UNIVERSITY OF AMSTERDAM

UvA-DARE (Digital Academic Repository)

Children's Media Use and Its Relation to Attention, Hyperactivity, and Impulsivity

Beyens, I.; Valkenburg, P.M.

DOI
10.4324/9781003118824-26

Publication date
2022

Document Version
Final published version

Published in
The Routledge International Handbook of Children, Adolescents, and Media

License
Article 25fa Dutch Copyright Act (https://www.openaccess.nl/en/policies/open-access-in-dutch-copyright-law-taverne-amendment)

Link to publication

Citation for published version (APA):
Beyens, I., & Valkenburg, P. M. (2022). Children's Media Use and Its Relation to Attention, Hyperactivity, and Impulsivity. In D. Lemish (Ed.), *The Routledge International Handbook of Children, Adolescents, and Media* (2nd ed., pp. 202-210). (Routledge international handbooks). Routledge. https://doi.org/10.4324/9781003118824-26

General rights
It is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), other than for strictly personal, individual use, unless the work is under an open content license (like Creative Commons).

Disclaimer/Complaints regulations
If you believe that digital publication of certain material infringes any of your rights or (privacy) interests, please let the Library know, stating your reasons. In case of a legitimate complaint, the Library will make the material inaccessible and/or remove it from the website. Please Ask the Library: https://uba.uva.nl/en/contact, or a letter to: Library of the University of Amsterdam, Secretariat, P.O. Box 19185, 1000 GD Amsterdam, The Netherlands. You will be contacted as soon as possible.

UvA-DARE is a service provided by the library of the University of Amsterdam (https://dare.uva.nl)

Download date:12 Oct 2026

22

CHILDREN'S MEDIA USE AND ITS RELATION TO ATTENTION, HYPERACTIVITY, AND IMPULSIVITY

Ine Beyens and Patti M. Valkenburg

Abstract

A widely debated question is whether there is an association between children's media use and the development of ADHD. This chapter identifies the most important hypotheses for this association and reviews the main results of the empirical studies that addressed this association. The available evidence suggests that there is a small association between media use and the presence of ADHD-symptoms (i.e., attention problems, hyperactivity, and impulsivity). More specifically, an increase in violent media use is significantly associated with an increase in attention problems and impulsivity. The effect of fast-paced media use on ADHD is not yet clearly understood, as the empirical evidence is still too scant to allow meaningful conclusions. Altogether, the findings underline the crucial need for future research to systematically investigate individual differences in the association between children's media use and ADHD as well as underlying mechanisms that may explain the association.

Keywords: adolescents; ADHD; attention problems; hyperactivity; impulsivity; inattention; individual differences; internet; preschoolers; school-age children; social media; television; video games

Beyens, I., & Valkenburg, P.M. (2022). Children's media use and its relation to attention, hyperactivity, and impulsivity. In D. Lemish (Ed.), *The Routledge International Handbook of Children, Adolescents, and Media* (2nd ed., pp. 202-210). Routledge.

Children's media environment has changed considerably in the past decades. It has become more fast-paced, violent, and arousing, and has been targeting children at an ever younger age (Valkenburg & Piotrowski, 2017). During these same decades, the frequency of the diagnosis of Attention Deficit Hyperactivity Disorder (ADHD) among children has also significantly increased, from about 1.5 percent in the 1970s to 1980s to about 8.5 percent in the 1990s and early 2000s (Akinbami et al., 2011; Kelleher et al., 2000). ADHD is a behavioral disorder characterized by elevated levels of attention problems, hyperactivity, and impulsivity that are age-inappropriate, pervasive, and impair a child's cognitive and social-emotional functioning (American Psychiatric Association, 2013).

A widely debated question related to these parallel occurring changes is whether there is an association between children's media use and the development of ADHD. Knowledge of this association is essential not only for academics, but also for parents, educators, and society at large. Only if we know whether, and (if so) how and why, media influence children, can we develop tailored prevention and intervention strategies. Meta-analyses and reviews into the association between children's media use and ADHD or ADHD-related behavior have shown a rapid increase of studies published between the 1970s and 2020s (e.g., Beyens et al., 2018; Nikkelen, Valkenburg, et al., 2014). The aim of this chapter is to review this literature and discuss suggestions for future research.

Conceptualizations and Measures of ADHD and ADHD-Related Behavior

Studies on the association between media use and ADHD differ greatly in their conceptual and operational definitions of ADHD. Moreover, many of these studies have treated media effects on attention problems, impulsivity, and hyperactivity as identical and interchangeable. It is however quite possible that media exposure is differentially related to

attention problems, hyperactivity, and impulsivity (also see Nikkelen, Valkenburg, et al., 2014). In this chapter, we therefore not only review studies that investigated the effects of media on ADHD as a composite, but also studies that specifically focused on one of the three ADHD-symptoms. We define attention problems as the inability to focus attention to organizing and completing a task (i.e., children do not pay attention to what they are doing or are easily distracted). Impulsivity is defined as children's inability to control immediate actions (i.e., children do not think before they act and/or are impatient; Nigg, 2006). Hyperactivity is conceptualized as excessive physical activity (i.e., children are continuously in motion; Nigg, 2006).

The majority of empirical studies used a self-report or parent-report measure to assess ADHD and/or ADHD-related behavior, such as the ADHD questionnaire (Scholte & Van der Ploeg, 2010) and the distractibility/hyperactivity scale of the Parenting Stress Index (Abidin & Brunner, 1995). Other studies used teacher ratings (e.g., Ullmann et al., 1999), classroom observations, or scales based on the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 2013).

Hypotheses on the Media–ADHD Association

The effects of media use on ADHD have typically been attributed to two important characteristics of media: its fast pace (i.e., frequently occurring cuts, edits or scene changes, and highly active characters) and its violent content.

Fast Pace

Two hypotheses may explain the association between watching fast-paced media and ADHD or ADHD-related behaviors. The *arousal-habituation hypothesis* (Nikkelen, Valkenburg, et al., 2014) states that the fast pace of entertainment media may increase

arousal during and after exposure. It is assumed that in the long term children become habituated to this media-induced arousal stimulation. After repeated exposure, their arousal system adjusts itself to this continuous stimulation. In the long run, their baseline arousal level decreases, which in turn leads to boredom, inattention, or hyperactivity during other, less arousing activities.

The second hypothesis, the *scan-and-shift hypothesis* (Nikkelen, Valkenburg, et al., 2014), proposes that fast-paced entertainment media teach children to develop an attentional style that is characterized by scanning and shifting rather than selecting and focusing. As a result, children are less prepared to cope with other attentional tasks that require effortful attention, such as playing, reading, or homework (Jensen et al., 1997).

Violent Content

Two hypotheses may account for an association between violent media content and ADHD. The *violence-induced script hypothesis* (Nikkelen, Valkenburg, et al., 2014) argues that through exposure to violent media content, children acquire aggressive scripts. These scripts may lead to the performance of aggressive behavior, which is characterized by impulsivity and poor inhibitory control, such that the frequent activation of such scripts may lead to a learned behavioral style of poor self-control.

A second hypothesis on the association between the violent content of media and ADHD is the *violence-induced arousal-habituation hypothesis* (Nikkelen, Valkenburg, et al., 2014). As with fast-paced content, this hypothesis argues that frequent exposure to violent media may cause such high levels of arousal that it creates a desensitization effect, such that children's baseline arousal level declines. This state of under-arousal may ultimately lead to ADHD-related behaviors.

Empirical Evidence

The first empirical studies that investigated the effect of media use on ADHD among children date from the late 1970s (Anderson & Maguire, 1978; Anderson et al., 1977; Tower et al., 1979). Since then, nearly 60 empirical studies have been conducted, primarily in the US (32 cross-sectional, 20 longitudinal, and 7 experimental studies). These studies focused on a hodgepodge of different types of media use, including exposure to fast-paced (e.g., Lillard & Peterson, 2011) and violent content (e.g., Kronenberger et al., 2005), as well as the time spent viewing television (e.g., Ansari & Crosnoe, 2016), playing video games (e.g., Chan & Rabinowitz, 2006), and using social media (e.g., Boer et al., 2020). Thirteen studies focused on attention problems, six on hyperactivity, and six on impulsivity. Most studies (44) focused on ADHD as a composite. In this chapter, we discuss research covering all types of media use and organize the existing literature by the three ADHD-symptoms (i.e., attention problems, hyperactivity, and impulsivity) and ADHD as a composite.

Media Effects on Attention Problems

Four out of the five cross-sectional studies that investigated the association between media use and attention problems found evidence for a positive association. Chan and Rabinowitz (2006) and De Sousa (2011) found that adolescents in the U.S. and India, respectively, who spent more time playing video games than their peers reported higher levels of inattention than their peers. The results of Kronenberger et al. (2005) indicated that adolescents in the U.S. who spent more time playing violent video games and viewing violent television than their peers had poorer attentional skills than their peers. This was observed particularly among aggressive adolescents. Similarly, the study by Mazurek and Engelhardt (2013) showed that boys in the U.S .who engaged more often in problematic video game

playing showed more inattention symptoms than boys who engaged less often in problematic gaming, both among boys with typical development and boys diagnosed with ADHD. Finally, however, Linebarger (2015) found no association between video game playing and attention problems among preschoolers and school-age children in the U.S.

All four longitudinal studies that investigated the association between media use and attention problems revealed a positive association. In a study among mothers in the U.S., U.K., and Europe, Gueron-Sela and Gordon-Hacker (2020) found that more cumulative screen time among children at age 1 was associated with less focused attention four months later, but not vice versa. A similar association was observed in the longer term among children in the U.S.: Zimmerman and Christakis (2007) found that viewing violent and non-violent entertainment television (but not educational television) under age 3 was associated with attention problems 5 years later. Furthermore, Gentile et al. (2012) found evidence for transactional associations between overall and violent video game playing and attention problems among 8- to 17-year-olds in Singapore: Playing video games was associated with attention problems 1 year later, and vice versa. Likewise, Boer et al. (2020) investigated transactional associations between social media use and attention problems among Dutch 11- to 15-year-olds. They found that an increase in adolescents' social media use problems was associated with an increase in attention problems one year later, but not vice versa.

Finally, four experimental studies investigated the effect of program pacing on children's attention problems, with mixed results. Cooper et al. (2009) found that children in the U.K. who watched a fast-paced video showed fewer (rather than more) attentional problems than children who watched a slow-paced video. This seemed to be more pronounced among 4-year-olds than among 6- and 7-year-olds. In contrast, a study by Lillard and Peterson (2011) among 4-year-olds in the U.S. found that children who viewed a fast-paced program displayed more attentional problems after viewing the program compared with children who

viewed a slow-paced program and children who watched no television but engaged in drawing. In a follow-up study, Lillard et al. (2015) investigated the assumption that the fantastical content rather than the pace of the program could explain the attentional problems. They indeed found that it is not fast pacing but fantastic content that is problematic. In a similar vein, Kostyrka-Allchorne et al. (2019) found that U.K. children who watched a fast-paced video showed more attentional problems than children who watched a slow-paced video, but only when the content was realistic.

Together, with two exceptions, the cross-sectional, longitudinal, and experimental studies suggest that media use is associated with attention problems, among preschoolers as well as school-age children and adolescents, although in most studies, the reported associations were small.

Media Effects on Hyperactivity

Only six studies examined the association between media use and hyperactivity: four cross-sectional and two longitudinal studies. Except for one study (Chan & Rabinowitz, 2006), the cross-sectional studies found small to moderate positive associations, all in U.S. samples. In a sample of 3- to 6-year-olds, Miller et al. (2007) found a positive association between children's daily television viewing and their activity level. Linebarger (2015) found a positive association between children's video game playing and hyperactivity among 2- to 5-year-olds, but not among 6- to 8-year-olds. However, the association disappeared after adjusting for parenting style. In a study among 8- to 18-year-old boys, Mazurek and Engelhardt (2013) found that boys who showed more problematic video game use also showed more hyperactivity symptoms, among boys with typical development, but not among boys diagnosed with ADHD. However, Chan and Rabinowitz (2006) found no differences in

hyperactivity levels between heavier and lighter video game players, television viewers, and internet users among adolescents.

The two longitudinal studies yielded mixed results. Ansari and Crosnoe (2016) found that higher levels of hyperactivity at age four were related to higher levels of television viewing 1 year later among girls but not among boys in the U.S. In contrast, the study by Boer et al. (2020) among Dutch adolescents showed that social media use did not predict hyperactivity 1 year later, or vice versa. However, Boer and colleagues discovered that adolescents who more often used social media and who reported more social media use problems also reported higher levels of hyperactivity.

Overall, the studies seem to suggest that children who spend more time watching television, playing video games, or using social media than their peers display more hyperactivity symptoms than their peers. However, no evidence was found for the assumption that media use may stimulate hyperactivity.

Media Effects on Impulsivity

Six studies examined the association between media use and impulsivity: two cross-sectional, two longitudinal, and two experimental studies. All studies revealed a positive association, except for an experimental study by Anderson et al. (1977). Anderson and colleagues investigated whether U.S. children who had seen a fast-paced episode of *Sesame Street* would be more likely to be impulsive compared to children who had seen a slow-paced episode of *Sesame Street*. This prediction was rejected, as the number of impulsive children in the fast-paced condition was not significantly larger than in the slow-paced condition. The field experiment by Gadberry (1980) among 6-year-olds in the U.S. revealed that children

whose television viewing was restricted, showed less impulsivity than children who were assigned to the unrestricted television viewing group.

The results of the two cross-sectional studies –both among U.S. samples– pointed at positive associations between television viewing and video game playing with teacher ratings of impulsivity. A study by Anderson and Maguire (1978) indicated that the number of violent television programs that children regularly watched was positively related to teachers' ratings of children's impulsivity, although this association was only found among third and fourth graders, but not among fifth and sixth graders. The other cross-sectional study showed that 9- to 11-year-old boys (but not girls) who were regular video game players were being observed by their teachers as more impulsive (Lin & Lepper, 1987).

Finally, the two longitudinal studies also found positive associations between media use and impulsivity. Gentile et al. (2012) found evidence for bidirectional associations between overall and violent video game playing and impulsivity among Singaporean children. In another study, Boer et al. (2020) found that an increase in Dutch adolescents' social media use problems was associated with an increase in their impulsivity level one year later, but not vice versa.

Altogether, at present, the empirical evidence is too scant to allow meaningful conclusions about the association of media use with children's impulsivity. The limited empirical work shows that the pacing of media seems to be unrelated to children's impulsivity (Anderson et al., 1977) but that violent content seems to be related to higher levels of impulsivity (e.g., Anderson & Maguire, 1978). Other studies also revealed associations between the total time spent using media (i.e., viewing television, playing video games, or using social media) and impulsivity.

Media Effects on ADHD as a Composite

By far the most studies have focused on the effects of media on ADHD as a composite. The meta-analysis of Nikkelen, Valkenburg, et al. (2014) revealed a positive but small association of general media use and violent media use with ADHD. The effect of fast-paced media could not be assessed in the meta-analysis because too few studies focused on the pace of media content. A comparison of the effects of television viewing and videogame playing revealed no significant differences. Furthermore, the association between media use and ADHD was stronger among boys than among girls, but it did not differ as a function of age.

Likewise, studies that focused on ADHD as a composite that were published after the meta-analysis of Nikkelen, Valkenburg, et al. (2014) generally point at a positive association between media use and ADHD, both for overall (e.g., Levelink et al., 2020; Ra et al., 2018) and violent media use (e.g., Beyens et al., 2020; Nikkelen et al., 2016), and for television, computer, and video games (e.g., Levelink et al., 2020) as well as for internet use (e.g., Morita et al., 2021) and social media use (e.g., McNamee et al., 2021; Settanni et al., 2018). Some studies elucidated the boundary conditions of the association between media use and ADHD, suggesting that the association only holds for boys and not for girls (Nikkelen et al., 2015). In addition, two longitudinal studies investigated the direction of the media-ADHD association: While one study found support for small bidirectional associations between problematic internet use and ADHD among children in Japan (Morita et al., 2021), another study found that an increase in Dutch children's ADHD was associated with an increase in children's violent media use 1 year later, but not vice versa (Beyens et al., 2020).

Conclusion, Critique, and Suggestions for Future Research

The general picture that arises from the empirical studies suggests a positive association of violent media use with children's attention problems, impulsivity, and ADHD as a composite. Unfortunately, the role of the pacing of media content is not yet clearly understood. While Lillard and Peterson (2011) found that exposure to fast-paced content led to *more* attentional problems, Cooper et al. (2009) found that it was associated with *fewer* attentional problems. And Kostyrka-Allchorne et al. (2019) and Lillard et al. (2015) showed that it was not the pacing but fantastic content that was associated with attention problems. The finding that hardly any study has focused on fast-paced media as a cause of the media-ADHD association is remarkable. After all, most explanatory hypotheses that are available in the literature attribute the effects of media on ADHD to its fast pace.

Moreover, the great majority of the studies on media and ADHD are based on simple input–output designs, which only investigate the association between general media use (input) and ADHD (output) without exploring what underlies this association. None of the available studies have investigated the mediating role of the underlying mechanisms that they propose, such as arousal and executive functioning. In fact, many studies have failed to argue precisely why media and ADHD could be related. Therefore, there is an apparent need for research that examines the differential effects of violent and fast-paced content on ADHD and ADHD-related behavior, while testing the specific mechanisms that may explain these associations.

The far majority of the studies on media use and ADHD employed cross-sectional designs. This is surprising: While some of the hypotheses on the media–ADHD association lend themselves to short-term experimental investigation (e.g., scan-and-shift hypothesis), most other hypotheses assume a longer-term cumulative effect of repeated media exposure (e.g., fast-pace arousal-habituation hypothesis and violence-induced arousal-habituation

hypothesis). To investigate the latter hypotheses, longitudinal studies are needed. Such studies are also needed to single out the causal direction of the association. Up until now, it remains unclear whether media use is a cause or a consequence of ADHD-related behavior: While some studies suggest that media use is both a cause and consequence of attention problems and impulsivity (e.g., Gentile et al., 2012), other studies suggest that media use is a cause but not a consequence of attention problems and impulsivity (e.g., Boer et al., 2020), and yet other studies suggest that media use is a consequence but not a cause of ADHD (e.g., Beyens et al., 2020). Apparently, more longitudinal work is needed to disentangle the direction of the media-ADHD association.

While theoretical arguments exist to expect age differences in the association between children's media use and ADHD-related behaviors, the results of the current literature review and the meta-analysis of Nikkelen, Valkenburg, et al. (2014) yielded no robust evidence for a moderating effect of age. This may be due to the fact that hardly any studies investigated age differences. While some studies suggest that younger children are more susceptible than older children to the effects of media use on ADHD (e.g., Linebarger, 2015), more research is needed to reach any decisive conclusions. In addition, there are some indications that gender and trait aggression may enhance the association between media use and ADHD-related behavior. However, while a moderating effect of gender was found in the meta-analysis of Nikkelen, Valkenburg, et al. (2014), the empirical evidence regarding the moderating effect of trait aggression is as yet too weak to allow decisive conclusions, as it has been investigated in only one study (Kronenberger et al., 2005).

Overall, hardly any of the empirical studies have investigated individual differences in the media-ADHD association (for exceptions, see, for instance Linebarger, 2015; Nikkelen et al., 2016; Nikkelen, Vossen, et al., 2014). This is remarkable, because it is highly conceivable that children differ in their susceptibility to media effects on ADHD. For example, it is likely

that violent and fast-paced media have a small and negligible influence on the great majority of children but a large influence on a small subgroup of children (Valkenburg & Peter, 2013). Therefore, there is a crucial need for future research to systematically investigate whether and how age, gender, and other individual-difference variables may enhance (or reduce) media effects on ADHD and ADHD-like behavior. After all, only if we know which children are particularly susceptible to specific media are we able to adequately target prevention and intervention strategies at these children.

References

Abidin, R. R., & Brunner, J. F. (1995). Development of a parenting alliance inventory. *Journal of Clinical Child Psychology, 24*(1), 31-40. https://doi.org/10.1207/s15374424jccp2401_4

Akinbami, L. J., Liu, X., Pastor, P. N., & Reuben, C. A. (2011). Attention deficit hyperactivity disorder among children aged 5–17 years in the United States, 1998–2009. *NCHS Data Brief, 70*, 1-8.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). American Psychiatric Publishing.

Anderson, C. C., & Maguire, T. O. (1978). Effect of TV viewing on the educational performance of elementary school children. *Alberta Journal of Educational Research, 24*(3), 156-163.

Anderson, D. R., Levin, S. R., & Lorch, E. P. (1977). The effects of TV program pacing on the behavior of preschool children. *AV Communication Review, 25*(2), 159-166. https://doi.org/10.1007/BF02769779

Ansari, A., & Crosnoe, R. (2016). Children's hyperactivity, television viewing, and the potential for child effects. *Children and Youth Services Review, 61*, 135-140. https://doi.org/10.1016/j.childyouth.2015.12.018

Beyens, I., Piotrowski, J. T., & Valkenburg, P. M. (2020). Which came first? Assessing transactional relationships between children's violent media use and ADHD-related behaviors. *Communication Research, 47*(8), 1228-1245. https://doi.org/10.1177/0093650218782300

Beyens, I., Valkenburg, P. M., & Piotrowski, J. T. (2018, Oct 2). Screen media use and ADHD-related behaviors: Four decades of research. *Proceedings of the National Academy of Sciences, 115*(40), 9875-9881. https://doi.org/10.1073/pnas.1611611114

Boer, M., Stevens, G., Finkenauer, C., & van den Eijnden, R. (2020). Attention deficit hyperactivity disorder-symptoms, social media use intensity, and social media use problems in adolescents: Investigating directionality. *Child Development, 91*(4), e853-e865. https://doi.org/10.1111/cdev.13334

Chan, P. A., & Rabinowitz, T. (2006). A cross-sectional analysis of video games and attention deficit hyperactivity disorder symptoms in adolescents. *Annals of General Psychiatry, 5*, Article 16. https://doi.org/10.1186/1744-859X-5-16

Cooper, N. R., Uller, C., Pettifer, J., & Stolc, F. C. (2009). Conditioning attentional skills: Examining the effects of the pace of television editing on children's attention. *Acta Paediatrica, 98*(10), 1651-1655. https://doi.org/10.1111/j.1651-2227.2009.01377.x

De Sousa, A. (2011). Video game usage and attention deficit hyperactivity disorder symptoms in adolescents. *Indian Journal of Private Psychiatry, 5*(1), 55-59.

Gadberry, S. (1980). Effects of restricting first graders' TV-viewing on leisure time use, IQ change, and cognitive style. *Journal of Applied Developmental Psychology, 1*(1), 45-57. https://doi.org/10.1016/0193-3973(80)90061-1

Gentile, D. A., Swing, E. L., Lim, C. G., & Khoo, A. (2012). Video game playing, attention problems, and impulsiveness: Evidence of bidirectional causality. *Psychology of Popular Media Culture, 1*(1), 62-70. https://doi.org/10.1037/a0026969

Gueron-Sela, N., & Gordon-Hacker, A. (2020). Longitudinal links between media use and focused attention through toddlerhood: A cumulative risk approach. *Frontiers in Psychology, 11*, Article 569222. https://doi.org/10.3389/fpsyg.2020.569222

Jensen, P. S., Mrazek, D., Knapp, P. K., Steinberg, L., Pfeffer, C., Schowalter, J., & Shapiro, T. (1997). Evolution and revolution in child psychiatry: ADHD as a disorder of adaptation. *Journal of the American Academy of Child and Adolescent Psychiatry, 36*(12), 1672-1681. https://doi.org/10.1097/00004583-199712000-00015

Kelleher, K. J., McInerny, T. K., Gardner, W. P., Childs, G. E., & Wasserman, R. C. (2000). Increasing identification of psychosocial problems: 1979-1996. *Pediatrcs, 105*(6), 1313-1321. https://doi.org/10.1542/peds.105.6.1313

Kostyrka-Allchorne, K., Cooper, N. R., & Simpson, A. (2019). Disentangling the effects of video pace and story realism on children's attention and response inhibition. *Cognitive Development, 49*, 94-104. https://doi.org/10.1016/j.cogdev.2018.12.003

Kronenberger, W. G., Mathews, V. P., Dunn, D. W., Wang, Y., Wood, E. A., Giauque, A. L., Larsen, J. J., Rembusch, M. E., Lowe, M. J., & Li, T. Q. (2005). Media violence exposure and executive functioning in aggressive and control adolescents. *Journal of Clinical Psychology, 61*(6), 725-737. https://doi.org/10.1002/jclp.20022

Levelink, B., van der Vlegel, M., Mommers, M., Gubbels, J., Dompeling, E., Feron, F. J. M., van Zeben-van der Aa, D. M. C. B., Hurks, P., & Thijs, C. (2020). The longitudinal relationship between screen time, sleep and a diagnosis of attention-deficit/hyperactivity disorder in childhood. *Journal of Attention Disorders*. Advance online publication. https://doi.org/10.1177/1087054720953897

Lillard, A. S., Drell, M. B., Richey, E. M., Boguszewski, K., & Smith, E. D. (2015). Further examination of the immediate impact of television on children's executive function. *Developmental Psychology, 51*(6), 792-805. https://doi.org/10.1037/a0039097

Lillard, A. S., & Peterson, J. (2011). The immediate impact of different types of television on young children's executive function. *Pediatrics, 128*(4), 644-649. https://doi.org/10.1542/peds.2010-1919

Lin, S., & Lepper, M. R. (1987). Correlates of children's usage of videogames and computers. *Journal of Applied Social Psychology, 17*(1), 72-93. https://doi.org/10.1111/j.1559-1816.1987.tb00293.x

Linebarger, D. L. (2015). Contextualizing video game play: The moderating effects of cumulative risk and parenting styles on the relations among video game exposure and problem behaviors. *Psychology of Popular Media Culture, 4*(4), 375-396. https://doi.org/http://dx.doi.org/10.1037/ppm0000069

Mazurek, M. O., & Engelhardt, C. R. (2013). Video game use in boys with autism spectrum disorder, ADHD, or typical development. *Pediatrics, 132*(2), 260-266. https://doi.org/10.1542/peds.2012-3956

McNamee, P., Mendolia, S., & Yerokhin, O. (2021). Social media use and emotional and behavioural outcomes in adolescence: Evidence from British longitudinal data. *Economics & Human Biology, 41*, Article 100992. https://doi.org/10.1016/j.ehb.2021.100992

Miller, C. J., Marks, D. J., Miller, S. R., Berwid, O. G., Kera, E. C., Santra, A., & Halperin, J. M. (2007). Brief report: Television viewing and risk for attention problems in preschool children. *Journal of Pediatric Psychology, 32*(4), 448-452. https://doi.org/10.1093/jpepsy/jsl035

Morita, M., Ando, S., Kiyono, T., Morishima, R., Yagi, T., Kanata, S., Fujikawa, S., Yamasaki, S., Nishida, A., & Kasai, K. (2021). Bidirectional relationship of problematic Internet use with hyperactivity/inattention and depressive symptoms in adolescents: a population-based cohort study. *European Child & Adolescent Psychiatry*. Advance online publication. https://doi.org/10.1007/s00787-021-01808-4

Nigg, J. T. (2006). *What causes ADHD? Understanding what goes wrong and why*. Guilford Press.

Nikkelen, S., Vossen, H., Piotrowski, J., & Valkenburg, P. (2016). Media violence and adolescents' ADHD-related behaviors: The role of parental mediation. *Journal of*

Broadcasting & Electronic Media, 60(4), 657-675. https://doi.org/10.1080/08838151.2016.1234476

Nikkelen, S. W. C., Valkenburg, P. M., Huizinga, M., & Bushman, B. J. (2014). Media use and ADHD-related behaviors in children and adolescents: A meta-analysis. *Developmental Psychology, 50*(9), 2228-2241. https://doi.org/10.1037/a0037318

Nikkelen, S. W. C., Vossen, H. G. M., & Valkenburg, P. M. (2015). Children's television viewing and ADHD-related behaviors: Evidence from the Netherlands. *Journal of Children and Media, 9*(4), 399-418. https://doi.org/10.1080/17482798.2015.1088872

Nikkelen, S. W. C., Vossen, H. G. M., Valkenburg, P. M., Velders, F. P., Windhorst, D. A., Jaddoe, V. W. V., Hofman, A., Verhulst, F. C., & Tiemeier, H. (2014). Media violence and children's ADHD-related behaviors: A genetic susceptibility perspective. *Journal of Communication, 64*(1), 42-60. https://doi.org/10.1111/jcom.12073

Ra, C. K., Cho, J., Stone, M. D., De La Cerda, J., Goldenson, N. I., Moroney, E., Tung, I., Lee, S. S., & Leventhal, A. M. (2018). Association of digital media use with subsequent symptoms of attention-deficit/hyperactivity disorder among adolescents. *Journal of the American Medical Association, 320*(3), 255-263. https://doi.org/10.1001/jama.2018.8931

Scholte, E. M., & Van der Ploeg, J. D. (2010). *ADHD-vragenlijst [ADHD questionnaire] (3rd revised ed.)*. Bohn Stafleu van Loghum.

Settanni, M., Marengo, D., Fabris, M. A., & Longobardi, C. (2018). The interplay between ADHD symptoms and time perspective in addictive social media use: A study on adolescent Facebook users. *Children and Youth Services Review, 89*, 165-170. https://doi.org/10.1016/j.childyouth.2018.04.031

Tower, R. B., Singer, D. G., Singer, J. L., & Biggs, A. (1979). Differential effects of television programming on preschoolers' cognition, imagination, and social play.

American Journal of Orthopsychiatry, 49(2), 265-281. https://doi.org/10.1111/j.1939-0025.1979.tb02608.x

Ullmann, R. K., Sleator, E. K., & Sprague, R. L. (1999). *ADD-H Comprehensive Teacher's Rating Scale (ACTeRS)* (2nd ed.). MetriTech Inc.

Valkenburg, P. M., & Peter, J. (2013). The differential susceptibility to media effects model. *Journal of Communication, 63*(2), 221-243. https://doi.org/10.1111/jcom.12024

Valkenburg, P. M., & Piotrowski, J. T. (2017). *Plugged in: How media attract and affect youth*. Yale University Press.

Zimmerman, F. J., & Christakis, D. A. (2007). Associations between content types of early media exposure and subsequent attentional problems. *Pediatrics, 120*(5), 986. https://doi.org/10.1542/peds.2006-3322

Authors

Ine Beyens, Ph.D., is an Assistant Professor in the Amsterdam School of Communication Research (ASCoR) at the University of Amsterdam. Her research focuses on the effects of media on the cognitive, affective, and social well-being of children and adolescents, with a special focus on differential susceptibility to media influences.

Patti M. Valkenburg, Ph.D., is University Distinguished Professor at the University of Amsterdam. Her research interests include the cognitive, emotional, and behavioral effects of old and new media on children, adolescents, and adults.