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Long-Term Relations between Prosocial Media Use, Empathy and Prosocial Behavior

Sara Prot, Douglas A. Gentile, Craig A. Anderson

Iowa State University, USA

Kanae Suzuki

University of Tsukuba, Japan

Edward Swing

Iowa State University, USA

Kam Ming Lim

National Institute of Education, Singapore

Yukiko Horiuchi

Ochanomizu University, Japan

Margareta Jelic

University of Zagreb, Croatia

Barbara Krahe

University of Potsdam, Germany

Wei Liuqing

Beijing Normal University, China

Albert Liau, Angeline Khoo

National Institute of Education, Singapore

Poesis Diana Petrescu

West University Of Timisoara, Romania

Akira Sakamoto

Ochanomizu University, Japan

Sachi Tajima

Kantogakuen University, Japan

Roxana Andreea Toma

West University Of Timisoara, Romania

Wayne Warburton

Macquarie University, Australia

Xuemin Zhang

Beijing Normal University, China

Ben Chun Pan Lam

Iowa State University, USA

Author Note

Correspondence concerning this article should be addressed to:

Sara Prot, Department of Psychology, Iowa State University

W112 Lagomarcino Hall, Ames, IA 50011-3180

Email: sprot@iastate.edu

Abstract

Despite recent growth of research on prosocial media effects (e.g., Greitemeyer, 2011a & b), processes underlying these effects are not well understood. Two studies explored theoretically relevant mediators and moderators of prosocial media effects on helping. Study 1 examined associations among prosocial and violent media use, empathy, and helping with participants from 7 countries. Prosocial media use was positively associated with helping. This effect was mediated by empathy and was similar across cultures. Study 2 explored longitudinal relations among prosocial video game use, violent video game use, empathy, and helping in a large sample of Singaporean children and adolescents measured three times across two years. Path analyses yielded significant longitudinal effects of prosocial and violent video game use on prosocial behavior through empathy. Latent growth curve modeling revealed significant mediated effects of change in video game use on change in helping through change in empathy over the two-year period.

Keywords: mass media, cross cultural differences, social behavior, prosocial media, violent media, prosocial behavior, empathy, helping, General Learning Model

Long-Term Relations between Prosocial Media Use, Empathy and Prosocial Behavior

Recent years have witnessed increasing interest in positive effects of prosocial media. A growing research literature demonstrates that prosocial media can foster prosocial interactions. Significant effects of prosocial media on helping have been demonstrated for a variety of media, including television shows (Mares & Woodard, 2005), video games (Saleem, Anderson, & Gentile, 2012a) and music lyrics (Greitemeyer, 2009).¹ For example, Gentile, Anderson, Yukawa, et al. (2009) found adolescents' prosocial video game use to be related to more frequent helping, cooperation and sharing, in cross-sectional, longitudinal, and experimental studies. Other studies have shown significant associations between watching prosocial television programs and prosocial acts in real life (e.g. Rosenkoetter, 1999; Sprafkin & Rubinstein, 1979).

Experimental studies demonstrate short-term causal effects of prosocial media. For example, Greitemeyer and Osswald (2010) showed that playing prosocial video games made participants more likely to help researchers pick up fallen pencils, agree to participate in further experiments and come to the aid of a female experimenter who was being harassed by an ex-boyfriend.

Longitudinal studies suggest that habitual use of prosocial media can cause long-term increases in prosocial behavior. Gentile et al. (2009) found that prosocial video game play predicted increases in prosocial behavior over a period of 3 to 4 months. D. Anderson et al. (2000) found that children who watched the television show *Blue's Clues* showed significantly greater increases in prosocial behaviors than nonviewers. Together, correlational, experimental, and longitudinal studies in this area provide evidence of prosocial media effects on prosocial behavior.

These effects can be understood within the framework of the General Learning Model, an extension of the General Aggression Model (Anderson & Bushman, 2002; Barlett & Anderson, in press; Buckley & Anderson, 2006; Gentile, Groves, & Gentile, in press; Maier & Gentile, 2012). The GLM is a metatheoretical framework that integrates key ideas from several more specific models, including Social Learning Theory and Social Cognitive Theory (Bandura, 1973; 1983), script theory (Huesmann, 1986; 1998), cognitive-neoassociation theory (Berkowitz, 1984), cultivation theory (Comstock & Scharrer, 2007), desensitization theory (Carnagey, Anderson, & Bushman, 2007), and social information processing theory (Crick & Dodge, 1994). It provides a general framework for understanding how long-term beliefs, attitudes and affective traits are developed from various life experiences. People learn from environmental interactions, including from the media, and they do so through several learning mechanisms. Media content determines much of what is learned. Violent media are likely to increase the probability of aggressive behavior and decrease the probability of prosocial behavior because of changes in attitudes, beliefs, affect and scripts. Prosocial media are expected to decrease the likelihood of aggression and increase the likelihood of prosocial behavior. In short-term contexts, prosocial media are thought to affect behavior by priming prosocial cognitions (including scripts) and increasing positive affect (Saleem, Anderson, & Gentile, 2012a; 2012b). In long-term contexts, prosocial media are posited to affect behavior through long-term changes in beliefs, attitudes, behavioral scripts and affective traits.

Although prosocial media effects have been demonstrated, processes underlying these effects are less extensively researched and less understood than processes underlying violent media effects (e.g. Anderson et al., 2003). At present, there is empirical support for short-term predictions of the GLM concerning prosocial media effects; several experimental studies

demonstrate short-term effects of prosocial media on helping using diverse samples, manipulations and measures (Barlett & Anderson, in press). However, no studies have examined long-term mediators of prosocial media effects on helping. Empirical evidence is also lacking concerning potential moderators of these relationships. Whereas several studies indicate that age, culture and parental involvement in media habits may significantly moderate media violence effects (e.g. Anderson et al., 2003; Anderson, Gentile, & Buckley, 2007), no comparable data are available for prosocial media effects.

To address these gaps, we conducted two studies on potential mediators and moderators of prosocial media effects on helping. Study 1 examined relations among prosocial media use, empathy and helping with participants from seven countries. We hypothesized that prosocial media use would be associated with more frequent helping (defined here as voluntary behavior intended to benefit another) and that this effect would be at least partially mediated by empathy (the tendency to be aware of and react to the mental and emotional states of other people; Davis, 1983). Given past findings of prosocial media effects on empathy and prosocial behavior in short-term contexts (e.g. Greitemeyer, 2009; Greitemeyer, Osswald, & Brauer, 2010), we focused on empathy as a potential key mediator of habitual prosocial media use on prosocial behavior in the long-term. Study 1 also explored culture, age and sex as potential moderators. Based on the General Learning Model, we expected prosocial media effects on empathy and prosocial behavior to generalize across gender, age and culture.

Study 2 examined relations among prosocial and violent media use, empathy and helping with a longitudinal sample of 3,034 children and adolescents measured three times over a period of 2 years. The longitudinal design allows for stronger tests of our causal mediation model. We

hypothesized that prosocial media use would predict increases in trait empathy and prosocial behavior over time.

STUDY 1

Method

Participants

A cross-sectional correlational study explored relations among prosocial media use, empathy and prosocial behavior across cultures. Samples were obtained in seven countries: Australia (426 participants), China (203 participants), Croatia (438 participants), Germany (200 participants), Japan (395 participants), Romania (233 participants) and the U.S. (307 participants). The total sample of 2,202 adolescents and young adults was 40% male with a mean age of 21 years, $SD = 5.6$.

Measures

Media use was measured using a version of the General Media Habits Questionnaire (Anderson & Dill, 2000; Gentile et al., 2004). Participants listed their three favorite television shows, movies and video games and rated: (1) frequency of use for each title (9 items rated on a 5-point scale from “Watched/played once a month or less” to “Watched/played 5 or more times a week”), (2) the amount of prosocial content present in each title (9 items, example item “How often do characters help each other?” rated on a 7-point scale from “Never” to “All the time”), and (3) the amount of violent content present in each title (9 items, example item “How often do characters try to physically injure each other?” rated on a 7-point scale “Never” to “All the time”). Each favorite media title was named and rated separately. Such self-ratings of media content have been shown to correlate highly with and yield validities similar to expert ratings (Gentile et al., 2009; Busching, Gentile, Krahé, et al., in press).

Empathy was measured by the empathic concern and perspective taking subscales from the Interpersonal Reactivity Index (Davis, 1980, 1983; 14 items). The IRI measures empathy as a stable personality characteristic. An example item is “Before criticizing somebody, I try to imagine how I would feel if I were in their place”. Items were rated on a scale from 1 (“Does not describe me well”) to 5 (“Describes me very well”).

Prosocial behavior was measured using the Brief Prosocial Scale (adapted from Cheung, Ma, & Shek, 1998; 10 items). An example item is “I try to be helpful to people even if I don’t expect to see them ever again”. Items were rated on a scale from 1 (“Extremely uncharacteristic of me”) to 5 (“Extremely characteristic of me”).

Also assessed were total screen time, sex, age, race, GPA, SES, and parental education. Participants responded to the questionnaire either online or in face-to-face interviews by trained research assistants, based on methods appropriate to each country.

Results and Discussion

Preliminary Analyses

To calculate total prosocial media exposure, prosocial content ratings for each favorite television show, movie and video game were multiplied by the corresponding amount of time spent watching or playing and then averaged across these 9 products. Violent media exposure was calculated similarly. Total screen time was computed by summing participants' ratings of time spent watching television shows, movies and playing video games. Descriptive statistics are shown in Table 1. Correlations between main variables are shown in Section 1 of the supplemental materials. Based on geographical location and scores on the cultural dimension of individualism-collectivism (Hofstede, 1980, 2001), nations were divided into three cultural

groups: individualistic Western countries (Australia, Germany and the U.S.), collectivistic East European countries (Croatia, Romania) and collectivistic East Asian countries (China, Japan).

Multigroup confirmatory factor analyses were conducted with Mplus 6.1 to test the measurement equivalence of empathy and prosocial behavior across cultural groups. Missing data were treated using Full Information Maximum Likelihood estimation. Because of the large sample size, differences in Comparative Fit Index were used to test invariance instead of nested Chi square tests (Cheung & Rensvold, 2002). Differences in the CFI of an absolute value less than .01 suggest invariance. A measurement model of empathy and prosocial behavior across culture without parameter constraints showed adequate model fit ($\chi^2 = 121.74$, $df = 32$, $p < .01$; TLI = .98; CFI = .98; RMSEA = .06, 90% CI = .05 – .08). Based on the results of cross-group equality-constrained models (shown in Section 2 of the supplemental materials), metric equivalence was established for the measures of empathy and prosocial behavior across groups. In analyses, the forms and factor loadings of empathy and prosocial behavior were constrained to be equal across culture.

Main Results

A structural model of media use, empathy and prosocial behavior was examined (Figure 1). Within each group, prosocial media consumption was linked to higher levels of prosocial behavior; this association was fully mediated by empathy. Constraining the indirect effects of prosocial media use on prosocial behavior through empathy to be equal across groups resulted in a significantly poorer model fit ($\Delta CFI = .03$). Paired comparisons showed significant differences between all three groups ($\Delta CFI > .01$ for all three paired comparisons). Thus, differences exist in prosocial media effects between cultural groups. Nonetheless, the indirect effects of prosocial media use on prosocial behavior through empathy were of similar magnitudes in all three groups

(standardized indirect effect of 0.38 Western countries, 0.21 for East European countries and 0.28 for East Asian countries, all p s < 0.01). These results suggest considerable cross-cultural generalization of the links between prosocial media use, empathy, and prosocial behavior.

To examine sex as a potential moderator, three series of multigroup models were run comparing results for men and women within each culture group. As in the previous model, prosocial media use was entered as a predictor of helping, with empathy as a mediator, and with total screen time, violent media use, and age statistically controlled. Good model fit was obtained for an unrestricted multigroup model (Western sample: $\chi^2 = 146.06$, $df = 60$, $p < .01$; TLI = .96; CFI = .97; RMSEA = .06, 90% CI = .04 – .08; East European sample: $\chi^2 = 107.58$, $df = 60$, $p < .01$; TLI = .96; CFI = .97; RMSEA = .05, 90% CI = .03 – .06; East Asian sample: $\chi^2 = 98.04$, $df = 60$, $p < .01$; TLI = .95; CFI = .96; RMSEA = .05, 90% CI = .03 – .06). Constraining path coefficients from prosocial media use to empathy and from empathy to prosocial behavior to be equal across sex did not result in a significant reduction in model fit (Western sample: $\Delta CFI = .00$; East European sample: $\Delta CFI = .00$; East Asian sample: $\Delta CFI = .00$). Thus, prosocial media effects were similar for men and women.

To examine age as a moderator, interaction terms were added to the model between age and prosocial media use as well as age and violent media use. No significant interactive effects of age and media habits on empathy or helping were found (all p s > .05).

Discussion

Study 1 results are consistent with a causal theoretical model linking prosocial media use to helping behavior through changes in empathy, but of course the cross-sectional nature of these data precludes strong causal conclusions. Therefore, we conducted a 2-year 3-wave longitudinal study to provide a more thorough test.

STUDY 2

Method

Participants

The initial sample consisted of 3,034 children and adolescents from six primary and six secondary schools in Singapore (73% male, average age 11.2 years, $SD = 2.1$). Data were collected annually. Samples of 3,034, 2,360 and 2,232 participants were collected in wave 1, wave 2 and wave 3, respectively. Questionnaires were administered in class by teachers who received detailed instructions from research personnel. The response rate was 99% at wave 1, 87.5% at wave 2 and 85% at wave 3.

Measures

For practical reasons, we assessed only video game habits. At each wave, participants listed their three favorite video games and indicated how often they play each game (2 items, one for school days, one for weekends): “On a usual school day (Monday through Friday) (weekend/Saturday and Sunday), how many hours do you play this game?” using 16 time choices ranging from “None” to “More than 10 hours”). Participants also indicated how frequently each of their listed games contains violent or prosocial themes (4 items, example violent item “How often do you shoot or kill creatures in this game?”; example prosocial item “How often do you help others in this game?” Each item was rated on a 4-point scale from “Never” to “Almost always”). Children who reported playing no videogames received a score of 0 for both prosocial and violent game exposure.

The Children’s Empathic Attitudes Questionnaire (Funk et al., 2008; 16 items) measured trait empathy. An example item is “I would feel bad if my mother’s friend got sick”. Items were rated on a 3-point scale (“No”, “Maybe” and “Yes”).

The helping and cooperation subscales of the Prosocial Orientation Questionnaire (POQ; Cheung, Ma & Shek, 1998; 18 items) measured helping. An example item is “I would spend time and money to help those in need” (rated on a scale from 1 “Strongly disagree” to 5 “Strongly agree”). Also assessed were sex, age, race, SES, school grades, and parental education.

Results and Discussion

Preliminary Analyses

Table 2 displays basic statistics for the main measures. At each wave, prosocial media use was positively related to empathy ($r_1 = .10$, $r_2 = .09$, $r_3 = .08$, all $ps < .01$) and to prosocial behavior ($r_1 = .09$, $r_2 = .08$, $r_3 = .06$, all $ps < .01$). Violent media use was negatively related to empathy ($r_1 = -.15$, $r_2 = -.14$, $r_3 = -.14$, all $ps < .01$) and to prosocial behavior ($r_1 = -.13$, $r_2 = -.13$, $r_3 = -.13$, all $ps < .01$). Correlations of the main variables are in supplemental materials Section 3.

Longitudinal Results

An autoregressive path model using Mplus 6.1 was run with prosocial and violent video game play at time 1 as predictors of prosocial behavior at time 3, with empathy at time 2 as a mediator (model shown in Figure 2). Missing data were treated using Full Information Maximum Likelihood estimation. Initial levels of prosocial behavior, empathy, total amount of video game time and sex were included as predictors. The model yielded a good fit ($\chi^2 = 9.05$, $df = 5$, $p > .05$; TLI = 0.98; CFI = .99; RMSEA = .02, 90% CI = .00 – .03). Prosocial video game use at time 1 had a significant positive indirect effect on prosocial behavior at time 3 through empathy at time 2. Violent game use at time 1 had the opposite effect on prosocial behavior at time 3, through its effect on empathy at time 2. Two alternative path models were tested to explore the possibility of reverse causal effects between prosocial behavior and media habits (see supplemental materials Section 4). No evidence was found of such effects. However, the indirect

effects of prosocial and violent video game use on later prosocial behavior through empathy remained significant. These longitudinal results strongly support our causal theoretical model.

To check for potential effects of sex as a moderator, a multigroup path model was conducted. Good model fit was obtained ($\chi^2 = 16.47$, $df = 10$, $p > .05$; TLI = 0.971; CFI = .99; RMSEA = .02, 90% CI = .00 – .04). For both boys and girls, prosocial media use predicted greater helping indirectly through its effect on empathy. Similarly, violent media use predicted less helping through its effect on empathy in both groups. Constraining path coefficients to be equal across sex did not result in a significant reduction in model fit ($\Delta CFI = .00$). Thus, the longitudinal media effects on helping were essentially equivalent for males and females.

To examine age as a moderator, age X media use interaction terms were added to the model. Interactive effects of age and media habits on empathy and prosocial behavior were not significant (all $ps > .05$).

Latent Growth Curve Results

Latent growth curve modeling further examined these relations over time (Figure 3). Latent growth curve modeling does not test causal relations, as did the autoregressive path models described above, but it can provide useful insights into relations of variables over time once a causal order has been established. Good model fit was obtained ($\chi^2 = 145.9$, $df = 46$, $p = < .01$; TLI = .98; CFI = .99; RMSEA = .03, 90% CI = .02–.03). Higher initial levels of prosocial video game use predicted higher initial levels of prosocial behavior (standardized indirect effect through the intercept of empathy equaling .33, $p < .01$). In contrast, the initial level of violent video game use predicted lower initial levels of prosocial behavior (standardized indirect effect through the intercept of empathy equaling -.61, $p < .01$). The rate of change in prosocial gaming had both a positive direct effect on change in helping (standardized effect of .66, $p < .01$) and an

indirect effect through change in empathy (standardized effect of .20, $p < 0.02$). In comparison, the rate of change in violent video gaming negatively predicted change in prosocial behavior through change in empathy (standardized effect of -.22, $p < .02$).

GENERAL DISCUSSION

Main Findings and Implications

Two main goals of the present research were to explore mediators and moderators of long-term prosocial media effects on prosocial behavior. Both studies demonstrated that prosocial media use is positively associated with prosocial behavior in real life. More importantly, both studies found empathy to be a key mediator of prosocial media effects. Longitudinal findings from Study 2 are especially noteworthy because they demonstrate simultaneous positive long-term effects of prosocial media and negative long-term effects of violent media on later prosocial behavior. Most important of all, both the prosocial and the violent media effects on prosocial behavior were mediated by changes in empathy, and were evident even after controlling for relevant covariates.

Another interesting finding from both studies was the effect of total time, independent of prosocial or violent content. In both studies, total media time was associated with less prosocial behavior, mediated through empathy. At first glance, the total media time effect on prosocial behavior might be seen as the simple result of more media time automatically means less time is available to help others. However, the fact that this effect was mediated by empathy suggests that some other process must be underlie this effect. Perhaps excessive entertainment media time leads to less socialization opportunities in which one can learn empathy for others.

On the whole, the present results complement past findings from short-term experimental studies (e.g. Greitemeyer & Osswald, 2009; 2010; Saleem, Anderson & Gentile, 2012a; 2012b)

and suggest that short-term effects of prosocial and violent media accumulate, bringing about lasting changes in behavioral patterns and personality traits. These findings support long-term predictions of the General Learning Model, the General Aggression Model, and other social-cognitive models of personality.

Our findings advance theory in several ways. Study 1 is the first to directly compare prosocial media effects on empathy and helping across cultures. It demonstrated yielded some intercultural differences, but also showed mostly similarities in prosocial media effects. It also is the first to demonstrate empirically that trait empathy appears to mediate long term effects of prosocial media on helping. Another major theoretical advance is the finding from Study 2 over a two year period, trait empathy was significantly affected by amount of time youths spent consuming prosocial and violent. These findings provides novel evidence that entertainment media can not only cause short-term changes in empathy in laboratory studies, but also can lead to stable changes in empathy as a personality trait.

Other findings of note concern potential moderators of prosocial media effects on prosocial behavior. In Study 1, prosocial media consumption was found to predict higher levels of prosocial behavior in samples from Western, East European and East Asian countries. Empathy was shown to significantly mediate this relationship in all three groups. Although multigroup modeling demonstrated significant differences in magnitude of prosocial media effects in Western, East European and East Asian countries, the direction of prosocial media links with helping was the same across groups. In short, the links between prosocial media use and prosocial behavior generalize across cultures. The cross-cultural differences that did appear may be the result of different regulations (e.g., social norms) and contexts (e.g., relationship with the target) of prosocial behaviors in individualistic and collectivistic cultures (Miller, Bersoff &

Harwood, 1990; Yamagishi & Yamagishi, 1994). This speculation suggests future research directions.

Potential effects of sex as a moderator were examined in both studies. In both, links between prosocial media use, empathy and helping were similar for males and females. Findings of robust media effects in different groups are consistent with findings from the media violence literature (e.g. Anderson et al., 2003, 2007). The cross-culture, cross-age, and cross-gender similarity of the media effects in the present studies further suggests that the mechanisms through which media affect behavior are fairly general.

Limitations

Both studies were based on self-reports, so these findings may have been influenced by self-report biases. In future studies, it may be useful to employ other measures of media use, empathy and prosocial behaviors (such as informant reports or observational measures, although it seems unlikely that other reporters would be better at reporting someone else's media use or empathy). It is possible that both social desirability and self-enhancement tendencies influence self-reports of prosocial behavior. However, past research supports the construct and predictive validity of the prosocial behavior scale used in these two studies (e.g. Cheung, Ma & Shek, 1998; Gentile et al., 2009). Furthermore, such measurement error would tend to weaken the observed relationship between prosocial media use and prosocial behavior.

The obtained effect sizes of prosocial media effects on trait empathy and helping found in both studies were small. However, effects of this magnitude are to be expected given the long-term stability of personality traits and the many factors that may influence them (Caspi, Roberts, & Shiner, 2005; Roberts, Walton, & Viechtbauer, 2006). The fact that a single environmental factor such as prosocial media consumption was found to predict significant changes in trait

empathy and prosocial behavioral tendencies over time is noteworthy. Furthermore, the positive associations among the multiple predictors may well have led to underestimations of the true effect sizes, a necessary but conservative statistical consequence of such data (Prot & Anderson, 2013).

Conclusion

This research provides evidence that prosocial media use can lead to long-term increases in trait empathy and helping. Furthermore, these relationships generalized across sex, age and culture. These findings underscore the fact that media are powerful teachers. Just as media violence exposure can lead to negative outcomes such as desensitization and increased aggression, using prosocial media can lead to positive changes such as increased empathy and helping. Coupled with the rapid increases in media use among youth in developed countries, our studies suggest that accumulation of media effects has the potential to significantly alter important interpersonal behaviors in both positive and negative ways. Knowledge of these long-term effects may help parents, policy makers, and other concerned citizens make decisions about what kind of society they want for the future and how to create it.

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Table 1

Means, standard deviations and reliabilities for the main scales of interest, Study 1.

Variable	Items	<i>Australia</i>	<i>China</i>	<i>Croatia</i>	<i>Germany</i>	<i>Japan</i>	<i>Romania</i>	<i>The U.S.</i>	<i>Mean</i>
		<i>M(SD)</i>	<i>M(SD)</i>	<i>M(SD)</i>	<i>M(SD)</i>	<i>M(SD)</i>	<i>M(SD)</i>	<i>M(SD)</i>	α
Prosocial media use	9	110.02(38.59)	91.07(42.36)	62.27(32.64)	61.29(29.35)	93.94(41.57)	66.57(28.55)	74.28(26.11)	0.82
Violent media use	9	82(41.6)	55.02(36)	52.07(32.2)	38.13(24.37)	58.8(31.7)	43.84(28.13)	70.4(44.55)	0.74
Total screen time	9	21.6(10.26)	18.56(7.35)	15.17(7.47)	13.32(5.97)	20.93(7.22)	16.74(6.67)	22.01(7.46)	0.78
Empathy	14	4.64(0.76)	3.69(0.55)	3.41(0.48)	3.77(0.46)	3.46(0.43)	3.42(0.59)	3.63(0.58)	0.76
Prosocial behavior	10	5.17(0.88)	5.09(0.73)	4.89(0.89)	5.33(0.7)	4.92(0.87)	4.88(0.97)	5.01(0.80)	0.78

Table 2

Means, standard deviations and reliabilities for the main scales of interest, Study 2.

	Items	<i>Time 1</i>		<i>Time 2</i>		<i>Time 3</i>	
		α	<i>M (SD)</i>	α	<i>M (SD)</i>	α	<i>M (SD)</i>
Prosocial video game use	6	0.85	1.34(0.87)	0.84	1.28(0.88)	0.85	1.35(0.89)
Violent video game use	6	0.75	1.39(0.91)	0.75	1.27(0.90)	0.76	1.15(0.91)
Total video game play time	6	0.88	3.53(2.84)	0.89	4.05(2.47)	0.89	3.88(2.42)
Empathy	16	0.86	2.32(0.40)	0.87	2.32(0.39)	0.89	2.33(0.39)
Prosocial behavior	18	0.84	3.05(0.45)	0.84	3.05(0.43)	0.84	3.05(0.41)

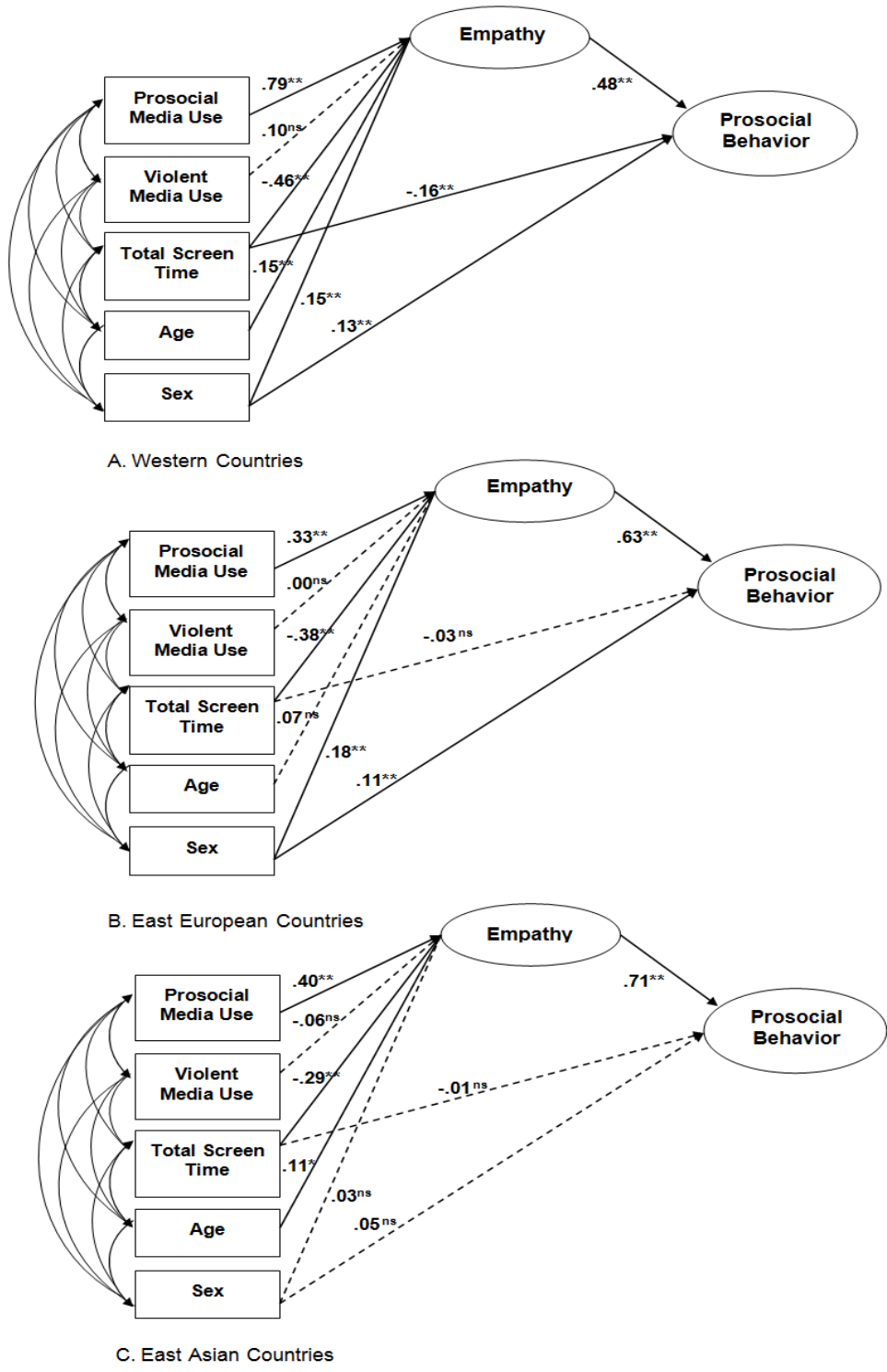


Figure 1. Multigroup structural equation model of prosocial media effects on prosocial behavior in Western, East European and East Asian countries ($\chi^2 = 187.13$, $df = 52$, $p < .01$; TLI = .96; CFI = .98; RMSEA = .05, 90% CI = .04 – .06). Standardized coefficients are shown; * $p < .02$, ** $p < .01$.

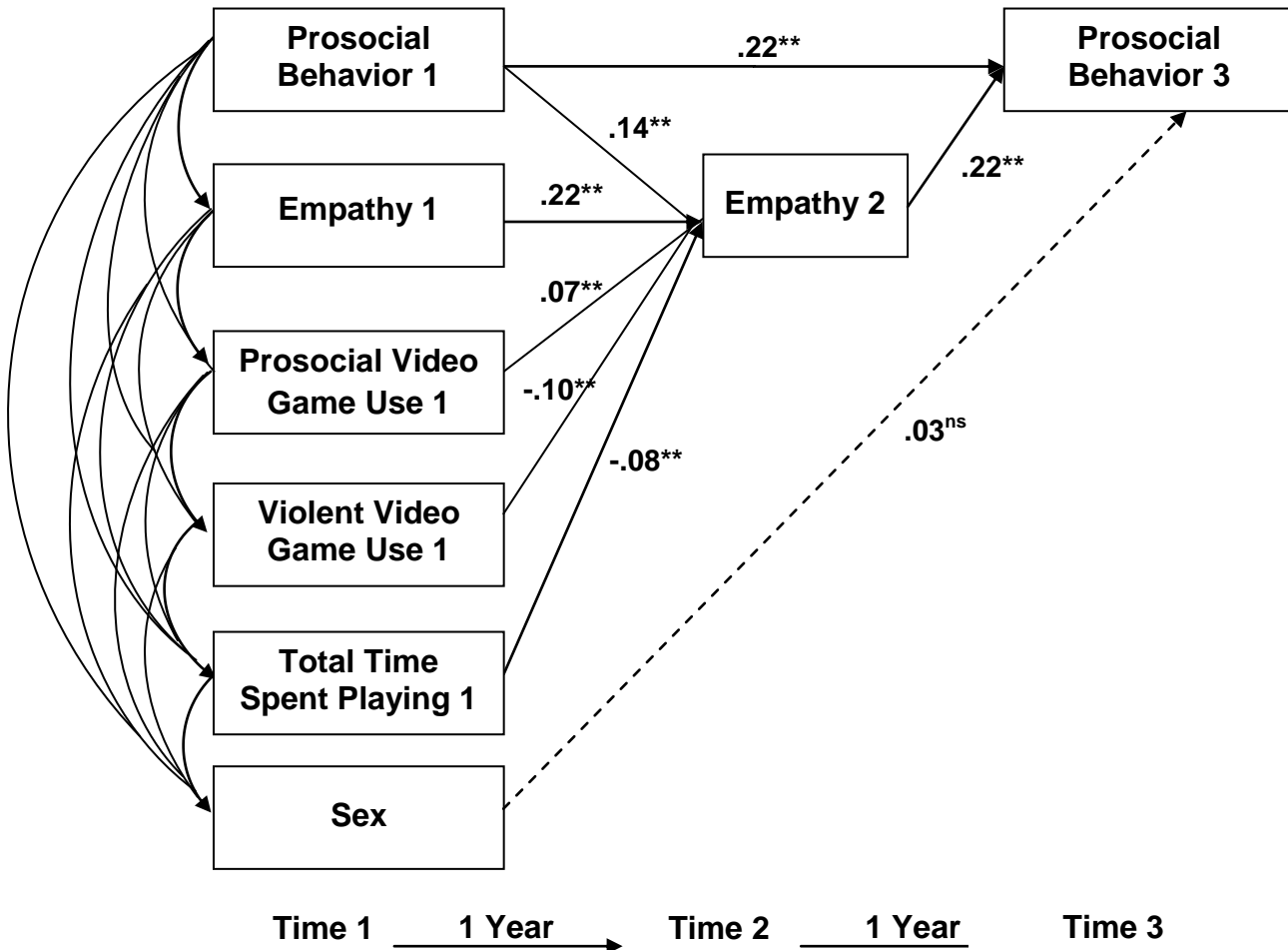


Figure 2. Path model of prosocial video game use as a predictor of prosocial behavior over time

($\chi^2 = 9.05$, $df = 5$, $p > 0.05$; TLI = 0.98; CFI = .99; RMSEA = .02, 90% CI = .00 – .03).

Standardized coefficients are shown; * $p < .02$, ** $p < .01$.

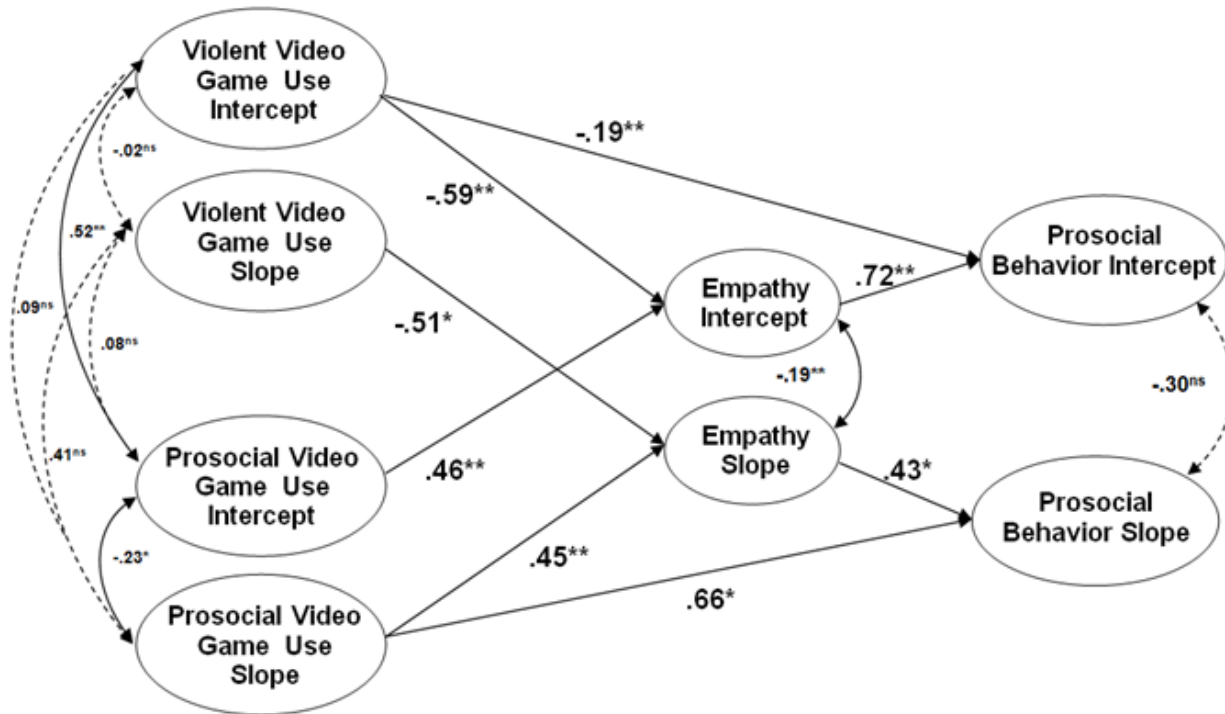


Figure 3. Latent growth curve model of prosocial video game use, violent video game use, empathy and prosocial behavior over a 2-year period ($\chi^2 = 145.9$, $df = 46$, $p < .01$; TLI = .98; CFI = .99; RMSEA = .03, 90% CI = .02 – .03). Sex and amount of play at time 1 are included as covariates. Standardized coefficients are shown; * $p < .05$, ** $p < .01$.

¹ We use "helping" as synonymous with "prosocial behavior" throughout this article, for simplicity of exposition.