree*): The item content was "I felt like behaving as if I had been the main character." Fun and difficulty of video games were rated on a 5-point uni-polar scale (1 =*strongly disagree* to 5=*strongly agree*). Finally, familiarity (playing experience) of the video game was answered on a 5-point scale (1=*never played*, 2=*played a little*, 3=*played*, 4=*played very much*, 5 =*already cleared*). These four questions such as absorption, fun, difficulty, and familiarity about video games were measured for confirming our experimental manipulation and statistically being controlled in the analyses of the effects of video games: These variables would be likely to influence the effects of video games (Anderson & Dill, 2000).

After participants' baselines of physiological reactions were measured again after they were inactive for 3 minutes, the female experimenter gave participants a careful debriefing of the experiment. She explained the procedures and hypotheses of this experiment, disclosed the cover story, and asked participants if they had noticed these hypotheses or cover story during the experiment. All participants answered that they had not noticed them. After thanking with a small present, the experimenter dismissed participants.

***Measures***

*Play style and impression.* Two kinds of scores about play stale of video games were calculated on the basis of Study 1: Stimulus-reaction (SR) was the composite averaged score of "It requires manipulation technique," "It requires reflexes," "It contains action," "It requires concentration," and "It contains active movement"; role-identification (RI) was the composite averaged score of "It is easy to identify (synchronize) with the character," "It is easy to empathize with the character," "It requires thinking," "It contains adventure," "It has a story," and "It is possible to select the behavior of the character." The coefficient Cronbach alphas calculated for each score in Study 2 were .62 (SR) and .60 (RI), which appeared in Table 5. One participant in the condition of watching a control video game failed to answer the SR and RI questions, while one in the condition of playing a violent video game failed to answer the SR questions.

On the other hand, we also computed two kinds of scores about impression of video games on the ground of Study 1: Graphic violence (GV) was the composite averaged score of "cruel," "violent," "terrifying," "shocking," "real," and "realistic"; fantasy violence (FV) was the composite averaged score of "artistic," "fictional," and "entertaining." The coefficient Cronbach alphas calculated for each score in Study 2 were .71 (GV) and .29 (FV). The alpha of FV was so extremely low that we decided not to use this variable in the further analyses. The alpha of GV was presented in Table 5. Two participants in the condition of watching a control video game and watching a violent video game respectively failed to answer the GV questions.

*Number of thoughts.* Independently of the experiment, two raters classified the thoughts written by participants into the following 6 categories: (a) Physical violence (e.g., hit, shoot), (b) verbal violence (e.g., abuse, insult), (c) thing/ person/state related to violence (e.g., death, blood, gun), (d) negative affect (e.g., unpleasant, disgusting), (e) positive affect (e.g., enjoyable, beautiful), and (f) the rest that did not apply to any of above-mentioned categories. The concordance rate between the two raters was 89.4%,

and the coefficient alpha of concordance (Krippendorff, 1980) was .76.

When calculating total thoughts for each category, we counted the thoughts that the raters had classified similarly as "one thought," while we numbered the thoughts that the raters had classified differently as "half of a thought." In other words, the former meant 1 point were added, and the latter 0.5 point. The total of (a), (b) and (c), which were all related to violence, was used as the number of aggressive thoughts (AT) for the following analyses.

*Affective reactions.* Four kinds of scores were calculated based on the study of Yukawa and Yoshida (2001): (a) Negative affect (NA) was the composite averaged score of "disturbed," "gloomy," "frightened," "uneasy," "disgusted," "depressed," "throbbing," and "sad"; (b) hostile affect (HA) was the composite averaged score of "hateful," "irritated," "annoyed," "angry," "hostile," and "vexed"; (c) empty-powerless affect (EA) was the composite averaged score of "empty," "vacant," and "powerless"; and, (d) positive affect (PA) was the composite averaged scores of "refreshed," "fine," and "happy." The coefficient Cronbach alphas calculated for each score in Study 2 were .81 (negative affect), .88 (hostile affect), .83 (empty-powerless affect), and .87 (positive affect), which were set out in Table 5. One participant in the condition of playing a violent video game failed to answer the HA questions.

*Physiological reactions.* We calculated the Automatic Lability Score (ALS: Lacey, 1956) of each physiological reaction (systolic blood pressure: SBP, diastolic blood pressure: DBP, and pulse rate: PR). The ALS is a score which counts the Low of Initial Values (LIV) about autonomic response (Wilder, 1950), and is standardized with the average score 50 and the standard deviation 10. In this study, we calculated an average baseline from two baselines (measured at the beginning and the last of this experiment) as a non-stimulated normal value, and employed a response immediately after exposure to a video game as a stimulated value.

*Noise blasts on the learning task.* We calculated the mean number and duration (sec) of noise blasts participants had delivered to the confederate on the basis of their evaluation of the confederate's 5 solutions. We operationally defined aggressive behavior as the sum of standardized scores of both the number and duration, after a logarithmic transformation was used on duration measure.

*Other measures.* Absorption, fun, difficulty, and familiarity were all single-item measures. One participant in the condition of a watching a control video game failed to answer the questions about fun and difficulty. Three participants, who were in the condition of watching a control video game, watching a violent video game, and playing a violent video game respectively, failed to answer the familiarity.

## Results

### *Questions about Video Game*

The means of absorption, fun, difficulty, and familiarity about video games were shown in Table 4. A 2 (game; control game versus violent games) × 2 (participation; watching versus playing) between-subjects analysis of variance (ANOVA) was performed with each of them as the dependent variable. First, the result about fun indicated a significant main effect of participation ($F(1, 115)=4.20$, $p<.05$, $MSE=1.22$, $R^2=.08$); playing video games elicited more fun significantly than watching them. Second, the result about difficulty indicated a significant main effect of game ($F(1, 115)=11.28$, $p<.01$, $MSE=1.14$, $R^2=.12$); the nonviolent control video game was significantly more difficult than the violet video games. There was no significant main effect or interaction on the absorption and familiarity measures.

In sum, it is proper that playing was more amusing for participants than watching since the video games were just "games." The reason that the control game was more difficult was that it was a railroad operation simulation game, which requires a relatively high technique to manipulate. In terms of familiarity with a game that a participant was exposed to, there was no significant difference among each experimental condition. Concerning absorption, there also was no significant difference between playing and

Table 4 Means for each condition of a 2 (control game vs. violent games) X 2 (watching vs. playing)

| | Control Game | | Violent Games | | |
|---|---|---|---|---|---|
| | Watching | Playing | Watching | Playing | Significance |
| Absorption | 3.30 | 4.00 | 2.76 | 3.42 | |
| Fun | 3.44 | 3.90 | 3.36 | 4.04 | b* |
| Difficulty | 4.00 | 4.80 | 3.40 | 3.60 | a** |
| Familiarity | 1.22 | 1.20 | 1.69 | 1.63 | |
| SR | 3.58 | 2.96 | 3.76 | 3.78 | a** |
| RI | 2.65 | 2.82 | 3.18 | 3.14 | a* |
| GV | 2.37 | 1.97 | 2.89 | 3.04 | a** |
| AT | .25 | .40 | 2.25 | 3.14 | a** |
| NA | 2.39 | 1.71 | 2.58 | 2.63 | a* |
| HA | 2.68 | 2.23 | 2.49 | 2.49 | |
| EA | 3.00 | 2.50 | 2.95 | 2.72 | |
| PA | 2.50 | 3.70 | 2.47 | 3.24 | b** |
| ALS of SBP | 50.83 | 48.35 | 49.53 | 50.64 | |
| ALS of DBP | 55.92 | 48.74 | 49.37 | 49.70 | |
| ALS of PR | 54.33 | 48.33 | 49.14 | 50.33 | |
| AB | .47 | .05 | .04 | −.14 | |

*Note.* SR=stimulus-reaction; RI=role-identification; GV=graphic violence; AT=aggressive thoughts; NA=negative affect; HA=hostile affect; EA=empty-powerless affect; PA=positive affect; AB=aggressive behavior. On the right significance line, "a" means a significant main effect of game, while "b" means a significant main effect of participation (There was no significant interaction on every measure). $^{**}p<.01$, $^{*}p<.05$.

watching video games, which might suggest that playing did not lead to more identification or synchronization with a character of the video game. However, there was a marginally significant main effect of participation ($F(1, 116)=3.01$, $p=.09$, MSE=2.56, $R^2=.06$); playing somewhat tended to absorb participants into the video game world than watching.

### *Play Style and Impression*

The means of stimulus-reaction (SR), role-identification (RI), and graphic violence (GV) were shown in Table 4. A 2 (game; control game versus violent games) × 2 (participation; watching versus playing) between-subjects analysis of variance (ANOVA) was performed with each of them as the dependent variable. Firstly, the result about SR indicated a significant main effect of game ($F(1, 114)=7.07$, $p<.01$, $MSE=.57$, $R^2=.09$); violent video games had a significantly more remarkable feature of stimulus-reaction than a nonviolent video game. Secondly, the result about RI indicated a significant main effect of game ($F(1, 115)=5.68$, $p<.05$, $MSE=.52$, $R^2=.05$); violent video games had a significantly more remarkable feature of role-identification than a nonviolent video game. Lastly, the result about GV indicated a significant main effect of game ($F(1, 114)=13.95$, $p<.01$, $MSE=.72$, $R^2=.13$); violent video games had a significantly more remarkable feature of graphic violence than a nonviolent video game.

In sum, violent video games were more stimulus-reactive, more role-identificating, and more graphic in violence than a nonviolent video game in this study. That is, there were difference between the violent games and the nonviolent game in terms of play style and impression. Especially about impression, it was verified that violent video games used in this study were literally more graphically "violent" than the nonviolent game.

### *Aggressive Thoughts (Cognitive Reaction)*

The means of aggressive thoughts (AT) were shown in Table 4. A 2 (game; control game versus violent games) × 2 (participation; watching versus playing) between-subjects analysis of variance (ANOVA) was performed with AT as the

dependent variable. The result indicated a significant main effect of game ($F(1, 116)=21.33$, $p<.01$, $MSE=.4.39$, $R^2=.18$); violent video games had significantly more aggressive thoughts than a nonviolent video game. There was neither significant main effect of participation nor interaction between game and participation.

***Affective Reactions***

The means of negative affect (NA), Hostile affect (HA), empty-powerless affect (EA), and positive affect (PA) were shown in Table 4. A 2 (game; control game versus violent games) × 2 (participation; watching versus playing) between-subjects analysis of variance (ANOVA) was performed with each of them as the dependent variable. First, the result about NA indicated a significant main effect of game ($F(1, 116)=5.35$, $p<.05$, $MSE=.94$, $R^2=.06$); violent video games elicited significantly more negative affect than a nonviolent video game. Second, the result about PA indicated a significant main effect of participation ($F(1, 116)=8.80$, $p<.01$, $MSE=1.84$, $R^2=.10$); playing video games elicited significantly more positive affect than watching them. There was no significant main effect or interaction on the HA and EA measures.

In sum, consistent with fun mentioned above, it is proper that playing "games" was more amusing and pleasant for participants than watching them. On the other hand, though the violent games and the nonviolent game were not significantly different from each other in positive affect, the violent games were more disturbing, frightening, and disgusting than the nonviolent game.

***Physiological Reactions***

The means of ALS of SBP, ALS of DBP, and ALS of PR were shown in Table 4. A 2 (game; control game versus violent games) × 2 (participation; watching versus playing) between-subjects analysis of variance (ANOVA) was performed with each of them as the dependent variable. The result indicated that there was no significant main effect or interaction of game and participation about physiological reactions.

***Noise Blasts on the Learning Task (Behavioral Reaction)***

The means of aggressive behavior (AB) were shown in Table 4. A 2 (game; control game versus violent games) × 2 (participation; watching versus playing) between-subjects analysis of variance (ANOVA) was performed with AB as the dependent variable. The result indicated that there was no significant main effect or interaction of game and participation about this behavioral measure.

***Relationship among all variables***

Zero-order correlations (Pearson correlation coefficients) among all variables were presented in Table 5. If we look at Table 5 we will see the follows below. (1) Both stimulus-reaction and role-identification were positively associated with graphic violence. Especially, stimulus-reaction was positively related to aggressive thoughts, while role-identification was positively related to negative affect. (2) Graphic violence was positively linked with aggressive thoughts, negative affect, and hostile affect, and was negatively linked with positive affect. (3) Negative affect, Hostile affect, and empty-powerless affect were positively connected with each other, and were negatively connected with positive affect. (4) SBP was positively associated with DBP. (5) Absorption and fun were positively related to each other. They were positively linked to role-identification and positive affect, and negatively linked to empty-powerless affect. (6) Difficulty was negatively correlated to familiarity.

Speaking of a causal relationship between features of video games and affective, cognitive, physiological and behavioral reactions, it seems reasonable to think that stimulus-reaction might lead to aggressive thoughts, role-identification might lead to negative affect, and graphic violence might lead to aggressive thoughts, negative affect, and hostile affect. Additionally, we see from Table 5 that there was a positive correlation between role-identification and absorption. This suggests that such a game feature as role-identification undoubtedly led to identification or synchronization with a character of the video game in this experiment.

Table 5 Zero-order Correlations and Alphas: Study 2

| | Variable | Alpha | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Absorption | – | | | | | | | | | | | | | | | |
| 2 | Fun | – | .36** | | | | | | | | | | | | | | |
| 3 | Difficulty | – | −.17 | .05 | | | | | | | | | | | | | |
| 4 | Familiarity | – | −.12 | .11 | −.26** | | | | | | | | | | | | |
| 5 | SR | .62 | .07 | .16 | .16 | .07 | | | | | | | | | | | |
| 6 | RI | .60 | .23* | .24** | −.02 | −.01 | .05 | | | | | | | | | | |
| 7 | GV | .71 | .05 | .09 | .00 | .07 | .26** | .34** | | | | | | | | | |
| 8 | AT | – | .00 | −.02 | .13 | −.11 | .34** | .17 | .31** | | | | | | | | |
| 9 | NA | .81 | −.02 | −.04 | .12 | −.05 | .11 | .24** | .58** | .17 | | | | | | | |
| 10 | HA | .88 | .02 | −.09 | .08 | −.08 | .02 | .01 | .19* | .08 | .43** | | | | | | |
| 11 | EA | .83 | −.29** | −.42** | .01 | −.04 | −.09 | −.16 | .06 | .06 | .41** | .31** | | | | | |
| 12 | PA | .87 | .35** | .44** | .05 | −.08 | .07 | −.12 | −.23* | −.05 | −.22* | −.18* | −.35** | | | | |
| 13 | ALS of SBP | – | −.01 | .08 | −.03 | −.04 | .03 | −.08 | .04 | −.04 | .04 | −.10 | −.02 | .09 | | | |
| 14 | ALS of DBP | – | −.08 | −.04 | −.07 | −.04 | −.01 | −.06 | −.10 | .05 | −.01 | −.16 | .07 | .04 | .63** | | |
| 15 | ALS of PR | – | .00 | −.09 | −.02 | −.03 | .07 | −.09 | .17 | −.02 | −.01 | .12 | −.04 | −.01 | .00 | .00 | |
| 16 | AB | – | .13 | .03 | .03 | −.06 | −.06 | .11 | −.03 | −.15 | −.06 | .03 | −.15 | .11 | −.03 | −.07 | −.08 |

*Note.* SR=stimulus-reaction; RI=role-identification; GV=graphic violence; AT=aggressive thoughts; NA=negative affect; HA=hostile affect; EA=empty-powerless affect; PA=positive affect; AB=aggressive behavior. Alphas are shown next to the names of variables. Dashes indicate that it is a single-item measure or it is not a simply-added score. $^{**}p<.01$, $^{*}p<.05$.

***Relationship between characteristics of and reactions toward video games***

We performed the forced entry multiple regression analyses with each of reaction toward video games as the criterion variables and characteristics of video games as the explanatory variables in order to examine how the characteristics link with the reactions. Such questions of video games as absorption, fun, difficulty, and familiarity were also included in each model of these multiple regression analyses for being statistically controlled. The analyses were performed separately for each condition of participation (watching and playing), which results were presented in Table 6.

The result of the watching condition, which is the upper side of Table 6, reveals that (1) stimulus-reaction led to a decrease in negative affect ($\beta = -.24$, $p<.05$), and (2) graphic violence facilitated negative affect ($\beta = .62$, $p<.01$), empty-powerless affect ($\beta = .33$, $p<.05$), and aggressive behavior ($\beta = .33$, $p<.05$) and inhibited positive affect ($\beta = -.35$, $p<.05$). On the other hand, the result of the playing condition on the lower side of Table 6 shows that (3) stimulus-reaction activated aggressive thought ($\beta = .36$, $p<.01$), (4) role-identification led to a decrease in positive affect ($\beta = -.29$, $p<.05$), and (5) graphic violence enhanced aggressive thought and negative affect ($\beta = .40$ and $.50$, $p<.01$, respectively).

Above all, aggressive thoughts as cognitive reaction were activated by stimulus-reaction and graphic violence only in the playing condition. Negative affect was aroused by graphic violence both in the watching and playing conditions. Most importantly, aggressive behavior was facilitated by graphic violence only in the watching condition.

Additionally, in order to examine whether the preset internal state leads to aggressive behavior or not, we performed the forced entry multiple regression analyses with aggressive behavior as the criterion variable and cognitive, affective, and physiological reactions as the explanatory variables. The data was divided into each condition of participation (watching and playing). The result of analyses showed that $R^2$ of both conditions were not statistically significant. Hence, in this study, we could not find a significant link between the present internal state (aggression-related cognition, affect, and arousal) and the outcome (aggressive behavior).

## DISCUSSION

The purpose of this study was to investigate the effects of violent video games on cognitive, affective, physiological, and behavioral reactions related with aggression through taking the play

Table 6 The Effects on Cognitive, Affective, Physiological, and Behavioral Reactions related with Aggression: Standardized Partial Regression Coefficients (Beta)

| Watching Condition | Criterion Variable | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Explanatory Variable | AT | NA | HA | EA | PA | ALS of SBP | ALS of DBP | ALS of PR | AB |
| Absorption | −.02 | .16 | .03 | −.14 | .28* | −.07 | .12 | .11 | .17 |
| Fun | −.30* | −.17 | −.17 | −.42** | .37** | −.01 | −.07 | −.16 | .22 |
| Difficulty | .17 | .16 | .14 | .05 | .14 | −.18 | −.13 | .05 | .07 |
| Familiarity | −.06 | −.07 | −.03 | .04 | .01 | −.08 | −.16 | .05 | −.16 |
| SR | .20 | −.24* | −.25 | −.21 | .17 | .09 | .02 | .13 | .09 |
| RI | .28 | .03 | −.06 | −.22 | −.10 | .04 | −.03 | −.38* | −.01 |
| GV | −.11 | .62** | .36* | .33* | −.35* | .09 | −.03 | .12 | .33* |
| $R^2$ | .17 | .48** | .19 | .42** | .40** | .04 | .07 | .16 | .27* |

| Playing Condition | Criterion Variable | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Explanatory Variable | AT | NA | HA | EA | PA | ALS of SBP | ALS of DBP | ALS of PR | AB |
| Absorption | −.20 | −.13 | .03 | −.18 | .09 | −.13 | −.37* | .07 | .17 |
| Fun | −.01 | .07 | .09 | −.13 | .44** | .27 | .13 | −.02 | −.10 |
| Difficulty | −.08 | .07 | −.06 | −.17 | −.18 | −.08 | −.14 | −.04 | .07 |
| Familiarity | −.22 | −.06 | −.21 | −.22 | −.27 | −.18 | −.04 | −.05 | .12 |
| SR | .36** | .19 | .19 | .18 | .01 | .00 | .02 | −.05 | −.25 |
| RI | .14 | .05 | −.15 | −.10 | −.29* | −.26 | −.04 | .05 | −.01 |
| GV | .40** | .50** | .14 | .00 | −.23 | .02 | −.07 | .30 | −.10 |
| $R^2$ | .46** | .40** | .12 | .11 | .30* | .10 | .11 | .10 | .12 |

*Note.* SR=stimulus-reaction; RI=role-identification; GV=graphic violence; AT=aggressive thoughts; NA=negative affect; HA=hostile affect; EA=empty-powerless affect; PA=positive affect; AB=aggressive behavior. $^{**}p<.01$, $^{*}p<.05$.

style (stimulus-reaction and role-identification) and impression (graphic violence and fantasy violence) of violent video games into consideration. We also investigated the effects of participation in video games by dividing participants into two groups: watching groups and playing groups. We will discuss the results obtained from this research in the light of these purposes.

### Effects of violent video games

The results of this study revealed that violent video games increased aggressive thoughts and negative affect. This result is almost consistent with the prediction by GAM about the present internal state: "recent exposure to violent media can cause short-term increases in aggression through its impact on a person's present internal state, represented by cognitive, affective, and arousal variables" (Bushman & Anderson, 2002, p. 1680). However, physiological reactions and aggressive behavior were not increased by violent video games. Thus, the results partly supported Hypothesis 1.

The reason why violent video games had no significant influence on physiological reactions might be problems of individual difference and measurement. Generally speaking, there is an acute difference between individuals concerning physiological reactions. Though we calculated the ALS because of this difference, we could not find the significant effects on physiological reactions. In addition, we exclusively measured hemodynamic (cardiovascular) parameters as autonomic arousal only at the three points in time: at the beginning and the last of this experiment, and immediately after exposure to a video game. Then, in the future, we ought to retest the effects on

physiological reactions by successively measuring the other parameters such as respiration and electrodermal activity (EDA).

On the other hand, the reason for no significant effects on aggressive behavior might be that the higher-level control processes activated on outcomes. In GAM, Anderson and Bushman (2002) note that "..., the results from the inputs enter into the appraisal and decision processes through their effects on cognition, affect, and arousal. ...The outcomes of these decision processes themselves determine the final action of the episode" (p. 40). Aggressive behavior is generally regarded as a negative or antisocial behavior and strongly restrained by social norms. Especially, in Japan, aggression and violence toward others is considered to be a shameful act, because calm and modesty are the greatest virtues for Japanese. We think that these virtues may be grounded on the so-called *"Bushido,"* which is *samurai* ethics and the soul of Japan governing the behavior of Japanese underlyingly (Nitobe, 1899/2001). In past times, it was necessary for the *samurai* to be always noble-minded. It is certain that the *samurai's Bushido* contributes to the modern Japanese mentality. In fact, the cross-cultural study about interpersonal conflicts between Japanese and Americans, which was conducted by Ohbuchi and Takahashi (1994), demonstrated that "a particularly strong tendency to avoid conflict was found among Japanese subjects, who were motivated by both their desire to preserve relationships and their perceptions of shared responsibility" (p. 1345) as compared to American subjects. This study also demonstrated that there was no statistically significant link between the present internal state (cognition, affect, and arousal) and the outcome (behavior). Thus, there is a possibility that participants might have inhibited their aggressive behavior strictly even if they were purely stimulated by several experimental manipulations in the laboratory. In future studies, we must do an even more detailed examination of how the appraisal and decision processes operate on aggressive behavior in consideration of cultural factors (e.g., Bond, 2004).

### Effects of Play Style

The present study showed that, as for the game feature of role-identification, it inhibited positive affect only in the playing condition. It had no impact on other reactions both in the watching and playing condition. Practically, stimulus-reaction rather than role-identification elicited aggressive thoughts in the playing condition. Thus, these results did not support Hypothesis 2, which had predicted that greater degree of role-identification leads to a greater increase in aggression. After all, the data in this study served to strengthen the fact that the very stimulus-reaction type of games as used frequently in previous studies facilitates aggression-related reactions.

It is possible that the results of this study depended on whether the higher controlling processes activated or not. We had inferred that video games that can induce a deeper level of involvement with the media world (i.e., games that can induce easy identification or synchronization with the character) increase aggression. Then, the role-identification feature of video games had been expected to be related to aggression-related reactions. Actually, in contrast, the other feature of stimulus-reaction was linked to aggressive cognition. We should not leap to a conclusion, but these results of this study imply that role-identification seems to bring players a margin enough to consider and control their own states and reactions. It is because they can think and select the behavior of the character at their own paces in the role-identification games. According to GAM, the higher-level appraisal and decision processes with moral reasoning and judgment can affect present internal states interactively, as well as actual overt actions (Anderson & Bushman, 2002, p. 40-41). In this study, there is likely to be a margin to appraise and regulate the players' own aggression-related reactions sufficiently in the role-identification games. On the other hand, it is possible that stimulus-reaction may increase aggressive cognition because of no time enough to reflect the players' own reactions during playing. It is because players must reflexively shoot down and kill enemies that appear one after another. It will thus be necessary in future studies to

examine the higher processes to control and regulate reactions after exposure to violent video games.

## Effects of Impression

This study demonstrated that graphic violence increased aggressive behavior in the watching condition. Graphic violence also elicited negative affect both in the watching and playing condition, and activated aggressive thoughts in the playing condition. These results almost supported Hypothesis 3. However, in the playing condition, aggressive behavior was not facilitated by graphic violence.

We can not determine the reason precisely, but there might be two possibilities regarding this result. One reason is that playing graphic violent video games made people feel more sense of disgust and resistance toward actual use of violence than watching them. It was found that graphic violence facilitated both negative affect and aggressive behavior in the watching condition, while it facilitated negative affect with no significant effects on aggressive behavior in the playing condition. Players probably involved themselves in the fictional world and virtually experienced graphic violence, which contains extremely cruel and realistic images of zombies and monsters gushing blood and writhing in pain. It appeared that they enjoyed playing graphic violence in the "virtual" world but then hated employing violence in the "real" world. Otherwise, this result looks as if something like a cathartic effect had occurred. Virtually experiencing graphic violence is likely to prompt us to release and express anger and frustration that we feel in our real life. If this expression in the harmless virtual world can lead to a feeling of refreshment, graphic violent video games might appear to provide a cathartic effect. However, in the playing condition, it was not that graphic violence decreased aggressive behavior and increased positive affect. In future studies, we need to pay more attention to the effects of playing graphic violence on aggressive behavior in terms of a feeling of disgust toward real violence or relief from daily frustration.

## Effects of Participation

As a result of this study, playing video games increased only positive affect more than watching them. As for aggression-related reactions, there was not even interaction effect between video games and participation. This result did not support Hypothesis 4. That is, the effects of violent video games did not make a significant difference in aggression according to the way how people were exposed to them. As it turned out, the result was consistent with the previous studies, Cooper and Mackie (1986) and Graybill et al. (1987). According to this consistency, we might arrive at a transient conclusion that participation perhaps has no effect on aggression and then no relation to GAM. But participation is the most distinctive feature of video games. We must continue to examine the effects of participation through improving research design and method.

One important thing is that playing video games increased positive affect and fun. In a word, playing video game is purely amusing and entertaining for players. If so, playing "violent" video games also will be amusing and entertaining like others. We can guess that the major reason for the popularity of violent video games may be that they provide consumers with feelings of achievement and relief by escaping from crises, fear and danger. Such games can also engender a feeling of refreshment by letting the player express their anger and frustration in a harmless virtual world. The feeling of achievement and refreshment obtained from playing violent video games, like a cathartic effect, is therefore likely to be a primary motive for playing them. Although previous studies focused only on feelings such as hostility, anxiety, and depression, future research ought to pay more attention to the role of positive affect when players virtually experience violence in the fictional world.

## Conclusions

The purpose of this study was to examine the effects of violent video games on aggression. The results revealed that violent video games increased aggressive thoughts and negative affect,

but not physiological reactions and aggressive behavior more than a nonviolent control video game. Besides, we did focus the effects of game types (play style and impression) and participation. The main results showed that: (1) aggressive thoughts were activated by stimulus-reaction and graphic violence only in the playing condition: (2) negative affect was aroused by graphic violence both in the watching and playing conditions: (3) aggressive behavior was facilitated by graphic violence only in the watching condition.

We could provide three suggestions or prospects. First, there is likely to be a higher-level appraisal and decision processes regulating aggressive behavior on the stage of outcomes or on playing role-identification games. We would like to focus attention to investigate the higher-level processes in more detail especially through cultural perspectives. Second, there also might be a somewhat qualitative difference between observing and experiencing "graphic violence." More concretely, it may be possible to say that experiencing graphic violence can not always increase but decrease (or have no effects on) aggressive behavior of players. Put differently, as the involvement in the fictional media world becomes deeper, the effects of graphic violence might not simply become stronger but also change in quality. We must examine whether the essence of the effects is in fact a feeling of disgust toward real violence or relief from daily frustration. Lastly, we must examine the habitual (repeated) playing of violent video games in order to fully verify the process presented by GAM. This study dealt with the short-term effects of violent video games only. However, the feature of playing video game is habituation (Braun & Giroux, 1989; Griffiths & Hunt, 1998). Besides, it usually takes a long time such as a week or a month for players to finish role-identification games like RPG and ARP. According to GAM, this repeated violent game playing is likely to reinforce aggression-related knowledge structures in players and desensitize players to aggression or violence, which will facilitate aggressive behavior in a single episode (Anderson & Bushman, 2002; Bushman & Anderson, 2002). It will thus be necessary in future studies to examine the effects of long-term repeated playing of violent video games.

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Appendix Problems to be Solved in the Learning Task

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| Problems given to Participants in the Provocation Manipulation | |
| 1 | What would you do to raise the record of the door-to-door sales of some health improving equipments? |
| 2 | What do you think is an effective way for Japanese to improve their English skills? |
| 3 | If you were an elementary school teacher, what should you do to remove bullying in your school? |
| 4 | If you worked for a city, what should you do to let the citizens of the city keep rules about collection of garbage by type? |
| 5 | What do you think is an effective measure to ease a crowded cafeteria in a university at noon? |
| Problems and Solutions given to the Confederate in the Measurement of Aggressive behavior | |
| 1 | What would you do to attract many customers to an inconveniently located supermarket? - Launch a big advertising campaign. |
| 2 | What do you think is a good idea to help women to work with childcare? - Hasband and wife share their housework. |
| 3 | What do you think is an effective means not to lose the way during the trip to a strange place? - Have a map. |
| 4 | If you were an organizer of a new-year party, what should you do to let participants be punctual for the party? - Fine them for being late. |
| 5 | What do you think is an effective measure to decrease trafic accidents? - Strengthen penalties for trafic violations. |