# Effect of Video Games on Children's Aggressive Behavior and Pro-social Behavior: A Panel Study with Elementary School Students.

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**ABSTRACT**
We conducted a panel study with elementary school students in order to examine the effect of video games on children. We conducted two surveys, and measured the amount of use of video games, exposure to certain types of scenes, and preference for types of games as "video game variables," and also measured the level of aggressive behavior and pro-social behavior as "dependent variables." The result of cross-lagged effect model analysis suggested that for boys pro-social behavior was suppressed more as they used video games more. Also, for all participants and for boys, their pro-social behavior was promoted more as they were exposed to more pro-social scenes, or they indicated stronger preference for non-violent games, while their pro-social behavior was suppressed more as they indicated stronger preference for violent games.

**Author Keywords**
video game, aggressive behavior, pro-social behavior, panel study

**PROBLEM**
Many studies to date have examined whether "playing violent video games would heighten the level of aggression or increase aggressive behavior" [3, 5]. Previous studies can be roughly divided into experimental studies, survey studies, and panel studies, and they often indicated the possibility that video games could have adverse effects on aggression or aggressive behavior. In laboratory experiments, those who are in the experimental group play aggressive video games in a laboratory, and their aggression is later compared with that of the control group. In general, laboratory experiments have a strong ability to identify causal relationships; however, they have problems in that experimental scenes are artificial and that identified causal relationships are usually short-term relationships. Meanwhile, in survey studies, the amount of video game use and aggression of the participants are measured to examine the correlation between them. Although some of the previous studies indicated that there was a significant positive correlation between the amount of video game use and aggression [2, 11, 7], one-wave studies cannot identify the cause and effect even though they can identify correlations. Survey studies, therefore, overcome the artificiality problem, but are still unable to identify causal relationships.

Although it is still a survey study, a panel study can to some degree get closer to identifying causal relationships than other methods that obtained correlations in one-time studies [4]. A panel study is a survey study in which the same variables are measured multiple times with the same subjects. Causal relationships can be estimated by analyzing data obtained through this method. There have not been many panel studies so far; therefore, we conducted a panel study in order to examine the effect of video games on aggressive behavior in real life.

So far, the amount of time spent on using video games and games of specific genres were used as independent variables in panel studies[8, 6]. In addition to these variables, in this study, we measured the amount of time that the participants were exposed to violent scenes as well as their preference for violent games. Although the amount of video game use changes with the situations that the participants are in, preference usually stays the same; therefore preference has the advantage that it remains stable in terms of time.

We also studied not only aggressive behavior but also pro-social behavior as dependent variables. A negative relationship between violent video games and pro-social behavior has been reported [1]. One of the examples in which aggressive behavior and pro-social behavior were used as dependent variables in a study is the study by Wiegman & van Schie (1998) [10]. They used the amount of use and preference for violent games as video game variables, and examined correlations between the video game variables and dependent variables. As a result, they suggested that there was a significant negative correlation between the amount of video game use and pro-social behavior, and that boys exhibiting strong preference for violent games were likely to show aggressive behavior and unlikely to show pro-social behavior compared to those exhibiting weak preference for violent games. In this study,

**Situated Play, Proceedings of DiGRA 2007 Conference**

we conducted a panel study to examine if playing violent video games would cause an increase in aggressive behavior and a decrease in pro-social behavior.

## METHOD

### Participants

The participants of this study were fifth graders of randomly-sampled Japanese elementary schools. A total of eight public elementary schools were randomly selected; four from large cities and four from regions. 900 students participated in the first survey, and 903 students participated in the second survey. After excluding incomplete responses, data obtained from 780 students (male: 384, female: 396) who participated in the second survey was analyzed.

### Survey periods

The survey was conducted twice; the first one was conducted from November to December in 2001, and the second one was conducted from February to March in 2002.

### Content of the survey

*Measurement of the amount of video game use*

We measured how many days in a week the participants played video games within the most recent month in units of days. The subjects' answer was "0" if they did not play at all and "3" if they played on three days, for example. In a similar manner, we measured how many hours in a day the participants spent playing video games within the most recent month on a weekday (school day) and weekend (non-school day) in units of hours. The participants' answer as "0" if they did not play at all, "0.5" if they spent 30 minutes playing video games, and "2" if they spent two hours playing video games, for instance.

*Measurement of esposure to scenes*

For the recent month, the participants were asked if they saw the scenes frequently shown in video games in their daily life, and they answered by using the five-point scale ranging from 1 (I did not see them at all) to 5 (I see them quite often). The scenes here included three types of scenes: violent scenes (five items, example: scenes in which characters verbally abuse others, scenes in which characters shoot guns or cut with swords, and scenes of robot or airplane combats); pro-social scenes (two items, example: scenes in which characters help troubled persons); and sexual scenes (one item: scenes in which characters kiss or male and female characters hold each other).

*Measurement of preferred game genres*

For genres of video games that the participants liked, they first chose the one that they liked the most from violent games (two items: games to beat the opponents and games to advance a story while fighting the opponents) and non-violent games (four items: sports or racing games, games in which very realistic events can be experienced, puzzle games and music games), and then one from among the three genres that they liked in general other than the one that was selected above.

*Measurement of aggressive and pro-social behavior*

We developed a five point scale ranging from 1 (None) to 5 (Very frequently) to measure the frequency of aggressive behavior and pro-social behavior for the last month. For example, an item such as "I punched or kicked others" was included as aggressive behavior, and "I was kind to other people" was included as pro-social behavior.

*Measurement of social desirabilityr*

In order to examine validity of the answers provided for the questions above, we measured the tendency to provide socially desirable answers by using the Social Desirability Scale for Children (SDSC) developed by Sakurai (1984) [9] consisting of the two point scale of 1 (Yes) and 2 (No). Social desirability was measured only at the first survey.

*Other variables*

As demographic factors, the participants provided information on their sex, age, grade, class, and student number.

## RESULT

### Mean value for each variable

*Amount of video game use*

We obtained the mean values for the number of days in a week that the participants were exposed to video games during the past month, and the number of hours that they were exposed to video games on a weekday or weekend (Table 1). boys used video games more than four days a week, and girls used video games more than two days a week. Also, boys spent more than one hour playing video games on a weekday while girls spent less than an hour, and boys spent more than two hours playing video games on a weekend while girls spent more than one hour. Therefore, boys used video games significantly more than girls in terms of the number of days in a week as well as the number of hours on a weekday and weekend. This result was the same in both the first and the second surveys.

*Scenes that the participants were exposed to*

We obtained the mean values for how often the participants viewed violent scenes, pro-social scenes, and sexual scenes during the past month (Table 2). For violent scenes, boys were exposed to them significantly more than girls in both the first and the second survey. For pro-social scenes, there was no significant difference between boys and girls. For sexual scenes, however, girls were exposed to them significantly more than boys in the second survey.

*Preferred game genres*

For genres of video games that the participants liked, they first chose the one that they liked the most from violent games (two items: games to beat the opponents and games to advance the story while fighting the opponents) and non

violent games (four items: sports or racing games, games in which very realistic events can be experienced, puzzle games and music games), and then one from among the three genres that they liked in general other than the one that was selected above. The result is shown in Table 3.

At the first survey, the participants chose "games to beat the opponents (violent game)," "sports or racing games (non-violent game)," and "games to advance the story while fighting the opponents (violent game)" in this order as video game genres that they liked in general. As for the game genre that they liked the most, "games to beat the opponents (violent game)" was most frequently chosen. At the second survey, too, the participants chose "games to beat the opponents (violent game)," "puzzle games (non-violent games)," "games to advance the story while fighting the opponents (violent game)," and "sports or racing games (non-violent game)" in this order as video game genres that they liked in general. As for the game genre that they liked the most, at the second survey, too, "games to beat the opponents (violent game)" was most frequently chosen. Thus, at both the first and second surveys, the participants chose "games to beat the opponents (violent game)" quite often as the game genre that they liked in general as well as the game genre that they liked the most. This suggested that many of the games that elementary school students liked contained violence.

We then converted "like in general" into 1 point and "like the most" into 2 points to obtain the level of preference for violent games (two items: games to beat the opponents and games to advance the story while fighting the opponents) and non-violent games (four items: sports or racing games, games in which very realistic events can be experienced, puzzle games and music games) (Table 4). The result confirmed that, at both the first and second surveys, boys liked violent games significantly more than girls, and that girls liked non-violent games significantly more than boys.

*Aggressive and pro-social behavior*

We obtained the mean values for the aggressive behavior scores and pro-social behavior scores (Table 5). Since the questionnaire was developed for this study, we first obtained the reliability coefficient α and conducted the principal component analysis. The α coefficient was .7 or higher for all cases, indicating that reliability was sufficient. Also, the principal component analysis resulted in .4 or higher loading on each item and a 1 or lower eigenvalue for the secondary component or lower; therefore, we concluded that the questionnaire basically consisted of one component. Although no significant sex difference was found in terms of aggressive behavior, the score was significantly higher for girls than for boys in terms of pro-social behavior. This result was the same in both the first and the second surveys.

**Table 1** Amount of video game use

| | | First | | | | Second | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | **all** | **boys** | **girls** | ***t*-value** | **all** | **boys** | **girls** | ***t*-value** |
| **Use per week** | ***M*** | **3.39** | **4.36** | **2.25** | **13.54**** | **3.51** | **4.42** | **2.43** | **12.69**** |
| | ***SD*** | (2.28) | (2.18) | (1.83) | | (2.21) | (2.06) | (1.88) | |
| **Use per day"weekday"** | ***M*** | **1.18** | **1.59** | **.68** | **7.48**** | **1.36** | **1.67** | **.98** | **3.49**** |
| | ***SD*** | (1.71) | (2.01) | (1.09) | | (2.49) | (2.23) | (2.73) | |
| **Use per day"weekend"** | ***M*** | **2.15** | **2.76** | **1.43** | **8.09**** | **2.29** | **2.76** | **1.72** | **4.64**** |
| | ***SD*** | (2.27) | (2.41) | (1.86) | | (2.84) | (2.34) | (3.26) | |

**$p<.01$

**Table 2** Scenes that the participants were exposed to

| | | First | | | | Second | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | **all** | **boys** | **girls** | ***t*-value** | **all** | **boys** | **girls** | ***t*-value** |
| **violent scenes** | ***M*** | **2.58** | **3.01** | **2.07** | **10.83**$^{**}$ | **2.56** | **2.90** | **2.15** | **8.56**$^{**}$ |
| | ***SD*** | (1.17) | (1.13) | (1.01) | | (1.18) | (1.18) | (1.04) | |
| **pro-social scenes** | ***M*** | **2.01** | **2.04** | **1.98** | **.74** | **2.01** | **2.00** | **2.03** | **-.45** |
| | ***SD*** | (1.03) | (1.03) | (1.04) | | (1.06) | (1.05) | (1.07) | |
| **sexual scenes** | ***M*** | **1.36** | **1.37** | **1.35** | **.29** | **1.32** | **1.25** | **1.40** | **-2.41**$^{*}$ |
| | ***SD*** | (.87) | (.90) | (.85) | | (.78) | (.70) | (.87) | |

$^{*}p<.05$, $^{**}p<.01$

**Table 3** Preferred game genres

| | First | | | | Second | | | |
|---|---|---|---|---|---|---|---|---|
| | **like** | | **best** | | **like** | | **best** | |
| | **freq** | **%** | **freq** | **%** | **freq** | **%** | **freq** | **%** |
| **games to beat the opponents** | **321** | **44.09** | **184** | **25.27** | **346** | **47.59** | **195** | **26.82** |
| **games to advance a story while fighting the opponents** | 298 | 40.93 | 182 | 25.00 | 298 | 40.99 | 188 | 25.86 |
| **sports or racing games** | 307 | 42.17 | 53 | 7.28 | 293 | 40.30 | 59 | 8.12 |
| **games in which very realistic events can be experienced** | 153 | 21.02 | 6 | .82 | 155 | 21.32 | 16 | 2.20 |
| **puzzle games** | 289 | 39.70 | 76 | 10.44 | 314 | 43.19 | 68 | 9.35 |
| **music games** | 206 | 28.30 | 95 | 13.05 | 212 | 29.16 | 104 | 14.31 |

※no answer…52

**Table 4** The level of preference for violent games and non-violent games

| | | First | | | | Second | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | **all** | **boys** | **girls** | ***t*-value** | **all** | **boys** | **girls** | ***t*-value** |
| **violent games** | ***M*** | 1.86 | 2.30 | 1.39 | 11.96$^{**}$ | 1.94 | 2.37 | 1.50 | 11.71$^{**}$ |
| | ***SD*** | (1.12) | (.95) | (1.09) | | (1.09) | (.89) | (1.10) | |
| **non-violent games** | ***M*** | 1.94 | 1.58 | 2.32 | -7.55$^{**}$ | 2.02 | 1.59 | 2.46 | -9.35$^{**}$ |
| | ***SD*** | (1.38) | (1.26) | (1.39) | | (1.33) | (.1.27) | (1.26) | |

$^{**}p<.01$

**Table 5** Aggressive behavior and pro-social behavior and social desirability

| | | First | | | | Second | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | **all** | **boys** | **girls** | ***t*-value** | **all** | **boys** | **girls** | ***t*-value** |
| **aggressive behavior** | ***M*** | **2.74** | **2.74** | **2.75** | **-.27** | **2.71** | **2.70** | **2.72** | **-.20** |
| | ***SD*** | (.90) | (.92) | (.88) | | (.92) | (.96) | (.88) | |
| **pro-social behavior** | ***M*** | **2.92** | **2.81** | **3.02** | **-3.39**** | **2.89** | **2.78** | **2.99** | **-3.44**** |
| | ***SD*** | (.83) | (.90) | (.74) | | (.86) | (.91) | (.78) | |
| **social desirability** | ***M*** | **1.55** | **1.55** | **1.56** | **-.66** | — | — | — | — |
| | ***SD*** | (.24) | (.24) | (.24) | | — | — | — | |

**$p$<.01

**Examination of causal relationships**

In this study, we conducted two surveys with certain time intervals (two to four months) and measured the video game variables and dependent variables at each survey. In general, events that occur later do not cause the events that occur before. Therefore, if there is a strong correlation between the video game variable measured at the first survey and the dependent variables measured at the second survey, the possibility of the video game variables measured at the first survey influencing the dependent variables measured at the second survey would be considered instead of the other way around.

Structural equation model analysis (cross-lagged effect model analysis) was used to estimate causal relationships. In the analysis, sex of the participants was controlled. At the same time, social desirability was controlled since it had a strong correlation with dependent variables.

The finalized cross-lagged effect model is as shown in Figure 1. Two variables, sex and social desirability, were incorporated in the model such that they could be controlled. As a result of having these two variables incorporated in the model, the video game variables measured at the first survey and aggressive behavior as well as pro-social behavior measured at the first survey became endogenous variables; therefore, errors $e_1$ and $e_2$, and their covariance ($\sigma_1$) were set. The errors for the video game variables measured at the second survey was $e_3$, and the errors for aggressive behavior as well as pro-social behavior measured at the second survey was $e_4$, and their covariance was $\sigma_2$. We applied each of the video game variables, and aggressive behavior and pro-social behavior scores one by one to this model to carry out the analysis.

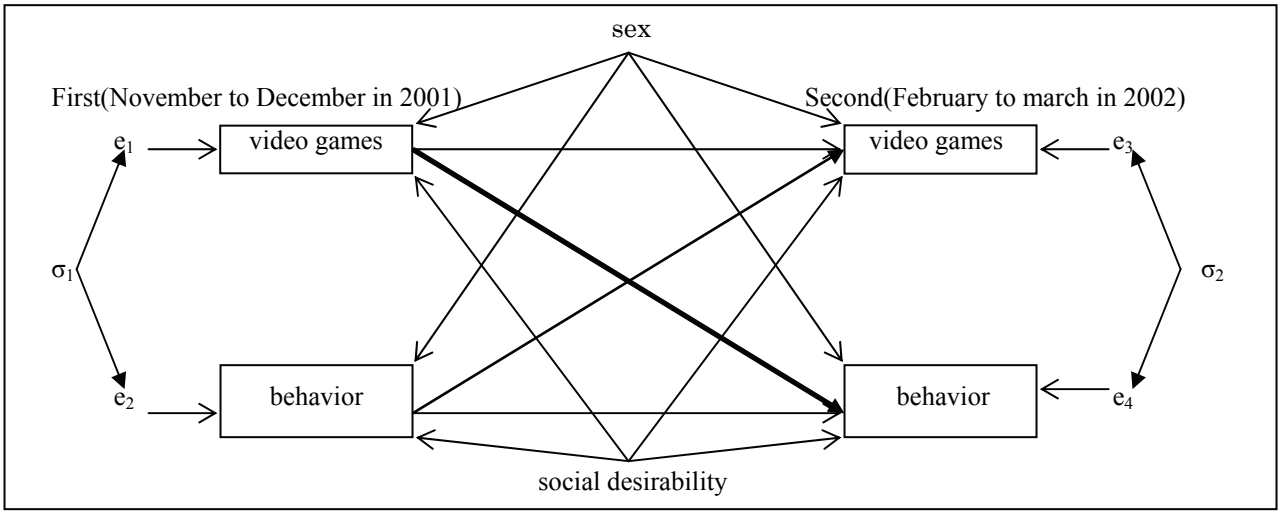


**Figure 1:** The analysis model of this study

In this study, we compared four models that were derived from the model shown in Figure 1, chose the one that appeared to be the most appropriate, and obtained the final result. Model 1 makes estimations with unfixed $\sigma_1$ and $\sigma_2$. It is the saturation model having the least restrictions. Model 2 makes estimations with unfixed $\sigma_1$ and $\sigma_2$ being

fixed to 0. Model 3, on the other hand, makes estimations with unfixed $\sigma_2$ and $\sigma_1$ being fixed to 0. Model 4 makes estimations with both covariance values fixed to 0. This model has the highest stability of all. If a comparison of these four models in terms of their $\chi^2$ values resulted in no significant differences, a model with more restrictions was selected.

This section examines the path from the video game variables measured at the first survey to aggressive behavior as well as pro-social behavior measured at the second survey. Positive effects mean that higher video game variables lead to an increase in aggressive behavior or pro-social behavior, and negative effects mean that higher video game variables lead to a decrease in aggressive behavior or pro-social behavior.

*Effects of the amount of video game use on behavior (Table 6)*

When the paths from the amount of video game use on a weekday to dependent variables were examined, no significant effects were found for all participants or for girls. For boys, however, there was a significant negative effect on pro-social behavior. This suggested that a larger amount of video game use on a weekday would decrease pro-social behavior.

Meanwhile, when the paths from the amount of video game use on a week and a weekend to dependent variables were examined, no significant effects were found.

*Effects on behavior of exposure to scenes (Table 7)*

When the paths from exposure to pro-social scenes to dependent variables were examined, there was a significant positive effect on pro-social behavior for all participants and boys. This suggested that more exposure to pro-social scenes would increase pro-social behavior for all participants and boys.

Meanwhile, when the paths from exposure to violent scenes and sexual scenes to dependent variables were examined, no significant effects were found.

*Effects of preference for game genres on behavior (Table 8)*

When the paths from preference for violent games to dependent variables were examined, there was a significant negative effect on pro-social behavior for all participants and boys while no significant effects were found for girls. This suggested that stronger preference for violent games would lead to a decrease in pro-social behavior for all participants and boys.

When the paths from preference for non-violent games to dependent variables were examined, there was a significant positive effect on pro-social behavior for all participants and boys. No significant effects were found for girls. This suggested that stronger preference for non-violent games would lead to an increase in pro-social behavior for all participants and boys.

**Table 6** Effect of video game use on behavior

| | aggressive behavior | | | | | | pro-social behavior | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **all** | | **boys** | | **girls** | | **all** | | **boys** | | **girls** | |
| **weekdays** | -.01 | (4) | -.02 | (4) | .02 | (4) | -.07 | (4) | -.10* | (4) | .03 | (4) |
| **weekends** | -.01 | (3) | -.00 | (4) | -.01 | (3) | .01 | (2) | -.05 | (4) | .09 | (2) |
| **week** | .01 | (3) | .01 | (3) | .00 | (4) | .04 | (2) | .02 | (4) | .05 | (2) |

*$p < .05$

**Table 7** Effect on behavior of exposure to scenes

| | aggressive behavior | | | | | | pro-social behavior | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **all** | | **boys** | | **girls** | | **all** | | **boys** | | **girls** | |
| **violent scenes** | .06 | (1) | .03 | (1) | .10 | (1) | .01 | (2) | .04 | (4) | .00 | (4) |
| **pro-social scenes** | .04 | (1) | .02 | (3) | .08 | (2) | .10** | (2) | .11* | (2) | .09 | (1) |
| **sexual scenes** | -.02 | (1) | -.02 | (4) | -.02 | (1) | .01 | (2) | -.02 | (4) | .05 | (2) |

*$p < .05$

**Table 8** Effect of preference for game genres on behavior

| | aggressive behavior | | | | | | pro-social behavior | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **all** | | **boys** | | **girls** | | **all** | | **boys** | | **girls** | |
| **violent games** | .02 | (4) | -.01 | (4) | .04 | (4) | -.08* | (2) | -.16** | (4) | .02 | (2) |
| **non-violent games** | .03 | (4) | -.01 | (4) | .08 | (4) | .07* | (2) | .10* | (2) | .03 | (2) |

*$p$< .05, **$p$<.01

## DISCUSSION

In this study, we examined whether or not video games had adverse effects on children's aggressive and pro-social behavior by measuring the amount of exposure to specific scenes of video games and preference for games as video game variables in addition to the total amount of video game use which was conventionally measured.

The result was that we did not find any adverse effects of video games in which they heightened the level of aggressive behavior, but the study suggested that there were adverse effects in which pro-social behavior decreased.

The findings regarding aggressive behavior did not agree with the findings of the previous studies that "use of video games would heighten the level of aggression" and "video games with violent contents would heighten the level of aggression." This may be attributed to the following two factors. First, developers of video games now impose self-restrictions. In the video game industry, CESA (Computer Entertainment Software Association) establishes the ethics codes. Claiming that they will be "careful not to block the growth of good sentiments and sound mentality of young people," CESA stipulates that video games must not depict cruelty, crimes such as murders and violence, and the methods of such crimes unless necessary when showing anti-social behavior, violence, and crimes. Also, CESA recently suggested the necessity of age ratings in addition to self-restrictions imposed by CESA, and as a result, CERO (Computer Entertainment Rating Organization) for examining the contents and expression used in game software and also for categorizing it into appropriate player age ranges was established and is now active in the industry. Therefore, this study may have failed to identify the same adverse effects on aggressive behavior as identified by the previous studies due to the effects of the social considerations described above.

Also, we divided scenes participants were exposed to into three categories and examined the effect of each of them, but this categorization itself may have had problems. For example, we divided violent scenes into as detailed ones as possible such as into verbal violence, fist fights, and violence using weapons or fighter planes, but the meaning of violence may have changed with the context in which the violence was used. Therefore, some of the violent scenes may not have effects that were strong enough to influence aggressive behavior.

Furthermore, we found adverse effects as well as favorable effects on pro-social behavior in this study. As for adverse effects, the study suggested that pro-social behavior was suppressed as boys used video games more on a weekday and also when they strongly preferred violent games. Pro-social behavior was a measurement of frequency of doing something socially desirable, and if such behavior was suppressed by playing video games or liking violent games, then it could be concluded that video games had adverse effects on children. This agrees with the result of the study by Wiegman & van Schie (1998) [10].

As for positive effects, we found that pro-social behavior was promoted when boys were exposed to pro-social scenes frequently and also when they showed strong preference for non-violent games. While there was no effect of exposure to violent scenes on violent behavior, exposure to pro-social scenes had effects on pro-social behavior. Note, however, that the study result indicated that children who exhibited pro-social behavior frequently were exposed to pro-social scenes more; therefore, the study suggested that exposure to pro-social scenes and pro-social behavior had circulative effects.

In this study, we attempted to understand the effect of video games by improving variables that were used in conventional video game studies and also by carrying out a panel study that would facilitate understanding of causal relationships. As a result, we did not find any effects of video games on aggressive behavior, but the study did indicate the adverse effect of video games in which pro-social behavior would be suppressed. This means that, although adverse effects of video games that were discussed focused on aggression, we believe that pro-social behavior and other variables must be considered as important as aggression. This study also indicated the favorable effect of video games in which exposure to pro-social scenes would promote pro-social behavior. By effectively using this favorable effect, it may be possible to develop educational video games in the future.

This study however has a few problems. The first problem is the measurement of scenes. As described earlier, scene categorization may need creative improvements. The second problem is the relationship between participants and survey period. We conducted the study with elementary

school students, but it is quite possible that the participants of different ages are influenced differently by video games, and it is thus necessary to conduct studies with participants of different ages. As for the survey period, we conducted two surveys with time intervals of two to four months, but it is necessary in the future to change the number of surveys to be administered by changing time intervals or increasing the number of surveys. By conducting studies under different conditions, it is necessary to examine what kind of effects will be indicated by these studies.

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