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Television, Video Game and Social Media Use Among Children with ASD and Typically Developing Siblings

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Abstract This study examined the nature of television, video game, and social media use in children (ages 8–18) with autism spectrum disorders (ASD, $n = 202$) compared to typically developing siblings (TD, $n = 179$), and relative to other activities. Parents completed measures assessing children's screen-based and other extracurricular activities. Children with ASD spent approximately 62 % more time watching television and playing video games than in all non-screen activities combined. Compared with TD siblings, children with ASD spent more hours per day playing video games (2.4 vs. 1.6 for boys, and 1.8 vs. 0.8 for girls), and had higher levels of problematic video game use. In contrast, children with ASD spent little time using social media or socially interactive video games.

Keywords Autism spectrum disorder · Video game · Television · Internet · Social media · Activities · Gender

Introduction

Autism spectrum disorders (ASD) are characterized by significant impairment across communication, social, and behavioral domains (American Psychiatric Association 2000), and are associated with a range of other co-occurring difficulties such as cognitive impairment (Chakrabarti and Fombonne 2005; De Bildt et al. 2005), poor adaptive functioning (Carter et al. 1998; Kanne et al. 2011), and psychiatric problems (Lecavalier 2006; Simonoff et al. 2008). Between 42 and 78 % of adults with ASD obtain poor to very poor overall outcomes (Billstedt et al. 2005; Eaves and Ho 2008; Howlin et al. 2004), highlighting the importance of identifying factors that influence long-term success. Emerging research in this area has shown that adolescents and adults with ASD have limited participation in social and community activities (Orsmond et al. 2004; Orsmond and Kuo 2011; Shattuck et al. 2011), which may exacerbate long term functional difficulties. Characterizing patterns of activity engagement among children and adolescents with ASD may provide important information for understanding both short- and long-term outcomes.

The use of electronic screen-based media appears to be a particularly relevant type of discretionary activity for children with ASD. The term "screen-based media" will be used henceforth to refer to television, video games, computer games, and electronic social media (including email, text messages, and online social networking sites). Screen-based media has become an increasingly popular tool for entertainment and social connection among typically developing children and adolescents (Olson 2010; Roberts and Foehr 2008). However, excessive use of television and video games has been linked to negative outcomes among typically developing children (Hancox et al. 2005; Johnson et al. 2007; Marshall et al. 2004; Sharif et al. 2010; Zimmerman and Christakis 2005). Preoccupation with these media also appears to be a clinically significant problem for many children with ASD, according to clinical and anecdotal reports (Nally et al. 2000; Winter-Messiers 2007). In contrast, some screen-based media may have the potential to enhance interventions and social engagement, especially given the increasing availability of electronic social-

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networking tools. Surprisingly, there has been almost no empirical research on the topic.

Television and Video Game Use Among Typically Developing Children

Television viewing and video game play are highly popular activities among typically developing children and adolescents. In a nationally representative sample of 2,002 children and adolescents between the ages of 8 and 18, participants were found to spend an average of 3 h per day watching live or time-shifted television, and an average of 1.2 h per day playing video games (Rideout et al. 2010). Similarly, data from the National Health and Nutrition Examination Survey (NHANES) collected between the years 2001 and 2006 also revealed patterns of screen-based media use among a large sample of 8,707 children. Over 47 % of the children in the sample spent 2 or more hours per day using screen-based media, including television, videos, and computers (Sisson et al. 2009). More recently, among a large sample of 1,323 children (ages 6–12), average daily time spent watching television viewing was 2.9 h per day, and time spent playing video games averaged 1.3 h per day (Swing et al. 2010).

There is also a growing body of research demonstrating that excessive use of television and video games can have detrimental effects for typically developing children and adolescents. For example, in a recent longitudinal study of over 6,500 adolescents, Sharif et al. (2010) found that the amount of time spent watching television and playing video games had a negative effect on school performance. These findings were largely consistent with previous studies of the association between academic performance and time spent watching television (Hancox et al. 2005; Johnson et al. 2007) and playing video games (Hastings et al. 2009; Sharif and Sargent 2006). Other studies have found that time spent using screen-based media is negatively related to time spent interacting with others (Vandewater et al. 2006) and engagement in physical activity (Sisson et al. 2010), which may partially explain the significant association between time spent in screen-based media use and obesity (Proctor et al. 2003; Vandewater et al. 2004; Viner and Cole 2005).

With the increasing popularity of video games, researchers have also begun to develop a more nuanced understanding of problematic, or pathological, patterns of video game play (Gentile 2009). Research in this area indicates that these patterns share many common features with other types of behavioral addictions (Gentile 2009; Griffiths 2000; King et al. 2011b; Tejeiro Salguero and Morán 2002). These core components are generally thought to include *salience* (e.g., preoccupations, craving), *tolerance* (requiring increasing amounts of time spent playing), *withdrawal* (negative emotional reactions when game play is discontinued), *relapse* (failed attempts to stop or reduce play), *mood modification* (game play as a means of relieving unpleasant emotions), and *conflict* (game play results in conflict with self, others, or obligations) (Gentile 2009; Griffiths 2005, 2000; King et al. 2011a). There is increasing evidence that problematic video game play can be reliably assessed (Gentile 2009; King et al. 2011b; Tejeiro Salguero and Morán 2002); and small to moderate associations between problematic video game play and negative mental health, social and academic performance have been found (see Ferguson et al. 2011 for review). A recent longitudinal study also found that pathological gaming among children was associated with negative outcomes at 2-year follow-up, including poor school performance and increased levels of depression, anxiety, and social phobia (Gentile et al. 2011). Although research has not yet examined problematic video game play patterns among children with ASD, the propensity to become preoccupied with specific interests and activities may make this pattern more likely.

Social Media and Socially Interactive Game Play in Typically Developing Children

Among recently emerging technologies, the use of social media has also become widespread among typically developing adolescents (Subrahmanyam and Greenfield 2008). These media include, email, chat rooms, instant messages, text messages, web-based social networking sites (e.g., Facebook), video sharing sites (e.g. YouTube), and many other new and emerging tools. In addition, although television viewing and video game play are assumed to be largely solitary, at least some of these activities can also be socially interactive. For example, Lenhart et al. (2008) found that 97 % of the 1,102 American adolescents they surveyed played video games. Of those who played games, 65 % played with other people in the same room, and 27 % played with other people through online connections. Both qualitative and quantitative research has also shown that social competition and social connection can be motivators for video game play among typically developing children (Lucas and Sherry 2004; Olson 2010; Olson et al. 2008).

There has been increasing interest in examining the role of electronic social media in adolescent development (Subrahmanyam and Greenfield 2008; Subrahmanyam et al. 2008), as well as ongoing debate regarding the impact of such media on social engagement. Some studies have found that internet use can be a solitary and socially isolating activity (Nie 2001; Nie et al. 2002), while others have argued that social media use can enhance social relationships among both adults and adolescents (Robinson et al. 2000; Shklovski et al. 2004; Valkenburg and Peter 2007). Gross et al. (2002) found that adolescents interacted in online communication largely with existing circles of friends. They also found that online communication was often related to social topics, and

was often motivated by a desire for companionship. Valkenburg and Peter (2007) also found that adolescents reported feeling closer to existing friends when they communicated online. Similar trends have been reported among young adults, the majority of whom report social engagement with existing friends as a primary reason for engaging in social networking sites (Subrahmanyam et al. 2008).

Asynchronous online communication, such as email, instant messaging, and text messaging, offer users the benefit of maintaining more control over social interactions than do face-to-face or real-time online interactions (Walther 1993; Walther and Burgoon 1992). These technologies offer opportunities for social interaction in a format that does not require attention to nonverbal cues, gestures, facial expressions, or vocalization (Walther 2007), all areas that are specifically impaired among individuals with ASD (American Psychiatric Association 2000). Thus, social media may offer promise for enhancing social interaction among individuals with ASD, given that computer technology provides a more controlled and predictable environment than face-to-face interaction. However, the extent to which children with ASD access this technology and how their usage patterns may compare to same-aged peers remains unexplored.

Screen-Based Media Use in Children with ASD

Despite the abundance of information regarding screen-based media use among typically developing children, we know very little about patterns of media use among children with ASD. In one of the few studies related to this topic, Orsmond and Kuo (2011) used a time diary method to examine daily activities among a sample of 103 adolescents with ASD. Mothers were asked to complete time use diaries for the most recent weekday and weekend day, recording both the primary activity and duration. Watching television was the most frequent discretionary activity (an average of 2.27 h per day among those who watched television), followed by using computers (an average of 1.65 h per day among those who used computers). These findings were similar to those of Shane and Albert (2008), who found that children with ASD spent significantly more time using screen-based media than they spent in any other leisure activity (Shane and Albert 2008).

In a more recent study of screen-based media use among adolescents with ASD (ages 13–17) enrolled in the National Longitudinal Transition Study-2 (NLTS2), a large percentage of the sample was reported to spend most of their free time watching television (60.3 %) and/or playing video games (41 %). Rates of non-social media use were significantly higher among adolescents with ASD than among adolescents with other disabilities (i.e., intellectual disabilities, learning disabilities, and speech/language impairments) (Mazurek et al. 2012). However, the amount and intensity of media use were not examined, and comparisons to a typically developing sample were not possible.

Further research is needed to characterize the patterns of screen-based media use among children with ASD. Given concomitant difficulties with social skills and tendencies to develop intense preoccupations (American Psychiatric Association 2000), children with ASD may be at greater risk for problematic use of some screen-based media. Video games are predicted to pose a particular risk given their inherently reinforcing design, and previously established patterns of problematic, or pathological, use among subsets of the general population (e.g., Gentile 2009). On the other hand, the use of socially interactive media may offer potential benefits for children with ASD to the extent that they access these technologies.

The role of gender in screen-based media use is also relevant to this population, given previously reported sex differences in ASD prevalence and phenotype (Mandy et al. 2012). Among typically developing children and adolescents, gender differences have been found with regard to some types of screen-based media. Although boys and girls do not appear to differ in television viewing (Cillero and Jago 2010; Gorely et al. 2004; Rideout et al. 2010), studies have consistently shown that boys spend significantly greater amounts of time playing video games than girls (Gentile 2009; Marshall et al. 2006). For example, among a large sample of 8–18 year-old children and adolescents, boys spent an average of 1 h 37 min per day playing video games, compared to 49 min per day among girls (Rideout et al. 2010). Males are also at much greater risk than females for pathological video game play patterns (Gentile 2009; Gentile et al. 2011; Lemmens et al. 2011). However, evidence for gender differences in social media use has been mixed. Some studies have found that girls spend more time using social media (Rideout et al. 2010), while others have found little to no gender difference in amount of social media use (Ohannessian 2009; Pujazon-Zazik and Park 2010). Thus, gender may require special consideration in characterizing screen-based media use among children with ASD.

The purpose of the current study was to characterize the amount and intensity of television, video game, and social media use among children with ASD as compared to typically developing children, and relative to engagement in other activities.

Methods

Participants

The sample for the current study included 202 children and adolescents with ASD and 179 typically developing siblings. Participants were recruited with the assistance of the

Interactive Autism Network (IAN) Project at the Kennedy Krieger Institute, Baltimore, Maryland.

All participating families were enrolled in IAN, a national open enrollment ASD registry, which includes families of children in the United States who have been professionally diagnosed with an ASD. Upon enrollment into IAN, families provide information about their child's primary ASD diagnosis, including completing the Social Communication Questionnaire (SCQ) (Berument et al. 1999) and a range of other survey questions and measures focused on both child and family functioning.

In a recent study by Daniels and colleagues, validity of parent-reported diagnosis among the IAN sample was confirmed through external clinical documentation among 98 % of the sample investigated (Daniels et al. 2012). Lee et al. (2010) also established the accuracy of parent-reported diagnosis among a subset of the IAN sample who were evaluated using gold-standard diagnostic tools, including the Autism Diagnostic Interview-Revised (Lord and Rutter 1994) and the Autism Diagnostic Observation Schedule (Lord et al. 2002). In their study, 99 % of the sample met criteria for ASD on the ADI-R, and 93 % met criteria based on developmental history and ADOS (Lee et al. 2010). Thus, the reliability of parent-reported diagnosis among the IAN sample appears to be high.

Eligible parents were recruited for the current study by email, and data were collected online via web-based parent-completed survey. To be eligible to participate in the current study, all participants in the ASD group were required to have a parent-reported diagnosis of ASD, including Autism or Autistic Disorder (53.5 %), Asperger's Disorder (27.2 %), or Pervasive Developmental Disorder, NOS (17.3 %). Parents were also asked to describe the type of clinician who provided the child's diagnosis, and to report their child's IQ range (if previously assessed). Table 1 provides sample characteristics for the ASD group.

All participants in the sibling group were required to have no previous diagnosis of an ASD or other developmental disorder. Children in both groups were required to be between the ages of 8 and 18, with a mean age of 12.1 years (SD = 2.8) for the ASD group, and 12.5 years (SD = 2.6) for the sibling group. Consistent with the gender differential in ASD prevalence, in the current sample a greater percentage of the ASD group was male (83.7 %) than in the sibling group (49.2 %). The majority of the total sample was Caucasian (88.6 %).

Table 1 ASD group characteristics

Variable	Percentage of ASD sample (%) ($n = 202$)
Diagnosis	
Autism	53.5
Asperger syndrome	27.2
PDD NOS	17.3
Professional who provided diagnosis	
Primary care physician	2.5
Developmental pediatrician	24.9
Psychiatrist	12.9
Psychologist	16.4
Neurologist	15.9
Team of healthcare professionals	22.3
Professionals in a school system	5.0
IQ range	
Below 55	4.0
55–70	5.4
71–84	7.9
85–115	18.8
116–129	11.9
130 or higher	6.9
Not known	45.0

Measures

Parents completed a demographic and history form designed for the purposes of this study to provide information about child and family variables. Information included age, race, parent marital status, household income, number of siblings, diagnostic information about the child with ASD, parent-reported IQ estimates (if known), and specific information about activity and screen-based media use, as described below.

Time Spent on Screen-Based Media and Other Activities

Parents were asked to estimate, in average number of hours per day, the amount of time their children spent engaged in the following activities outside of school: "reading for pleasure," "doing homework/studying," "spending time with friends," "playing sports/other physical activity," "watching TV," "playing video or computer games," and "using email, Facebook, or texting." Parents were asked to provide separate estimates in each category for "typical weekday" and "typical weekend day." Consistent with previous methods (Orsmond and Kuo 2011; Zimmerman and Christakis 2005), an average daily use variable was created for each activity by multiplying the weekday response by 5, multiplying the weekend response by 2, and dividing the sum of these by 7.

Video Game Use Patterns and Types

Parents were also asked to report whether their children ever played computer games, console video games,

handheld video games, or games on cell phones. They were also asked the following questions regarding interactive video game play: "Does your child play video or computer games with friends in the same location" and "Does your child play video or computer games with others ("online multi-player") in different locations?" If parents responded "yes" to either of these, they were also asked to report the frequency on a four-point scale ranging from "less than once per month" to "5–7 times per week." Finally, parents were asked to list the three most common video games their children had played in the past month.

Problematic Video Game Use

A modified version of the Problem Video Game Playing Test (PVGT) (King et al. 2011b) was used to examine problematic aspects of video game play. The PVGT was recently developed to measure problematic game playing in accordance with Griffiths' (2005) components model of behavioral addiction. The measure includes 20 items rated on a 5-point scale ranging from "never" to "always." The development sample included 785 adolescents and adults recruited from both the general population, and from a college population. High internal consistency (ranging from .92 to .93) was reported, and evidence for validity included high correlations between total PVGT scores and frequency and duration of gameplay (correlations ranging from .41 to .55) (King et al. 2011b). For the purposes of the current study, the wording of several items was adjusted to increase relevance for younger participants, and modified from first-person to parent-report format. Item 20 from the original scale (which focused on mood modification) was dropped due to parent reported difficulty in responding to this item during pilot testing of the modified instrument.

Given these modifications, we examined preliminary psychometric properties of this measure in the current sample. Cronbach's alpha coefficients were used to evaluate internal consistency of the modified scale. Item reliability estimates were very strong, with Cronbach's alpha of .942 for the scale for the entire sample ($n = 381$), $\alpha = .937$ for the ASD group ($n = 202$), and $\alpha = .938$ for the sibling group ($n = 179$). Item-total correlations were .55 and higher for the total sample. Evidence for construct validity was also demonstrated in the current sample by significant positive correlations between total PVGT score and average number of hours per day spent playing video games ($r = .454$, $p < .001$). Our reliability and validity statistics were highly consistent with those reported by King et al. (2011b). Given that factor analysis of the original scale found support for a single factor, a PVGT total score was used in subsequent analyses.

Data Analyses

Descriptive statistics, including percentage, mean, standard deviation, and range, were conducted to characterize the sample. Pearson's correlations were computed to examine bivariate relationships among continuous variables, and Chi-square analyses were used to examine relationships between categorical variables. A series of one-way analysis of variance (ANOVA) was conducted to examine differences between children with ASD and typically developing children in time spent engaged in activities, time spent using screen-based media, and PVGT scores. Given previous findings regarding gender differences in media use, and uneven group sizes across gender and diagnostic groups, separate one-way ANOVA models were examined for each gender. Levene's statistic was significant in some cases, indicating that the assumption of homogeneity of variances for ANOVA was violated. Welch adjusted statistics are reported for models in which these assumptions were violated. Analyses were conducted using SPSS version 19.

Results

Patterns of Television and Video Game Use

Children with ASD were reported to spend a large amount of time using screen-based media. Parents estimated that their children with ASD spent an average of 1.9 h per weekday (SD = 1.4) and 3.1 h per weekend day (SD = 2.1) watching television, and an average of 2.0 h per weekday (SD = 1.6) and 3.1 h per weekend day (SD = 2.3) playing video games. In contrast, children with ASD were reported to spend considerably less time engaged in non-screen activities. Children with ASD were reported to spend, on average, 4.5 h per day engaged in screen-based media (including television and video games), as compared to an average of 2.8 h per day in all specified non-screen activities combined (including reading, homework, studying, spending time with friends, and engaging in physical activity). See Table 2 for complete data regarding average daily time spent across each activity by gender.

One-way ANOVA results revealed no significant group differences in amount of time spent engaged in any activity based on IQ (>70 vs. ≤ 70), with the exception of hours per day spent on homework, $F(1, 109) = 6.0$, $p = .016$, which was significantly greater among those with IQ scores above 70 ($M = .46$, SD = .59) than among those with IQ scores at or below 70 ($M = .88$, SD = .69). No significant differences were found in amount of time spent engaged in any activity based on race, parent marital status, or household income.

Table 2 Activity participation in children with ASD versus typically developing siblings by gender

	Male					Female				
	ASD ($n = 166$) M (SD)	TD ($n = 88$) M (SD)	F	p	Cohen's d	ASD ($n = 31$) M (SD)	TD ($n = 90$) M (SD)	F	p	Cohen's d
Average hours per day										
Reading for pleasure	0.7 (0.7)	1.0 (0.9)	9.4	.002	−0.37	0.5 (0.5)	1.4 (1.1)	39.9[a]	<.001	−1.05
Completing homework	0.8 (0.7)	1.2 (0.8)	15.4	<.001	−0.53	0.9 (0.9)	1.5 (0.9)	11.1	.001	−.70
Time with friends	0.4 (0.6)	1.8 (1.1)	109.2[a]	<.001	−1.58	0.2 (0.5)	1.7 (0.9)	120.3[a]	<.001	−2.1
Sports/physical activity	0.9 (0.7)	1.5 (0.9)	28.0[a]	<.001	−0.74	0.7 (0.7)	1.2 (0.9)	9.1	.003	−.62
Watching television	2.2 (1.5)	1.9 (1.1)	1.4	.23	0.23	2.4 (1.7)	1.9 (1.0)	4.3	.04	.36
Playing video games	2.4 (1.7)	1.6 (1.1)	19.4[a]	<.001	0.56	1.8 (1.3)	0.8 (0.9)	15.1[a]	<.001	.89
Social media	0.2 (0.6)	0.8 (1.1)	25.0[a]	<.001	−0.68	0.3 (0.7)	1.2 (1.2)	21.2[a]	<.001	−.92

Cohen's d effect sizes are reported, with positive effect size indicating greater amount of time in the ASD group

[a] The adjusted Welch F ratio is reported due to unequal variance

Analysis of variance (ANOVA) was conducted to examine potential differences between children with ASD and typically developing (TD) siblings in activity participation. Separate analyses were conducted by gender. As shown in Table 2, both boys and girls with ASD spent significantly more time playing video games than typically developing children, $F(1,253) = 19.4$, $p < .001$ for boys; $F(1,118) = 15.1$, $p < .001$ for girls. Girls with ASD also spent significantly more time watching television than typically developing female siblings, $F(1,118) = 4.3$, $p = .04$; however, statistically significant differences in between ASD and TD groups were not observed with regard to time spent watching television among boys. Both boys and girls with ASD also spent significantly less time than typically developing children in all non-screen activities, including reading for pleasure, [$F(1,253) = 9.4$, $p = .002$ for boys; $F(1,118) = 39.9$, $p < .001$ for girls], doing homework, [$F(1,253) = 15.4$, $p < .001$ for boys; $F(1,118) = 11.1$, $p = .001$ for girls], spending time with friends, [$F(1,253) = 109.2$, $p < .001$ for boys; $F(1,118) = 120.3$, $p < .001$ for girls], and engaging in physical activity, [$F(1,253) = 28.0$, $p < .001$ for boys; $F(1,118) = 9.1$, $p = .003$ for girls] (Fig. 1).

Problematic Video Game Play

Regarding problematic video game play, boys with ASD demonstrated significantly higher PVGT scores ($M = 38.9$, SD = 11.6) than typically developing boys ($M = 33.7$, SD = 9.8), $F(1,243) = 28.0$, $p < .001$, Cohen's $d = 0.65$. Welch adjusted ANOVA F statistics are reported for males due to lack of homogeneity of variance. Among girls, those with ASD also demonstrated significantly higher PVGT scores ($M = 33.2$, SD = 7.6) than typically developing girls ($M = 27.0$, SD = 7.9), $F(1,101) = 28.0$, $p = .001$, Cohen's $d = 0.81$. Table 3 provides item mean scores for

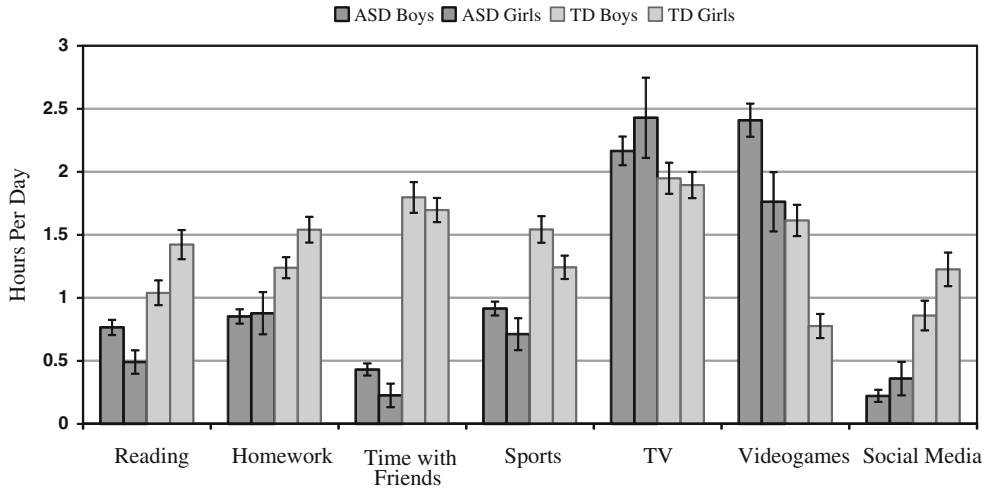

Fig. 1 Screen-based and non-screen activities of children with ASD and typically developing (TD) siblings

Table 3 PVGT item mean scores among children ASD versus typically developing siblings

	Male				Female			
	ASD ($n = 159$) M (SD)	TD ($n = 85$) M (SD)	F	p	ASD ($n = 27$) M (SD)	TD ($n = 75$) M (SD)	F	p
Question								
1. Does your child spend more time playing video games than playing with other children?	2.99 (1.0)	1.78 (0.8)	95.7[a]	<.001	3.15 (0.9)	1.44 (0.8)	85.3	<.001
2. Does your child snap, yell or get angry if someone interrupts him/her while playing video games?	2.14 (0.9)	1.74 (0.9)	11.2	.001	1.81 (0.7)	1.52 (0.7)	3.5	.06
3. Does your child seem to think life would be boring without video games?	2.56 (1.1)	2.18 (0.9)	8.6[a]	.004	1.96 (0.8)	1.47 (0.8)	7.0	.009
4. Does your child think about video games even when not playing them?	2.41 (0.9)	1.82 (0.7)	29.8[a]	<.001	1.81 (0.8)	1.40 (0.6)	6.8	.01
5. Does your child seem to play video games to get his/her mind off other things?	2.07 (0.8)	1.82 (0.8)	12.7	<.001	1.89 (0.7)	1.59 (0.7)	3.3	.07
6. Does your child play video games when he/she should be doing chores?	1.82 (.08)	1.81 (0.7)	.003[a]	.95	1.48 (0.6)	1.67 (0.6)	1.7	.19
7. Does your child lose sleep or stay up late because of playing video games?	1.52 (0.7)	1.45 (0.7)	0.48	.49	1.15 (0.4)	1.31 (0.5)	2.8[a]	.10
8. Does your child feel upset when he/she is not able to play video games?	2.25 (0.9)	1.67 (0.8)	24.8	<.001	1.89 (0.7)	1.29 (0.6)		<.001
9. Does your child play video games longer than he/she intended to?	2.30 (0.9)	2.02 (0.6)	7.3[a]	.007	1.85 (0.8)	1.60 (0.7)	2.3	.13
10. Does your child try to hide how much time he/she spends playing video games?	1.48 (0.8)	1.42 (0.7)	0.32	.57	1.19 (0.5)	1.09 (.03)	1.2	.28
11. Does your child play video games instead of doing homework?	1.53 (0.8)	1.52 (0.7)	0.01	.91	1.19 (0.4)	1.29 (0.5)	1.2[a]	.27
12. Are your child's grades worse because of the time he/she spends on video games?	1.26 (0.5)	1.24 (0.6)	0.14	.70	1.04 (0.2)	1.05 (0.3)	0.08	.78
13. Does your child lie about how much time he/she spends playing video games?	1.30 (0.6)	1.32 (0.6)	0.03	.85	1.0 (< .001)	1.07 (0.2)	1.9	.17
14. Does your child look forward to the next time he/she will be able to play video games?	2.83 (0.9)	2.25 (0.8)	23.2	<.001	2.41 (0.9)	1.63 (0.7)	22.4	<.001
15. Does your child play video games before doing something else he/she needs to do?	2.05 (0.8)	1.93 (0.7)	1.2	.27	1.78 (0.5)	1.61 (0.6)	1.9[a]	.18
16. Does your child have a hard time stopping him/herself from playing video games?	2.26 (0.9)	1.80 (0.8)	14.0	<.001	1.70 (0.8)	1.37 (0.6)	5.0	.027
17. Do you think your child plays video games too much?	2.26 (0.9)	2.02 (0.8)	4.2[a]	0.4	1.81 (0.8)	1.37 (0.7)	7.5	.007
18. Does your child ever say "just a few more minutes" when asked to stop playing video games?	2.55 (1.1)	2.26 (0.8)	5.1[a]	.02	2.04 (1.0)	1.83 (0.7)	1.2	.28
19. Does your child play video games instead of spending time with family?	2.30 (0.9)	1.76 (0.8)	20.1	<.001	2.07 (0.6)	1.37 (0.5)	31.0	<.001

[a] The adjusted Welch F ratio is reported due to unequal variance

ASD and typically developing sibling groups for both girls and boys. Results of group comparisons indicate that the boys with ASD obtained significantly higher item mean scores on 11 out of 19 items compared to typically developing boys; and girls with ASD obtained significantly higher item mean scores on 9 out of 19 items compared to typically developing girls.

Social Media and Socially Interactive Game Play

Both boys and girls with ASD were reported to spend very few hours per day using email, Facebook, or texting ($M = 0.2$, SD = 0.6 for boys, $M = 0.3$, SD = 0.7 for girls). Additionally, children with ASD spent significantly less time using social media than typically developing children, [$F(1,253) = 25.0$, $p < .001$ for boys; $F(1,118) = 21.2$, $p < .001$ for girls].

With regard to socially interactive game play, approximately half of the boys with ASD (47.9 %) and over half of the girls with ASD (61.3 %) never played video games with other people, and only 15 % of boys and 6.5 % of girls with ASD were reported to play video games with others at least once per week (see Table 4). The great majority of children with ASD (76 % of boys and 90.3 % of girls) never played online multiplayer games. Boys with ASD were significantly more likely than typically developing boys to never play video games with other people (47.9 vs. 21.6 %), $\chi^2(1, N = 255) = 16.8$, $p < .001$, and were significantly more likely to never play online multiplayer video games with others (76.0 vs. 39.8 %), $\chi^2(1, N = 255) = 32.7$, $p < .001$. In contrast, girls with ASD were equally likely to never play video games with others, either in person or online as compared to girls without ASD.

Discussion

This study is the first to examine the nature and amount of television, video game, and social media use among children with ASD as compared to typically developing children. Children with ASD in the current sample were reported to spend, on average, 4.5 h per day using screen-based media. This is well in excess of recommendations by the American Academy of Pediatrics, which recommends no more than 1–2 h of screen-based media per day (American Academy of Pediatrics 2001). Children with ASD spent approximately 62 % more time watching television and playing video games than engaged in non-screen activities (including reading, studying, spending time with friends, and engaging in physical activities). Parents reported that on average, their children with ASD spent approximately 4.5 h per day watching television and playing video games, as compared to 2.8 h per day in non-screen activities. This pattern was reversed among typically developing siblings, who spent nearly 87 % more time on non-screen activities than on screen-based activities (5.7 vs. 3.1 h per day). Children with ASD also spent significantly greater amounts of time playing video games than typically developing children, but significantly less time engaged in academic, physically active, or social activities.

Preference for Television and Video Games

Consistent with anecdotal observations, our results show that children with ASD have a strong preference for electronic entertainment tools, particularly television and video games. This preference for video games was particularly striking. When comparing time spent playing video games in ASD versus typically developing groups, the effect sizes ranged

Table 4 Socially interactive video game play in children with ASD versus typically developing siblings

	Male		Female	
	ASD (%) ($n = 159$)	TD (%) ($n = 85$)	ASD (%) ($n = 31$)	TD (%) ($n = 90$)
Plays video games with friends in the same location				
Never	47.9	21.6	61.3	43.3
Less than once per month	13.2	9.1	12.9	16.7
1–4 times per month	23.4	31.8	12.9	27.8
1–4 times per week	15.0	34.1	6.5	12.2
5–7 times per week	0.6	3.4	6.5	0
Plays video games with others ("online multi-player") in different locations				
Never	76.0	39.8	90.3	78.9
Less than once per month	1.8	3.4	0	5.6
1–4 times per month	13.2	12.5	6.5	8.9
1–4 times per week	9.0	25.0	3.2	4.4
5–7 times per week	0	19.3	0	2.2

from medium (among boys) to large (among girls). Interestingly, the amount of time girls with ASD spent playing video games was similar to that of typically developing boys. This suggests that diagnostic group differences are present irrespective of gender, and that diagnostic group differences may be especially pronounced for girls.

The underlying reasons for this preference for video games are not well understood. There is evidence that many individuals with ASD have strengths in visual perceptual skills (Jolliffe and Baron-Cohen 1997; Mottron et al. 2006; Shah and Frith 1993), and respond particularly well to visual stimuli (Mineo et al. 2009). These areas of relative strength may make visual media more inherently rewarding for individuals with ASD. Another possible explanation for this preference may relate to overall play skill patterns. Children with ASD often show deficits in both functional and symbolic play (Jarrold et al. 1993); however, they are able to demonstrate pretend play actions when specifically cued or prompted (Charman and Baron-Cohen 1997; Jarrold et al. 1996). With this in mind, children with ASD may prefer video game play to more self-directed or generative play activities. Video games offer inherent structure and prompting, and present circumscribed, yet imaginative, experiences for the user. Game rules are generally well-defined, yet users are able to engage freely within the confines of the game world. Video games also offer clear visual and/or auditory cues and immediate reinforcement. Rather than creating original play scenarios, which may be challenging for many children with ASD (Jarrold et al. 1996), users are able to choose from pre-determined options within the game. Video games also offer opportunities for mastery and achievement (Olson 2010), which may also increase their appeal for children with ASD.

In contrast, the amount of time spent watching television was not markedly different among children with ASD as compared to typically developing children. Both groups were reported to spend a relatively large amount of time on this activity, and significant differences were only observed when comparing girls with and without ASD. Even in this case, the observed effect size was relatively small. The overall similarity among groups in television viewing is interesting, and lends support to previous assertions that television is ubiquitous among American families, with approximately 99 % of families having at least one television set (Rideout et al. 2010; Roberts and Foehr 2008). Because television represents a more passive activity than video game play, it is also likely that television viewing may occur concurrently with other activities for some children. Assessment of multi-tasking (i.e., watching television while engaging in other activities) in future studies may reveal differential patterns of television use across varying levels of symptom severity or functional level.

Problematic Video Game Use

The results of the current study also provide new information about problematic aspects of video game play. Children with ASD in the current sample were reported to have significantly greater levels of problematic use of video games than typically developing children, and this was true for both genders. Among the most commonly reported problems were spending more time playing video games than with friends or family, thinking life would be boring without video games, thinking about video games even when not playing, feeling upset when not able to play, looking forward to the next gaming session, and having trouble disengaging or stopping him/herself from playing. All of these problems were endorsed at significantly higher levels among children with ASD than among typically developing children (for both genders). In addition, boys with ASD were reported to have significantly greater problems than typically developing boys in getting angry when interrupted from games, playing games to "get his mind off other things," and playing longer than intended. In contrast, girls with ASD were rated more highly than typically developing girls in playing video games "too much." These findings indicate that although there may be some gender-specific patterns, children with ASD of both genders are more likely to demonstrate problematic patterns of play than typically developing children. These results suggest that for many children with ASD, video game play can become salient and preoccupying, and can be associated with distress. Coupled with the fact that many children with ASD were reported to spend more time playing video games than engaging with friends or in other pro-social activities, this finding lends support to anecdotal concerns voiced by many parents and clinicians. Future research is needed to identify longitudinal predictors and consequences of problematic game use among children with ASD.

Research examining pathological video game use has recently begun to identify individual risk factors among the general population. In a recent longitudinal study examining trajectories of pathological gaming among 3,034 adolescents, Gentile and colleagues found that the amount of time spent playing video games and impulsivity at baseline predicted the number of pathological gaming symptoms. In addition, lower social competence and greater impulsivity also predicted increases over time in pathological gaming symptoms (Gentile et al. 2011). These findings suggest that children with ASD may be at greater risk for problematic gaming due, in part, to their core impairments in social competence (American Psychiatric Association 2000), and associated difficulties with impulsivity and response inhibition (Corbett et al. 2009). The inclusion of measures of core and associated symptoms of

ASD in future studies would be helpful in identifying factors that may predispose some children with ASD to become preoccupied with these media, and whether those factors are similar for both genders. Furthermore, previous studies have found that video game genre (particularly role-playing games) is related to pathological game use among typically developing adolescents (e.g., Rehbein et al. 2010). Thus, a specific examination of video game genre in predicting problematic gaming patterns among children with ASD will be important in future studies.

Social Media and Socially Interactive Game Play

Some have noted that although individuals with ASD spend a great deal of time using electronic media, this media may offer them an avenue for social interaction (Benford and Standen 2009; Brownlow et al. 2006; Muller et al. 2008). However, in the current study, children with ASD were reported to spend very little time using social media (including email, social media websites, or sending text messages). Children in the ASD group used social media an average of only 0.2 h per day. This was significantly less than typically developing siblings, who were reported to spend approximately 1 h each day using social media. Similarly, children with ASD were significantly less likely than typically developing children to play video games with other people, either in-person or online. The majority of children with ASD who played video games never played them with other people; whereas the majority of typically developing children played video games with others at least once per month.

These patterns indicate that the social difficulties associated with ASD may extend beyond face-to-face interactions. Children with ASD in the current sample spent little time interacting with friends in person, or engaging with others virtually using social media or video games. These findings call into question the assumption that electronic media is widely used for social interaction among children with ASD. Our findings may also be consistent with previous research conducted by Valkenburg and Peter (2007). Although they found that online communication may stimulate social intimacy among some adolescents; they also found that adolescents who were lonely, introverted or socially anxious were less likely to use the internet for social communication (Valkenburg and Peter 2007). Future research should examine whether and how social media use changes over time, particularly among adults with ASD.

Implications for Treatment

Given our strong evidence of preference for television and video games among children with ASD, clinicians may be able to maximize motivation and task engagement by incorporating electronic media technologies into interventions. For example, the use of video games may be an effective reinforcer that can be built into intervention programs to increase positive behaviors. This would be consistent with previous studies that have successfully used restricted interests or repetitive behaviors as motivators within intervention programs (Baker et al. 1998; Charlop-Christy and Haymes 1996; Wolery et al. 1985). For example, Baker et al. (1998) found that developing activities using a child's restricted interests resulted in intrinsically motivating opportunities for social play among children with autism.

There has also been increasing interest in video- and computer-based learning applications for autism intervention (Moore and Taylor 2000; Rayner et al. 2009). Bellini and Akullian (2007) concluded that existing evidence supports in the inclusion of video modeling and video self-modeling as an evidence-based practice for children with ASD. A number of studies using single-subject designs to examine video-based techniques have demonstrated treatment effects in a range of areas, including language and social communication skills (Charlop-Christy et al. 2000; Hetzroni and Tannous 2004; Sherer et al. 2001), behavioral functioning, and adaptive skills (Shipley-Benamou et al. 2002). Anecdotal descriptions also indicate that children with ASD particularly enjoy these computer-based intervention activities. For example, during the course of a multiple baseline design computer-based intervention study, Hetzroni and Tannous (2004) noted that "all participants preferred the computer interactive program" and that "they always wanted to go to work with the computer" (p. 110). Evidence supporting generalization of skills into real world contexts remains somewhat limited, however (Wainer and Ingersoll 2011). Care must also be taken to develop strategies for building generalization from solitary screen-media formats to real-world social situations, particularly given the current evidence that children with ASD do not appear to commonly initiate socially interactive screen-based media use. Additional research is needed to inform the development of interventions that leverage potentially positive aspects of these technologies, while reducing negative or problematic aspects of screen-based media use.

Limitations and Future Directions

The current study was limited by reliance on parent-report for constructs of interest. Future studies would benefit from more detailed characterization of the sample, including quantitative information about ASD symptom severity and level of cognitive, language and adaptive functioning. Although no group differences in activity participation were found based on parent-reported IQ in the current

sample, it is possible that standardized measurement of these constructs would reveal differential patterns of screen-based media use among children with varying levels of ASD symptom severity and IQ. One possibility is that individuals with greater symptom severity or lower intellectual functioning may spend more time using less cognitively demanding media, such as television; while those with milder symptom presentations may have increased engagement in a wider range of activities. Alternatively, excessive use of some screen-based media may be associated with the presence and intensity of restricted interests for children with ASD, irrespective of overall severity. In a recent study of screen-based media use among adolescents with autism in the National Longitudinal Transition Study-2 (NLTS2), functional cognitive abilities were found to be significant predictors of both video game play and social media use (i.e., email and internet chatting) (Mazurek et al. 2012). Orsmond and Kuo (2011) also found that adolescents with ASD and intellectual disabilities were less likely to use computers than those with average intelligence. Additionally, individuals with intellectual disabilities have been found to have difficulties with basic computer skills and technology (Davies et al. 2001; Li-Tsang et al. 2005). It is not yet known whether individuals with ASD with co-occurring intellectual disabilities have similar difficulties, or whether technological capability may be an area of relative strength for this population even in the presence of cognitive impairment.

Although the current study provides important information regarding the nature of screen-based media use among children with ASD, more research is needed in order to understand predictors and consequences of various patterns of media use. Although groups in the current sample did not differ on items assessing the perceived impact of video game use on homework completion or grades, more objective measures of academic performance and cognitive functioning are needed to more fully assess the relationships between these variables. This would also provide further information about whether the construct of pathological game use is valid for the current population.

Prospective longitudinal designs would be most helpful in order to determine whether and how screen-based media use influences functional outcomes and developmental trajectories of children with ASD. It will be particularly important to determine whether such effects are significant even after controlling for initial levels of severity and functioning. Given that studies among the general population have found associations between screen-based media use and academic performance, attention problems, obesity, and activity engagement (Hastings et al. 2009; Landhuis et al. 2007; Sharif et al. 2010; Sisson et al. 2010; Vandewater et al. 2004), these specific outcome areas will be important targets for examination among children with ASD. Future research in this area would inform the development of clinically-relevant screen-based media recommendations for both clinicians and families.

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