Children’s Media Use and its Relation to Attention, Hyperactivity, and Impulsivity

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Abstract

A widely held concern is whether there is a relationship between children’s media use and the development of ADHD. This chapter reviews the literature on this issue. We identify the most important hypotheses on this relationship. Then, we review the main results of the empirical studies that address this relationship, by combining a qualitative literature review with the results of a formal meta-analysis. The concluding picture reflects a negative relationship between media use and the presence of ADHD-symptoms (i.e., inattention, hyperactivity, and impulsivity). More specifically, violent media use was significantly associated with ADHD. An effect of fast-paced media use on ADHD could not be established, as the number of available studies that examined this relationship was too limited. The meta-analysis underlines the crucial need for future research to systematically investigate individual differences that may moderate the relation between children’s media use and ADHD.
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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 (e.g., Allen, Livingstone, & Reiner, 1998; Koolstra, van Zanten, Lucassen, & Ishaak, 2004). 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% in the ’70 – ’80s to about 8.5% in the ’90s and early 2000s (Akinbami, Liu, Pastor, & Reuben, 2011; Kelleher, McInerny, Gardner, Childs, & Wasserman, 2000). ADHD is a behavioral disorder characterized by elevated levels of inattentiveness, hyperactivity, and impulsivity that (a) are age-inappropriate, (b) pervasive, and (c) impair a child’s cognitive and social-emotional functioning (American Psychiatric Association, 2000).

A widely held concern related to these parallel occurring changes is whether there is a relationship between children’s media use and the development of ADHD. Knowledge of this relationship is essential not only for academics, but also for parents, educators, and the society at large. Only if we know whether, and (if so) how and why media influence children, we can develop tailored prevention and intervention strategies. A recent literature search into the relationship between children’s media use and ADHD or ADHD-related behavior indicated a rapid increase of studies published between the ‘70s and 2011 (see Nikkelen, Huizinga, & Valkenburg, 2013). The results of these studies are however very inconsistent. Some have reported positive relationships between media use and ADHD, whereas others have found no relationships at all (for similar observations, see Kirkorian, Wartella, & Anderson, 2008; Schmidt & Vandewater, 2008).
The aim of this chapter is to review the literature on the relationship between media use and ADHD or ADHD-related behavior. In the next sections, we will first identify the most important hypotheses on the relationship between media use, ADHD and ADHD-related behavior. Then, we will review the main results of the empirical studies that address the relationship between media use and ADHD and the three symptoms of ADHD: inattentiveness, hyperactivity, and impulsivity. Finally, we will discuss some limitations in previous literature and present some suggestions for future research.

**Conceptualizations and Measures of ADHD and ADHD-related behavior**

Studies on the relationship between media use and ADHD differ greatly in their conceptual and operational definitions of ADHD. Moreover, many of these studies have treated media-effects studies on inattentiveness, impulsivity, and hyperactivity as identical and interchangeable. It is however quite possible that media-exposure is differentially related to inattentiveness, hyperactivity, and impulsivity. In this chapter, we therefore not only review the studies that investigated the effects of media on ADHD as a composite, but also those studies that specifically focused on one of the three ADHD-symptoms. We define inattentiveness as the inability to focus deliberate, conscious attention to organizing and completing a task (i.e., children do not pay attention to what they are doing). Impulsivity is defined as children’s inability to control immediate actions (i.e., children do not think before they act and/or are impatient). Hyperactivity is conceptualized as excessive physical activity (i.e., children are continuously in motion; Barkley, 1997; Nigg, 2006).

The majority of empirical studies used a self-report measure to assess ADHD and/or ADHD-related behavior, such as parent ratings (e.g., the distractibility/hyperactivity scale of the Parenting Stress Index; Abidin & Brunner, 1995; Levine & Waite, 2000), or the Conner’s Parent
Rating Scale (CPRS; Chan & Rabinowitz, 2006). Other studies used teacher ratings (Levine & Waite, 2000; Ullmann, Sleater, & Sprague, 1991), classroom observations (Levine & Waite, 2000), or other scales based on the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association [DSM-IV-TR], 2000; Miller, Marks, Miller, Berwid, Kera et al., 2007).

Hypotheses on the Media - ADHD Relationship

Many studies on the effect of media use on ADHD have failed to argue precisely why media and ADHD could be related (e.g., Chan & Rabinowitz, 2006; Miller, Marks, Miller, Berwid, Kera et al., 2007; Özmert, Toyran, & Yurdakok, 2002). 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 relationship between watching fast-paced media and ADHD or ADHD-related behaviors. The Arousal-Habituation Hypothesis states that the fast pace of entertainment media may increase arousal during and after exposure. Arousal is caused by eliciting frequent shifts in attention and renewed orienting responses during watching (Lang, Zhou, Schwartz, Bolls, & Potter, 2000). It is assumed that in the long term, children get 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, which we refer to as the Scan-and-Shift Hypothesis, proposes that fast-paced entertainment media teaches the child to develop an attentional style that can be
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, Mrazek, Knapp, Steinberg, Pfeffer, Schowalter, & Shapiro, 1997).

**Violent content.** Two hypotheses may account for a relationship between violent media content and ADHD. The *Violence Induced Script Hypothesis* argues that violent content in entertainment media hinders the development of self-control (Zimmerman & Christakis, 2007). Several studies have found that exposure to violent media is related to self-control and the activation of brain regions underlying self-control (Hummer et al., 2010; Mathews et al., 2005; Wang et al., 2009). An explanation for this finding may be that violent media activates an aggressive script in the individual (Hummer et al., 2010; Kronenberger et al., 2005). Since aggressive behavior is associated with proactive, impulsive behavior with no inhibition of inappropriate responses, the frequent activation of such a script may lead to a learned behavioral style of poor self-control.

A second hypothesis on the relationship between the violent content of media and ADHD is the *Violence-Induced Arousal Habituation Hypothesis.* This hypothesis argues that media violence can induce high arousal levels in the viewer (C. A. Anderson & Bushman, 2001; Fleming & Rickwood, 2001). Furthermore, the more violent the content is, the higher the increase in arousal (Barlett, Harris, & Bruey, 2008). However, after some time a *desensitization effect* may occur. For example, playing an arousing video game causes a high increase in arousal at first, but this increase may become less when playing the game for several times (Ballard, Hamby, Panee, & Nivens, 2006). As with fast-paced programs, high exposure to violent content
may cause such high levels of arousal that after frequent exposure, the baseline arousal level becomes significantly lower, possibly leading to attention problems and hyperactivity.

**Empirical Evidence**

The literature search of Nikkelen et al. (2013) included 33 studies (20 cross-sectional, 11 longitudinal, and two experimental studies). Three of these studies focused on a separate, specific measure of inattentiveness. One study included a specific measure of hyperactivity, and three studies included a specific measure of impulsivity. The numbers of the studies into the separate ADHD-symptoms proved to be too small to justify a formal meta-analysis. Therefore, we used a qualitative meta-analysis to integrate these studies, and a formal quantitative meta-analysis (Comprehensive Meta-Analysis 2.2; Borenstein, Hedges, Higgins, & Rothstein, 2005) to review the media-effect studies focusing on ADHD as a composite.

**Media Effects on Inattentiveness**

Three cross-sectional studies investigated the relationship between media use and inattentiveness. One study examined the effect of adolescents’ violent television viewing and violent video game playing habits on executive function and attention (Kronenberger et al., 2005), one study focused on the link between time spent watching television and playing videogames and inattentiveness in adolescents (Chan & Rabinowitz, 2006), and the third study examined the correlation between TV viewing and attention among 9-year-old children (Schittenhelm, Ennemoser, & Schneider, 2010). The results of Kronenberger et al. (2005) indicated a significant negative association between violent media use and attentional skills ($r = -0.47$). Schittenhelm et al. (2010) found a negative relationship between TV viewing and attentional skills ($r = -0.41$), whereas Chan and Rabinowitz (2006) found a negative relationship for videogames only ($r = -0.37$). Finally, Kronenberger et al. (2005) found a significant
moderating effect of aggression on the media-violence by attention relation ($p < .05$), indicating that the media-violence effect was stronger in aggressive adolescents.

One longitudinal study investigated the relationship between media use and inattentiveness (Maaß, Hahlweg, Naumann, Bertram, Heinrichs, & Kuschel, 2010). This study indicated that TV viewing by preschool children was negatively related to attention skills four years later ($r = -.26$). Thus, these four studies suggest a negative association between media use and attention skills, which may be stronger for aggressive children (see Kronenberger et al., 2005).

**Media Effects on Hyperactivity**

Only one study examined the relationship between media use and hyperactivity (Miller, Marks, Miller, Berwid, Kera et al., 2007), by investigating the association between high levels of television viewing and activity level in preschool children. The results indicated a positive relation between children's daily television viewing and their activity level ($r = .20$).

**Media Effects on Impulsivity**

Three studies examined the relationship between media use and impulsivity. One study found no significant effect (D. R. Anderson, Levin, & Lorch, 1977), the other two studies yielded a negative effect (C. C. Anderson & Maguire, 1978; Lin & Lepper, 1987). D. R. Anderson et al. (1977) experimentally tested whether the pacing of a television program influenced 4-year-old children's behavior post-viewing. One cross-sectional study by C. C. Anderson and Maguire (1978) examined whether the extent of watching different types of television programs was related to teacher's ratings of third and fourth graders’ impulsivity, compared to fifth and sixth graders. The other cross-sectional study examined the relationship between home video game usage and teacher ratings of impulsivity of children from fourth to
sixth grade (Lin & Lepper, 1987). D. R. Anderson et al. (1977) predicted that children who had seen a fast-paced episode of Sesame Street were more likely to be impulsive, compared to children who had seen a slow-paced episode of Sesame Street. This prediction was however rejected, as the amount of impulsive children in the fast-paced condition (5 out of 24) was not significantly larger than in the slow-paced condition (7 out of 24). In contrast, the results of C. C. Anderson & Maguire (1978) indicated that the number of violent television programs that children regularly watched was positively related to children's impulsivity, although this effect accounted only for the younger age group ($r = .29$). In the older age group however, violence did not play a significant role, but only the total number of regularly watched television programs was positively related to impulsivity ($r = .35$). Finally, the results of Lin and Lepper (1987) indicated no significant correlations between home video game use and impulsivity in either boys ($r = .00$) or girls ($r = .09$). Summarized, the pacing of media (i.e., Sesame Street) is not related to children’s impulsivity (D. R. Anderson et al., 1977). In contrast, one cross-sectional study found a negative link between media violence and impulsivity. This study also suggested that media effects on impulsivity are stronger for younger children and for boys.

**Media Effects on ADHD as a Composite**

As discussed, only the media-effects literature on ADHD as a composite variable allowed for a formal meta-analysis. A detailed description of the meta-analytic approach falls beyond the scope of this chapter (but see for an in-depth discussion, Nikkelen et al., 2013). The meta-analysis revealed a positive relationship between general media use and violent media use and ADHD, although the strength of this relationship was small ($r = .12$ and $r = .12$, respectively). The effect of fast-paced programs could not be assessed because only two studies measured fast media use (D. R. Anderson et al., 1977; Tower, Singer, Singer, & Biggs, 1979). A comparison
of the effects of television viewing and videogame playing revealed no significant differences. Further, the strength of the relationship between media use and ADHD did not differ as a function of age. However, the meta-analysis indicated a marginal effect, suggesting that the media-ADHD effect is stronger for boys than for girls. The effects of the current meta-analysis are considerably smaller compared to the review of the empirical studies that separately address the ADHD-symptoms. Our meta-analysis however provides a more reliable conclusion, as the outcome reflects the pattern among the study results (i.e., the true effect size), as opposed to a less precise effect size derived from single studies, under a given single set of assumptions and conditions (e.g., Borenstein, Hedges, Higgins, & Rothstein, 2005).

Conclusions and Suggestions for Future Research.

The general picture that arises from our review of the few empirical studies that specifically examined one of the three ADHD-symptoms (inattention, hyperactivity, and impulsivity) suggests a negative relationship between media use and the presence of these ADHD-symptoms. Violent media use seem to hinder attentional skills (e.g., Kronenberger et al., 2005), and to stimulate hyperactivity (Singer et al., 1984), and impulsivity (e.g., C. C. Anderson & Maguire, 1978; Lin & Lepper, 1987). In addition, the results of a meta-analysis that focused on the effects of fast pace and violent content of media on a composite score of ADHD indicated that violent media use was significantly, albeit weakly, associated with ADHD. The effect of fast-paced media use on ADHD could not be established, because the number of available studies that examined this relationship was too small. Age did not moderate the effects of violent and fast-paced media use on ADHD. Finally, gender and aggressive tendency might moderate the effect of media on ADHD, but the evidence is too weak to draw decisive conclusions.
The finding that hardly any study has focused on the fast-paced media as a cause of the media-ADHD relationship is remarkable. After all, most explanatory hypotheses that are available in the literature attribute the effects of media to its fast pace (e.g., Jensen et al., 1997; Lang et al., 2000). Moreover, the great majority of the studies on media and ADHD are based on simple input-output designs, which only investigate the relationship between general media use (input) and ADHD (output) without exploring what underlies this relationship. None of the available studies have actually addressed the mediating role of underlying mechanisms that they propose, such as arousal and executive functioning (e.g., Anderson, C. A., & Bushman, 2001; Barkley, 2007; Barlett, Harris, & Bruey, 2008; Kronenberger et al., 2005). Therefore, there is an urgent need for future research that examines the differential effects of violent content and fast pace on ADHD and ADHD-related behavior, while testing the specific mechanisms that may explain these relationships.

The media effects of the meta-analysis of Nikkelen et al. (2013) are smaller than those found in meta-analyses on the relationship between media violence and aggression (e.g., C. Anderson et al., 2004). However, unlike in the field of media violence and aggression, the far majority of the studies on media use and ADHD employed cross-sectional designs. Therefore, unlike the media-violence-aggression literature, the media-ADHD literature does not allow us to decisively single out the causal direction of the relationships. Thus, despite the results of the meta-analysis, it remains unclear whether media use is the cause or the consequence of ADHD or ADHD-like behavior. To solve this gap in the literature, there is a vital need for future research that applies experimental or longitudinal designs.

The results of the current literature review yielded no evidence for moderating effects of age on ADHD. This may be due to the fact that hardly any studies investigated differences between
different age groups. In addition, there are some indications that gender and trait aggression may
enhance the relationship between media use and ADHD-related behavior. However, the evidence
for these latter moderating relationships is too weak to allow decisive conclusions, as the
moderating effect of trait aggression has been investigated in only one study (Kronenberger et
al., 2005). The moderating effect of gender on ADHD was however found in the meta-analysis
of Nikkelen et al. (2013), and this effect is based on the percentages of boys and girls in the
empirical studies included in the meta-analysis. In general, such an approach to detect gender
differences is however not the most reliable method (e.g., Bushman, Huesmann, & Whitaker,
2009).

To date, hardly any of the empirical studies have investigated whether the media-ADHD
relationship differs for boys and girls and for other possible individual difference variables. 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 rapidly paced media have a small and
negligible influence on the far majority of children but a large influence on a small subgroup of
children. Therefore, there is 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


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