Internet use and video gaming predict problem behavior in early adolescence

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ABSTRACT

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In early adolescence, the time spent using the Internet and video games is higher than in any other present-day age group. Due to age-inappropriate web and gaming content, the impact of new media use on teenagers is a matter of public and scientific concern. Based on current theories on inappropriate media use, a study was conducted that comprised 205 adolescents aged 10–14 years (Md = 13). Individuals were identified who showed clinically relevant problem behavior according to the problem scales of the Youth Self Report (YSR). Online gaming, communicational Internet use, and playing first-person shooters were predictive of externalizing behavior problems (aggression, delinquency). Playing online role-playing games was predictive of internalizing problem behavior (including withdrawal and anxiety). Parent-child communication about Internet activities was negatively related to problem behavior.

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Late childhood and early adolescence represents the age when video game use is most time-consuming (Rideout, Roberts, & Foehr, 2005), and adolescents aged 12–17 are the age group with the highest ratio of Internet users (87%, Pew Foundation, 2005). New media offer a vast amount of useful products, including web pages tailored to the needs of adolescents, and educational games. At the same time, new media provide ominous content, including web pages with age-inappropriate audiovisual material, violent video games, and unprotected chat rooms and discussion boards (e.g., Donnerstein, 2009; Funk, 2009). Consequently, the relationship between media use and normal versus problematic adolescent development is a matter of concern. In the present study, we focused on the age of early adolescence, and distinguished between adolescents with low to moderate behavior problems within the limits of healthy teen development and young adolescents with marked problem behavior. Patterns of Internet and video game use were identified which predicted whether or not a teenager fell into the problem behavior group.

Problem behavior in early adolescence

The transition from childhood to adolescence is affected by significant changes on emotional and cognitive levels. The formation of an identity in interaction with the self and the environment is one of the 'classical' developmental tasks in this period (e.g., Erikson, 1988). Nowadays, the mass media play an increasingly important role in adolescents' identity formation, which brings about new challenges, but also new opportunities (Arnett, 2002; Jensen, 2003). Early adolescence has been described as a time of high arousability and of increased vulnerability to problems in the regulation of affect and behavior

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(Arnett, 1999; Steinberg, 2005). However, most adolescents master the challenges of adolescence fairly well, although they may at times feel a deep worry about their future or about society, or engage in minor unlawful or risky behavior (e.g., Farrington, 1995; Miller & Byrnes, 1997). It is crucial, however, to distinguish between unremarkable problem behavior and those feelings, thoughts and actions that signal manifest problems that are likely to persevere.

Adolescent problem behavior as a clinically relevant phenomenon has been described along two dimensions, labeled as inhibition versus aggression (Miller, 1967), overcontrolled versus undercontrolled (Achenbach & Edelbrock, 1978), or internalizing versus externalizing problems (Achenbach, 1966, 1991). Aggressiveness and juvenile delinquency are typical examples of externalizing problem behavior. Internalizing behavior problems include social withdrawal, anxiety, depression, and somatic complaints (Achenbach, 1991). Problem behaviors along the lines of internalizing versus externalizing problems are assessed through clinical interviews or self-report scales, including the Youth Self-Report (YSR, Achenbach, 1991). However, we are aware of only two studies that related new media use with scores on this (or any other) widely used measure of clinically relevant problem behavior (Funk et al., 2002; Lohaus, Ball, Klein-Hessling, & Wild, 2005). We will look more closely at the distinction between externalizing and internalizing problems in order to briefly review the literature on media use und variables that are indicative of problem behavior.

New media use and externalizing problems

There is strong empirical evidence for a link between the consumption of violent video games like first-person shooters and other violent media and aggression. The empirical evidence is based on experimental and correlational studies with different samples, including children, adolescents, and adults (e.g., Anderson, 2004; Anderson & Bushman, 2001; Anderson & Dill, 2000; Barlett, Harris, & Baldassaro, 2007; Gentile, Lynch, Linder, & Walsh, 2004; Krahé & Möller, 2004; Wei, 2007). According to Anderson and colleagues' 'General Aggressiveness Model' (GAM, Anderson & Bushman, 2002), violent media content desensitizes the media user to both real-life violence and media violence, which in turn makes aggressive behavior more likely, as users of violent media develop stable patterns of aggressive cognitions, emotions, and aggression-legitimizing attitudes over time. In addition to offline computer and console games, the Internet may be a new potential transport device for violent media contents such as violent movie clips and violent video games (Funk, Bechtoldt Baldacci, Pasolt, & Baumgardner, 2004).

While the empirical support for the violent media-aggression link in controlled laboratory settings is largely undisputed, there is still some scientific debate as to its importance in the context of real-life behavior problems and youth delinquency (Bensley & Van Eenwyk, 2001; Ferguson, 2002; Sherry, 2007; Unsworth, Devilly, & Ward, 2007). Part of the controversy may be due to inadequate indicators of problem behavior in some studies that reported null findings (cf. Funk, 2009). What are the results of the two studies that obtained self-report data from the YSR? In the study by Funk et al. (2002), externalizing problems were found to be unrelated to playing violent games. The delinquency subscale was even more elevated for boys with low violent game preference than for boys with high violent game preference. Lohaus et al. (2005) found the general amount of computer use to be positively related to externalizing problems, but correlations were only significant for girls, who generally used the computer to a far lesser extent than boys. We consider the results of both studies as preliminary. The results of Funk et al. (2002) are based on a small sample with $N = 32$ participants in total and $n = 8$ adolescents with elevated problem behavior. This may have led to a substantial Type II error. The Lohaus et al. (2005) study did not differentiate between different kinds of computer use, thus potentially obscuring relevant relationships.

New media use and internalizing problems

While there is a history of research on the cultivation of fear by TV violence (e.g., Gerbner, Gross, Signorielli, Morgan, & Jackson-Beeck, 1979) and on fright reactions following exposure to violent movies (cf. Cantor, 2009), the impact of violent video games on internalizing problems, including anxiety and withdrawal, is less clear (cf. Appel & Jodlbauer, in press; Sparks, Sparks, & Sparks, 2009). In one study that addressed this relationship, Funk et al. (2002) found a trend ($p = .06$) that related violent video game play to substantial internalizing problem behavior. Recently, the popularity of massively multiplayer online role-playing games (MMORPGs) has given rise to the question of a link between playing fantasy games and internalizing problems (e.g., Funk, 2009). These fantasy games contain less gore than first-person shooter games, but some fighting and violence is included. A core feature of these fantasy games is slipping into the role of a virtual character. 'Trying out' a new identity during game play may have the potential to assist adolescent development, but it may also distract from real-world challenges and opportunities. Earlier research did not find substantial correlations between the engagement in *offline* fantasy role-playing games and psychopathological problems (e.g., Carter & Lester, 1998; Rosenthal, Soper, Folse, & Whipple, 1998). However, regarding *online* role-playing games, there is tentative evidence for detrimental effects from case studies in the field of psychiatry, which linked playing Internet-based fantasy games to internalizing problems such as anxiety and depression (Allison, von Wahlde, Shockley, & Gabbard, 2006; Mitchell, 2000; Salguero & Morán, 2002). Beyond these case studies, we are not aware of any studies that investigated the link between adolescent fantasy gaming and internalizing problem behavior.

The 'internet paradox' (Kraut et al., 1998) – a communication technology may lead to more loneliness – has received limited support in recent years. A number of studies reported null findings between Internet use and indicators of internalizing problems such as loneliness and depression scores (e.g., Gross, Juvonen, & Gable, 2002). However, several

more recent studies investigated specific Internet use patterns using different methodologies. These studies suggest a relationship between the frequency of communicating on the Internet and internalizing problems, as indicated by symptoms of depression (related to ICQ use: Van den Eijnden, Meerkerk, Vermulst, Sijkerman, & Engels, 2008; related to talking to strangers online and E-mailing: Ybarra, Alexander, & Mitchell, 2005), and loneliness (related to chatting: Hu, 2009).

Context: adolescent-parent communication

Context factors are supposed to be of critical importance regarding the relationship between new media use and adolescent problem behavior. We focused on the communication between parents and adolescents, which is assumed to be a key context factor of adolescent new media use (Lee & Chae, 2007). Talking about games and the Internet may be both an indicator of a close parent–adolescent relationship and a behavior that buffers detrimental effects of media use. Research on parental mediation has mainly focused on television (e.g., Nathanson, 2001). However, there is tentative evidence that parent-adolescent communication about the Internet might be effective in reducing detrimental effects of new media (Lee & Chae, 2007; Rideout et al., 2005). Strict family rules for computer use, on the other hand appear to be less efficient (Lee & Chae, 2007).

Aim and focus of the present study

The present study focused on the relationships between patterns of Internet and video game use, and behavior problems in early adolescence. Unlike most previous research, we were interested in a broad range of behavior problems, including both internalizing and externalizing problems. Moreover, variations within the scope of unremarkable problem behavior were secondary to our approach. Instead, we focused on the distinction between individuals with problem scores below or above the standard cut-off point of a widely used clinical instrument that screens for adolescent problem behavior.

Guided by research on the impact of violent video games (Anderson, 2004; Anderson & Bushman, 2001, 2002; Gentile et al., 2004), we hypothesized that the preference for the extremely violent and bloody video game genre of first-person shooters is accompanied by increased externalizing and internalizing problems. Although fantasy games are highly popular in the form of online role-playing games, they have received very little research attention. Based on theory and initial evidence mainly from case studies (e.g., Allison et al., 2006), we assumed that playing fantasy games predicts internalizing problems. Following our reasoning on computer games, we further expected that using the Internet to play computer games predicts both kinds of problem behavior. As findings on the link between communication on the Internet and internalizing problems have provided contradictory findings, we addressed this issue as a research question. We further investigated the communication between parents and adolescents regarding adolescents' Internet use (Lee & Chae, 2007; Rideout et al., 2005). We assumed that the communication with parents is a resource that is negatively related to problem behavior. Given that gender was found to play a constant role in studies on adolescent Internet and video game use (cf. Donnerstein, 2009; Funk, 2009), potential gender differences were considered.

Method

Participants and procedure

The sample comprised 205 (100 male, 105 female) students from Austria. The ages ranged from 10 to 14 (Md = 13; $M = 12.71$, SD = 1.01) and the participants' school types closely resembled the typical distribution pattern in this region. Participants were recruited from schools in both rural and urban areas. About 80 percent of the invited schools agreed to participate in the study. Individual participation was voluntary and included informed consent. The participants were not asked for any identifying information and remained anonymous. Each participant answered the questionnaire individually in class and under the supervision of the class teacher and a research assistant. The participants required between 25 and 45 min to complete the questionnaire. The survey took place between May and July 2007.

Material

Sociodemographic variables

The measures commenced with questions on gender, age, and whether or not a computer and the Internet were accessible in the adolescents' homes.

Internet use

The average time per day spent on the Internet was reported in 30-min intervals, ranging from no Internet (score = 0) to '4 h or more' per day (score = 7). Based on current research on adolescents' Internet activities (e.g., Bayraktar & Gun, 2007; Lee & Chae, 2007; Kraut, Kiesler, Boneva, & Shklovski, 2006), we investigated three relevant categories of Internet activities: communication, informational Internet use, and online gaming. In this study, activities on the Internet were assessed with

nine Likert-type items (five-point scale ranging from 1 = never to 5 = very often).[1] Three items addressed informational Internet use (reading news, expressing opinions, getting information, Cronbach's α = .48), three items addressed communicational Internet use (using e-mail, using chat-rooms, using social platforms like *MySpace*, Cronbach's α = .67), and three items addressed online-gaming (playing first-person shooters online, playing online role-playing games, playing other games, Cronbach's α = .76). To test the factorial structure, we conducted a confirmatory factor analysis using AMOS 16.01 with these nine items as manifest indicators of the three latent factors. The model fit was acceptable, as indicated by the practical fit indices, including RMSEA = .035 (confidence interval .000–.070); NFI = .92; CFI = .98.

Video game use

The average time spent on computer games per day was reported in 30-min intervals, from 'no gaming' (score = 0) to '4 h or more' per day (score = 7). The participants were further asked to note their three favorite video games. These open answers were subsequently assigned to 11 categories, which were based on earlier research (Lucas & Sherry, 2004) and recent developments on the video games market. Details on the categories, including the frequencies in the present study, are shown in Table 1.

Context

The participants were asked two questions on parental communication and parental knowledge: "Do you talk about the things you do on the Internet with your parents?" (yes/no), and "Do your parents know about all the things you do on the Internet?" (yes/no).

Behavior problems

Behavior problems were assessed with the problem items of the German version of the Youth Self Report (YSR, Achenbach, 1991; Döpfner, Berner, & Lehmkuhl, 1994). The YSR is an empirically derived, well established, and widely used instrument with excellent psychometric properties. For our analyses, we focused on the three second-order scales: Total Problems (a summary score of all behavior problem items), Internalizing Problems (the sum of raw scores for the Withdrawn, Somatic Complaints, and Anxious/Depressed scales), and Externalizing Problems (the sum of raw scores for the Delinquent and Aggressive Behavior subscales). Respondents were required to indicate whether each of 112 statements was 'not true', 'somewhat true', or 'very true' at present or within the past six months. Raw scores on each subscale were transformed into a normalized
T-score based on the distribution of scores obtained from normative samples (Achenbach, 1991; Döpfner et al., 1994). Higher scores indicated more problems in the respective category. It should be noted here that T-scores take into account gender effects in the distribution of problem scores.

Results

Descriptive analyses

Internet access and usage

Computer games and the Internet were accessible for most of our participants, as indicated by self-reports about the hardware equipment in their homes. The great majority of adolescents (201 or 98%) had at least one computer at home, and for almost half of the adolescents (100 or 48.8%), a computer was available in their private room. The Internet was accessible in 84% of their families' homes. The vast majority of the participants (91%) had used the Internet before, either at home, at school, or at friends'. The mean score for the time spent using the Internet was M = 2.42 (SD = 1.63), Md = 2.00, which reflects an average time of one to 1.5 h. Girls and boys did not differ in their daily time online (girls: M = 2.31, SD = 1.50; boys: M = 2.53, SD = 1.75, t[203] = -0.9, p = .34).

Regarding Internet content, girls reported a higher intensity of getting information on the Internet (M = 2.17, SD = .77) than boys (M = 1.94, SD = .74), t(203) = 2.2, p < .05, d = .30. Likewise, girls had higher scores for communicational Internet use (M = 3.37, SD = 1.30) than boys (M = 2.89, SD = 1.19), t(203) = 2.7, p < .01, d = .38. In contrast, Internet gaming was a male domain, with M = 1.74, SD = .78 for girls, and M = 2.22, SD = 1.09 for boys, t(179) = -3.6, p < .001; d = .53.

Computer gaming

Video game play included all possible platforms, i.e., video game consoles, the PC, and Internet games. Fourteen boys and 17 girls never played video games; the remaining 174 adolescents did play video games (85%). The mean score for the time spent playing video games was M = 1.91 (SD = 1.63), Md = 1.7, which reflects just under 1 h spent playing video games on an average day. Boys reported significantly more time playing video games than girls (girls: M = 1.40, SD = 1.18; boys: M = 2.45, SD = 2.07, t[203] = -4.5, p < .01, d = .63). These frequency patterns are similar to data obtained with US samples (Gentile et al., 2004; Rideout et al., 2005).

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[1] This scale included an additional item on 'creating a homepage', which was excluded from further analysis due to its potential ambivalence. Originally intended to reflect an informational Internet use pattern, it could equally be regarded as a means of communication (e.g., creating a homepage on *MySpace*).

Table 1
Video game genres and preferred games (categories adapted from Lucas & Sherry, 2004).

Genre	Description	Examples	Among favorite games			Gender differences	
			Total (N = 205)	Girls (N = 105)	Boys (N = 100)	p (exact test)	Effect size: Cramer's φ
Simulation	Games involving a simulation of (close to) real-life activities	*SimCity, The Sims, Rollercoaster Tycoon*	81	72	9	< .001	−.61
Arcade/Jump 'n' Run	Rather simple games requiring dexterity and speed	*Pinball, Moorhuhn (Shoot'em'Up), Tetris*	52	36	16	< .01	−.21
Action/adventure	Rather complex games involving 'action elements' like shooting and fighting in which you go on an adventure	*Resident Evil, Tomb Raider, Grand Theft Auto*	34	12	22	.06	.14
First-person shooter	Games in which you shoot other characters (involving a first-person perspective)	*Counterstrike, Ghost Recon, FarCry*	33	5	28	< .001	.32
Sports	Games based on athletic teams and events	*FIFA Soccer, Pro Evolution Soccer*	31	6	25	< .001	.27
Fantasy/role-playing	Games that let you assume a character role in a typical 'fantasy' environment	*World of Warcraft, Final Fantasy, Gothic*	30	2	28	< .001	.37
Racing	Games that focus on driving fast in vehicles	*Gran Turismo, Speed Racer*	29	7	22	< .01	.22
Strategy	Games that use strategic planning skills	*Command & Conquer, Civilization*	26	5	21	< 01	.24
Parlor games	Video game versions of 'old-time favorites'	*Chess, Checkers, Poker*	20	11	9	.82	−.03
Activity games	Games involving a real-life activity or which are meant to improve real-life abilities	*Sing Star, Guitar Hero, Quiz Games, Edutainment*	9	8	1	.04	−.16
Fighter	Games that focus on martial arts	*Mortal Combat, Tekken*	5	0	5	.03	.16

Note. Six expressions could not be identified as a computer game, and therefore could not be assigned to any of the categories.

Among our total sample of 205 adolescents, 173 named at least one favorite computer game, 147 wrote down two or more computer games, and 115 adolescents listed three titles they preferred to play. Overall, the simulation 'The Sims' was the most popular game (listed by 77 individuals), followed by the sports game 'FIFA Soccer' (27) and by the first-person shooter 'Counter-Strike' (24). Each game was assigned to one of the genres adopted from previous research (Lucas & Sherry, 2004). Subsequently, we analyzed the gaming preferences with regard to whether or not the participants favored at least one game that belonged to a specific genre. Simulations were the most popular genre, favored by 81 adolescents, most of whom were girls (Fischer's exact test for gender, $p < .001$; the effect size of the gender difference is large, as indicated by $\varphi = -.61$, see Table 1 for the complete results).

The games which were assigned to the genre of first-person shooters had a very similar gameplay and all games in this category comprised high levels of gore. All games assigned to the genre of fantasy games were of the 'World of Warcraft' type. In these games, players have to solve quests – often cooperatively with other players – in a fantasy environment featuring mythical figures like sorcerers, monsters, and dragons. Solving the quest demands a certain amount of fighting, but fights are graphically much less realistic and gory compared to first-person shooters. Fighting and killing is not as dominant and central as in shooter games. In sum, games within one particular category were rather similar, whereas the differences between categories were substantial.

Behavior problems

In the present sample, the YSR total score ranged between 38 and 90 points ($M = 56.34$; $SD = 9.01$). Differences in T-scores between boys and girls were not statistically significant (all $\chi^2 < 1$, all $ps > .35$), reflecting a special algorithm for boys and girls in the calculation of the T-scores. Among our young adolescent sample, we found a small positive relationship between age and externalizing problems (Table 2).

For our analyses, we divided the sample into adolescents with an unremarkable problem score and adolescents with a problem score that signals problems of clinical relevance. This split was conducted for each of the three major YSR criteria, i.e., externalizing problems, internalizing problems, and total problem score. Following the standard recommendations, the cut-off point was set at a T-score of 60, which marks the lower end of the conspicuous range. Scores between 60 and 63 are considered as lying at the boundary of problematic behavior, but deserve further attention nonetheless (Achenbach, 1991; Döpfner et al., 1994). Among the adolescents, 32.9% of the girls and 36.1% of the boys scored 60 points or more on the total problem score (externalizing problems: 23.8% of the girls, and 29.8% of the boys; internalizing problems: 27.6% of the girls, and 34% of the boys).

Media use and problem behavior: data analysis strategy

The aim of our study was to investigate which media use patterns predict whether or not an adolescent belongs to the problem group according to the YSR responses. To illustrate the basic relationships between all variables involved, Table 2 (top right) presents zero-order correlations.

Table 2
Correlations matrix of the main variables of the study. Zero-order correlations (above the diagonal; $N = 205$) and partial correlations controlled for communication with parents (beneath the diagonal and highlighted in grey; $N = 187$).

	1	2	3	4	5	6	7	8	9	10	11	12	13
1 Gender	–	−.03	.07	.30***	.36***	.32**	−.16*	.25***	−.19**	.06	.07	.02	−.13
2 Age	−.05	–	.13	.00	−.01	.26***	.23**	.05	.39***	.16*	.04	.03	−.16*
3 Internet amount	.08	.05	–	.45***	.23**	.02	.14*	.33***	.38***	.23**	.16*	.24**	−.03
4 Computer games amount	.30***	−.07	.44***	–	.50***	.30***	−.09	.58***	.10	.20**	.13	.20**	−.14
5 Fantasy games	.37***	−.04	.21**	.50***	–	.13	−.08	.36***	.00	.05	.16*	.17*	−.03
6 First person shooters	.31***	.23**	−.01	.29***	.13	–	−.08	.28***	.10	.16*	.02	.00	−.10
7 Informational Internet use	−.12	.21**	.06	−.11	−.10	−.09	–	.08	.37***	.13	.08	.19**	.15*
8 Online gaming	.24**	−.04	.31***	.56***	.36***	.25**	.07	–	.28***	.28***	.18**	.24**	−.17*
9 Communicational Internet use	−.22**	.35***	.35***	.04	−.02	.05	.36***	.21**	–	.26***	.04	.19**	−.19**
10 YSR externalizing problems	.03	.09	.20**	.16*	.04	.14*	.15*	.25**	.22**	–	.37***	.59***	−.27**
11 YSR internalizing problems	.06	−.02	.15*	.09	.16*	.01	.10	.16*	.01	.34***	–	.73***	−.18*
12 YSR-total problems	.00	−.04	.23**	.16*	.16*	−.03	.22**	.21**	.17*	.58***	.70***	–	−.21**
13 Communication with parents	–	–	–	–	–	–	–	–	–	–	–	–	–

Notes. Gender was dummy-coded ($0 =$ female, $1 =$ male), as were problem scores ($0 =$ inconspicuous, $1 =$ conspicuous), and communication with parents ($0 =$ no; $1 =$ yes). $^*p < .05$; $^{**}p < .01$; $^{***}p < .001$.

With dichotomous data as our main dependent variable, binary logistic regression analyses were conducted, complemented by 2×2 tables and Fisher's exact tests. To prevent distortions in models that include interactions, all continuous predictors were centered (z-standardized). An examination of graphical representations of the data revealed no non-linear trends that may be obscured by linear models and interpretations. For all significance tests reported here, type I error probability was set at .05. Nagelkerke R^2 and association coefficient φ (Cramer) are reported as measures of effect size.

Communication with parents

In order to gain a better understanding of the contexts of Internet use, adolescents were asked whether or not they talked about the Internet with their parents. Of the 185 adolescents who used the Internet and provided the data, 81 talked about the Internet with their parents, while 104 did not. For all three fields of problem behavior, the adolescents who talked about the Internet with their parents were less likely to show elevated problem behavior (Table 2). Parent communication was unrelated to playing fantasy games or first-person shooters. As communication with parents about the Internet may indicate the quality of the parent–adolescent relationship in general terms, we tested the robustness of the relationships when this variable was statistically controlled. As indicated in Table 2 (bottom left), the relationships between the media use variables and problem behavior remained significant.

Additional logistic regression analyses indicate that parent communication reduces the probability to show any of the three kinds of problem behavior, even if age, gender, amount of time spent on the Internet, and the three Internet use patterns are included in the equation (all $ps < .05$).[2] However, this logistic regression analysis showed no interactions between parent communication and total time spent on the Internet, or any of the three Internet use patterns (for the interaction term all Wald χ^2s < 0.6).

Internet use patterns and problem behavior

Our next analyses focused more closely on the specific activities for which the Internet was used, i.e., how often the adolescents played games, communicated, or looked for information on the Internet. Externalizing problems served as our first dependent variable (see Table 3, first columns). We conducted hierarchical logistic regression analyses with age and gender as control variables. The Internet use patterns were entered after the control variables. Second-order interaction effects between all predictors were examined, but did not significantly contribute to the model, all Omnibus $\chi^2(10) < 6.9$, $ps > .73$. Single regression weights representing interactions with gender or age were all non-significant, Wald $\chi^2(1) < 2.0$, $p > .20$.

The Internet use variables significantly explained whether or not adolescents' scores fell into the range of elevated aggressive and delinquent behavior problems (Table 3, Block 2). Odds ratios greater than 1 indicate that an increase of one

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[2] Our second question on parental mediation, which asked whether or not parents had a precise knowledge of the adolescents' Internet activities, was found to be unrelated to problem behavior (all $ps > .10$).

Table 3
Internet use patterns as predictors of relevant problem behavior. Results of binary logistic regression analyses.

	Externalizing problems			Internalizing problems			Problem behavior total		
	0 = 151; 1 = 54			0 = 142; 1 = 63			0 = 131; 1 = 74		
	B (SEB)	Wald χ^2	Odds Ratio (95% CI)	B (SEB)	Wald χ^2	Odds Ratio (95% CI)	B (SEB)	Wald χ^2	Odds Ratio (95% CI)
Intercept	−1.34 (0.27)	24.6***	0.26	−0.91 (0.23)	15.9***	0.40	−0.65 (0.23)	8.4**	0.52
Block 1: demographics									
Age	0.23 (0.19)	1.4	1.26 (0.87–1.83)	0.06 (0.17)	0.1	1.07 (0.76–1.49)	−0.13 (0.17)	0.6	0.88 (0.62–1.23)
Gender	0.27 (0.37)	0.5	1.31 (0.63–2.74)	0.14 (0.34)	0.2	1.15 (0.60–2.21)	0.05 (0.33)	0.0	1.05 (0.55–2.02)
Block 2: Internet use patterns									
Online gaming	0.49 (0.18)	7.4**	1.64 (1.15–2.33)	0.38 (0.17)	5.1*	1.46 (1.05–2.02)	0.43 (0.17)	6.6*	1.54 (1.11–2.13)
Communication	0.48 (0.22)	4.8*	1.61 (1.05–2.48)	−0.10 (0.19)	0.2	0.91 (0.62–1.33)	0.25 (0.19)	1.8	1.29 (0.89–1.87)
Informational Internet use	0.12 (0.18)	0.4	1.12 (0.79–1.59)	0.19 (0.17)	1.3	1.20 (0.87–1.67)	0.34 (0.16)	4.4*	1.41 (1.02–1.95)
Block 2 significance	$\chi^2 = 20.6$, df = 3, $p < .001$			$\chi^2 = 6.8$, df = 3, $p = .08$			$\chi^2 = 20.1$, df = 3, $p < .001$		
Model fit	$\chi^2 = 27.0$, df = 5, $p < .001$; Nagelkerke $R^2 = .18$			$\chi^2 = 8.1$, df = 5, $p = .15$ Nagelkerke $R^2 = .05$			$\chi^2 = 20.3$, df = 5, $p < .01$; Nagelkerke $R^2 = .13$		

Notes. Gender was dummy-coded (0 = female, 1 = male). *$p < .05$; **$p < .01$; ***$p < .001$. The continuous predictors were z-standardized. Coefficients for the complete equations (including both blocks) are displayed.

unit in the predictor variable raises the likelihood that adolescents express conspicuous problem behavior.[3] As expected, Internet gaming predicted externalizing problems. Furthermore, social Internet use/communication was found to be related to these problems. Both were associated with a higher probability of showing signs of clinically relevant externalizing problems. As expected, informational Internet use was unrelated to this form of problem behavior. With regard to internalizing problems, we found online gaming to be a significant predictor. Neither of the other two Internet use patterns affected this kind of problem behavior. Our data suggest that Internet activities are more closely associated with externalizing problems (complete model Nagelkerke $R^2 = .18$) than with internalizing problems (Nagelkerke $R^2 = .05$).

A subsequent analysis with total problem behavior as the criterion identified a significant regression weight for Internet gaming. Rather unexpectedly, using the Internet for informational reasons also increased the probability of indicating relevant total problem behavior.[4]

Gaming patterns and problem behavior

Based on the strong support for the violent game – violence link (cf. Anderson & Bushman, 2001; Gentile et al., 2004; but see Funk et al., 2002), we hypothesized that players of first-person shooters have a higher risk of showing signs of clinically relevant aggressive and delinquent behavior. Furthermore, we expected that players of fantasy games were more likely to report elevated internalizing problems (cf. Allison et al., 2006). Simple 2 × 2 contingency tables were analyzed for both critical genres and the problem behavior groups. Additional analyses included all other gaming genres that were favored by at least 10% of our sample. As expected, adolescents who preferred to play first-person shooters were significantly more likely to have externalizing problems than those who did not (Table 4). The coefficient of $\varphi = .19$ indicates that the effect is small in size. Whether or not the adolescents mentioned first-person shooters as one of their favorites did not affect either of the other two problem scales (internalizing or total problems).

In line with our hypothesis, adolescents who preferred fantasy games had a higher probability of showing marked internalizing problems, and were more likely to report elevated total problem behavior scores. It is noteworthy here that more than half of the fantasy gamers exhibit total problem scores above the standard cut-off point. Consistent with case reports (Allison et al., 2006; Mitchell, 2000; Salguero & Morán, 2002), playing fantasy games may signal and reinforce

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[3] The value of 1.64 indicates that for each one-unit increase in the predictor variable, the probability of falling into criterion category 1 is 1.64 times more likely. Online gaming was z-standardized; thus, for each standard deviation (= 1.00 unit) more of gaming, the likelihood to belong to the externalizing problem group is about 1.64 times higher. As the Internet use patterns were assessed through Likert-type items and z-standardized, the units of both measures do not directly represent natural units of time spent (e.g., minutes or hours). Nagelkerke R^2 is an approximation of the explained variance between two outcomes, similar to the R^2 in ordinary linear regression (Nagelkerke, 1991).

[4] This unexpected result was given further attention: Total problem behavior is an aggregate measure of externalizing problems, internalizing problems, and three additional syndrome scales, Social Problems, Thought Problems/Compulsion, and Attention Problems. Based on the non-significant relationships between informational Internet use and externalizing as well as internalizing problems, we suspected that informational Internet use is in particular predictive of one of the additional three syndrome scales. Conspicuous problems on the syndrome level are indicated by syndrome scores of 67 and above (Achenbach, 1991). We applied this cut-off point, i.e., adolescents with syndrome scores of 67 and above received a score of 1, and adolescents with syndrome scores of 66 and below received a score of 0. Three additional binary logistic regressions, with age and gender entered first, and the Internet use patterns (games, social Internet, informational Internet) entered in a second step, showed that informational Internet use was neither related to the 'social problems' subdimension nor to the 'attention problems'. There was a weak trend for informational Internet use predicting thought problems/compulsion, $B(SEB) = .36 (.22)$, Wald $\chi^2(1) = 2.7$, $p = .10$, odds ratio = 1.43, Omnibus $\chi^2(3) = 4.8$, $p = .18$ for the second step, Nagelkerke $R^2 = .06$ for the full model.

Table 4
Favorite computer game and problem behavior: crosstabs, Fisher's Exact Tests (two-tailed significance is displayed), and Cramer's φ.

			Externalizing problems			Internalizing problems			Problem behavior total		
			No	Yes	p	No	Yes	p	No	Yes	p
Shooter (Half-Life, Counterstrike)	Complete sample		151 (74%)	54 (26%)		142 (69%)	63 (31%)		131 (64%)	74 (36%)	
	Non-favorite	172	133 (77%)	39 (23%)	.01	121 (70%)	51 (30%)	.54	111 (65%)	61 (36%)	.70
	Favorite	33	18 (55%)	15 (46%)	($\varphi = .19$)	21 (64%)	12 (36%)	($\varphi = .05$)	20 (61%)	13 (39%)	($\varphi = .03$)
Fantasy (World of Warcraft, Gothic)	Non-favorite	175	131 (75%)	44 (25%)	.37	126 (72%)	49 (28%)	.05	118 (67%)	57 (33%)	.01
	Favorite	30	20 (67%)	10 (33%)	($\varphi = .07$)	16 (53%)	14 (47%)	($\varphi = .14$)	13 (43%)	17 (57%)	($\varphi = .18$)
Racing (Need for Speed)	Non-favorite	176	130 (74%)	46 (26%)	.83	117 (67%)	59 (33%)	.05	109 (62%)	67 (38%)	.21
	Favorite	29	21 (72%)	8 (28%)	($\varphi = .01$)	25 (86%)	4 (14%)	($\varphi = .14$)	22 (76%)	7 (24%)	($\varphi = .10$)

problems in early adolescent development. All other genres examined were unrelated to high problem scores, except for an encouraging result for the genre of racing games: adolescents who had at least one racing game among their favorite games were *less* likely to exhibit high internalizing problem scores. Possibly, racing games are a functional alternative to potentially problematic games such as fantasy games or first-person shooters.

Additional analyses compared the favorite genres for adolescents aged 10–12 ($n = 83$) with adolescents aged 13–14 ($n = 122$). Genre preference was unrelated to age (all Fisher $p > .17$), except for first-person shooters. This genre is less common at a younger age: five out of 83 individuals (6%) play shooters versus 28 out of 122 (22%) from the older group, Fisher's exact test $p < .01$, $\varphi = .23$. For those who preferred shooters, three out of five individuals (60%) from the younger age group showed externalizing problems compared to 12 out of 28 (43%) in the older age group. Regarding those who preferred fantasy games, seven out of 13 individuals (54%) from the younger age group showed internalizing problems compared to 12 out of 28 (41%) in the older age group. Elevated total problem behavior was reported by eight out of 13 (62%) fantasy game players of the younger age group and nine out of 17 (53%) fantasy game players of the older age group. Regarding those who preferred racing games, two out of 11 individuals (18%) of the younger age group showed internalizing problems, as did 2 out of 18 (11%) in the older age group. Although the descriptive data point to larger relationships for the younger group, inter-actions inspected in a logistic regression with game preference and age group as independent variables are not significant, all Wald $\chi^2(1) < 2.4$, $p > .12$. In sum, these analyses indicate that the identified relationships between video games and problem behavior occur in both age groups. However, in the present study, the power to detect any moderating influences of adolescent age on the results was limited. Thus, future research should specifically address the impact of age.

Discussion

Individuals in their early adolescence spend more time on video games and the Internet than members of any other age group, which has given rise to concerns regarding the relationship between new media use and negative consequences, such as emotional and behavioral problems. This study sought to answer the question of whether conspicuous problem behavior can be predicted by patterns of Internet and video game use.

We found that early adolescents' externalizing behavior problems (aggression and delinquency) can be predicted by Internet communication, by the amount of online gaming, and by playing first-person shooters. Internalizing behavior problems were neither related to Internet communication nor to a preference for violent first-person shooter video games. However, we did find support for the assumption that playing fantasy games is associated with internalizing problems and the total problem score. Around half of the fantasy game players in our sample report problems in this regard, a significantly larger percentage than the non-fantasy game players. Content matters: this study demonstrated that a penchant for specific video game products goes hand in hand with specific problems – fantasy games with internalizing problems, first-person shooters with externalizing problems.

Although not the specific focus of this investigation, the results on adolescent-parent communication (Lee & Chae, 2007; Rideout et al., 2005) appear noteworthy. Talking with one's parents about the Internet was negatively correlated to problem behavior. However, neither the correlations between Internet use and problem behavior nor those between gaming and problem behavior disappeared when controlling for parent-adolescent communication about the Internet.

In sum, our work is a critical extension of previous research: Using a sophisticated clinical questionnaire on problem behavior, we found support for theories on the impact of new media. Moreover, we focused on the relevant distinction of whether or not an adolescent deserves further attention based on the standard cut-off point for problem behavior. The present study is the first to connect fantasy game play and internalizing problems beyond case studies (e.g., Allison et al., 2006). The reported effects were small in size. They do, however, fall within the range expected from previous research and they are large enough to have real-life relevance (e.g., Anderson, 2004).

Nevertheless, certain limitations of our work should be acknowledged. First, using the standard scoring procedures, a considerably large percentage of participants in this study reached scores above the standard cut-off point. We do not posit that all of these elevated scores are due to psychopathological disorders. We employed a self-report measure that screens for clinically relevant behavior problems and thus we may have overestimated the percentage of individuals who have problems

beyond variations that are expected in healthy adolescent development. Although we employed a reliable and valid measure targeted at problem behavior, supporting measures obtained through clinical interviews, parent ratings, or teacher ratings would have strengthened our approach.

Second, our data points at the importance of parent-adolescent communication about the Internet. However, future research should benefit from multi-item measures with established psychometric qualities. This may help disentangle the influence of media-related interactions from supportive and secure parent–adolescent relationships in general terms.

Third, we distinguished adolescents' computer game play based on computer game genre. Genre is a level of analysis that is frequently used in research and we believe that genre-based results are of interest for both experts and the public. In our study, games belonging to the same genre were similar in terms of basic gameplay and visuals. This is possibly due to a common software architecture that runs first-person shooters, and the outstanding popularity of the online role-playing game *World of Warcraft*, which may have led market competitors to adopt this game's characteristics. Nonetheless, future studies might profit from conducting a fine-grained analysis of differences within genres. This may require a distinction between different variants and releases of the same game, which in turn calls for elaborate methods to identify computer game preferences and play by adolescents. In the past, experimental studies identified features that drive the impact of violent games on aggression (e.g., amount of gore: Barlett, Harris, & Bruey, 2008; Farrar, Krcmar, & Novak, 2006). In a similar vein, future studies might identify factors that contribute to the detrimental effects of online role-playing games.

Fourth, one must be cautious in interpreting the correlation results of this study as support for causal theories. This study does not provide results that shed light on the direction of the covariations. Do new media indeed lead to more problem behavior or do adolescents choose their media consumption based on their problems? For us, the relationship between media use and problem behavior is conceived as a reciprocal interaction (cf. Bandura, 1999). Both paths of causal influence are likely to be present and to depend on each other. Preexisting maladaptations may be aggravated by these media usage patterns. On the other hand, the same proneness to behavior problems may facilitate excessive Internet and video game usage. Viewing this study in the context of other longitudinal and experimental studies, our work adds to the evidence that certain patterns of video game and Internet use are risk factors for healthy adolescent development. More experimental, longitudinal, and correlational studies are needed to further clarify the separate contributions of the different risk factors and protective factors identified for the emergence of clinically relevant behavior problems in adolescence. This should strengthen the direction of future research in terms of including not only self-report data, but also behavioral measures and reports from other involved persons like parents, friends, and teachers.

Acknowledgements

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