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The role of media entertainment in children's and adolescents' ADHD-related behaviors: A reason for concern?

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General introduction

More than ever, today's children are growing up in a highly competitive and performance-oriented society. As a natural consequence, those children with developmental problems stand out from their peers and are of particular concern. One developmental disorder that has come under increased scrutiny is attention-deficit/hyperactivity disorder (ADHD). ADHD is characterized as a cluster of three main symptom behaviors (American Psychiatric Association, 2013): inattention (i.e., problems staying concentrated, being distracted easily), hyperactivity (i.e., being restless, fidgety), and impulsivity (i.e., problems in inhibiting inappropriate behavior or responses, not thinking before acting). With a prevalence ranging from 5.0 to 7.1% (Willcutt, 2012), it is one of the most common childhood developmental disorders, and often continues in adulthood (Faraone, Biederman, & Mick, 2006). The behavior problems of children with ADHD are particularly apparent in the classroom, where children are required to remain seated and focused for continuous periods of time. Not surprisingly, children with ADHD generally have lower academic performance than their typically developing peers (Loe & Feldman, 2007). However, these children also face problems in other domains. For example, ADHD is associated with significant peer problems (e.g., they have less friends and are less liked by their peers, Wehmeier, Schacht, & Barkley, 2010) and have a higher risk of later substance abuse (Bidwell, Henry, Willcutt, Kinnear, & Ito, 2014). As a result of these and other challenges, ADHD is associated with high economic costs for society. To illustrate, a recent report using the Netherlands as an example (Le et al., 2014) estimated an annual national cost of €1,041 million to €1,529 million that can be attributed to ADHD (e.g., including costs related to education, healthcare, and social services). ADHD is clearly of great concern to parents, teachers, healthcare professionals, as well as society at large.

Against common presumptions and worries that ADHD diagnosis rates have been rising, recent research has shown that the prevalence of ADHD has remained stable in the past decades (Polanczyk, Willcutt, Salum, Kieling, & Rohde, 2014). There has been, however, a growing awareness of ADHD and an alarming increase in the prescription of drugs to treat ADHD symptoms (Mehlkopf, Houweling, Heerdink, & Penning-van Beest, 2012), which has fueled the scientific and public interest in the disorder. In particular, the past decades have witnessed an increasing concern that excessive use of entertainment media (i.e., television and video games) may elicit ADHD symptoms in children. Due to and synchronous with these concerns, research on the potential relationship between entertainment media use and ADHD has accumulated. The results of some of these studies have been extensively covered in the popular press, with cautionary news headlines such as, *'Pants-wearing sponge blamed for kid's poor attention spans'* (Rubin, 2011, December 9), *'Television kids develop attention problems, study claims'*

(Green, 2012, February 3), and *'Children who play video games for two hours a day may 'DOUBLE risk of getting ADHD'* (Daily Mail Reporter, 2010, July 8). However, in contrast to what these headlines may suggest, studies on the media-ADHD relationship have not yet resulted in a clear picture of this association. It is still unknown, for example, what type of media (in terms of form and content) may be associated with ADHD, whether such relationships are the same for all children, and the direction of the relationship between media use and ADHD. It is therefore perhaps not surprising that recent literature reviews within the field of child psychology and psychiatry do not consider the role of children's entertainment media use in the development of children's ADHD symptoms (Tarver, Daley, & Sayal, 2014; Thapar, Cooper, Eyre, & Langley, 2013). However, given the importance of media in children's lives today, it is crucial that researchers work to disentangle the relationship between media use and ADHD. The focus of this dissertation is therefore to provide a nuanced perspective on this relationship in children and adolescents. Insights into the role of media use in ADHD may guide future non-medical interventions aimed at reducing ADHD symptoms. After all, strategies to regulate children's media use may be less pervasive than treatment with drugs, and may be relatively easily implemented.

Conceptualization of ADHD

Although ADHD traditionally represents a clinical diagnostic disorder, with a clear cut-off between children with and without the disorder, ADHD is measured as a continuous variable throughout the studies in this dissertation. There has been an increasing trend in psychology towards conceptualizing several conditions, including ADHD, on a spectrum rather than as qualitatively distinct, categorical disorders (e.g., Krueger & Bezdjian, 2009). In this view, the behaviors symptomatic of ADHD are distributed continuously among the general population, ranging from no to extreme problem behaviors (Larsson, Anckarsater, Råstam, Chang, & Lichtenstein, 2012; Levy, Hay, McStephen, Wood, & Waldman, 1997; Lubke, Hudziak, Derks, van Bijsterveldt, & Boomsma, 2009). As such, the term 'ADHD-related behaviors' is used throughout this dissertation. A benefit of conceptualizing ADHD in this way is that it enables for research and practice which is generalizable to the entire population of children, and not just to a small group of children showing extreme behavior problems.

Potential Roles of Media use in Children's ADHD-Related Behaviors

Arguments for why media use and ADHD-related behaviors are likely to be associated center mainly around children's arousal functioning. Arousal is an excitatory bodily state which fluctuates on a moment-to-moment basis, in

response to environmental stimulations and one's own behavior (Humphreys & Revelle, 1984). It is generally accepted that there is an 'optimal' level of arousal, which differs between individuals (optimal stimulation theory, Zentall & Zentall, 1983). Arousal levels that are too high (associated with tension, excitement) and too low (associated with dullness, boredom) are deemed unpleasant states and, to a certain extent, people can adjust their behavior accordingly (e.g., one may go to a quieter area when a place is too noisy or busy). It is frequently argued that the behaviors characteristic of ADHD are caused by low baseline arousal. For example, because a certain level of arousal is needed to remain focused, low arousal can lead to attention problems (Nigg, 2006). Moreover, because low arousal feels unpleasant, it may lead to hyperactive, impulsive behavior, which can elevate arousal to a more pleasant level (White, 1999).

When applying this arousal theory to media use, there are two main roles media use may play in children's ADHD-related behaviors. First, from a media effects perspective, media use may contribute to the development of ADHD-related behaviors by affecting children's arousal functioning. For example, television programs and videogames can be highly exciting and elicit increased arousal levels in the child (Anderson & Bushman, 2001; Fleming & Rickwood, 2001). With repeated exposure, children may become used to this frequent stimulation, and their responsiveness to this stimulation may decrease (i.e., a desensitization effect, Ballard, Hamby, Panee, & Nivens, 2006). As a consequence of this desensitization process, children may become under-aroused without the presence of exciting stimuli. As under-arousal is believed to underlie the behaviors associated with ADHD, children who frequently use exciting media may thus display ADHD-related behaviors in situations that are less exciting (i.e., in the classroom). As an alternative to this arousal-focused theory, it has been argued that media use displaces activities that are believed to be more cognitively stimulating than television viewing or game playing (e.g., educational play activities), thereby delaying cognitive development and increasing the likelihood that children develop ADHD-related behaviors (Christakis, 2009; Zimmerman & Christakis, 2007).

Second, from a media selection perspective, ADHD-related behaviors may influence specific media behaviors or preferences. Because of the low arousal levels characteristic of ADHD, children with high ADHD-related behaviors may be more drawn to entertainment media, and particularly to exciting content, to elevate their arousal to a more pleasant level (Miller et al., 2007). If this is true, media use may serve as a form of self-regulatory behavior. Alternatively, children with high ADHD-related behaviors may be likely to turn to media due to the social problems they often face. For example, because ADHD-related behaviors

are associated with frequent parent-child conflict, parents of children with high ADHD-related behaviors may be more permissive of their child's media use in order to enjoy some time without conflict and discussion (Acevedo-Polakovich, 2005). In addition, children with high ADHD-related behaviors may engage in more solitary play (like media use) as they often experience peer difficulties (Wehmeier et al., 2010).

Dissertation Aims

The aims of this dissertation are guided by the Differential Susceptibility to Media effects Model (DSMM, Valkenburg & Peter, 2013). The DSMM provides a comprehensive framework for understanding how and when media effects occur. It includes four basic premises: (1) media effects on behavior are indirect and mediated by media responses, such as arousal, (2) media use and effects are conditional on individual susceptibility factors, like parenting behavior, (3) individual susceptibility factors concurrently influence use and effect of media, and (4) media-behavior relationships are transactional. Taking the DSMM as a starting point, three important gaps in previous media-ADHD studies can be identified, which are addressed in this dissertation. First of all, to be able to examine the premises of the DSMM, it is essential to first have a thorough understanding of the specific media use behaviors that are associated with ADHD-related behaviors, that is, what media children use and how they respond when using it. This is unclear from previous literature. For example, although it is often hypothesized that children with high ADHD-related behaviors use more media in general and are more attracted to violent content (e.g., Miller et al., 2007), empirical studies show inconsistent results (i.e., some confirming and some disproving these expectations, also see Kirkorian, Wartella, & Anderson, 2008; Schmidt & Vandewater, 2008). In addition, little is known about whether ADHD-related behaviors are associated with differences in media responses. For example, it is plausible that ADHD-related behaviors are associated with differences in children's attention and arousal level when using media. This, however, has rarely been studied. The first aim of this dissertation is therefore to describe the specific media use behaviors associated with ADHD-related behaviors. By doing so, a clear foundation is built for further research looking at this relationship in more detail.

Second, there has been little focus on individual susceptibility in the media-ADHD relationship. The DSMM proposes that the relationship between media use and behavior is not universal. Instead, individual difference factors can directly influence media use (i.e., what media a child is exposed to) and can strengthen or weaken the effect of media use on behavior. Hence, it is crucial to incorporate

child and social context factors when examining media-behavior relationships. Applying the propositions of the DSMM to the media-ADHD relationship, individual difference factors may play two roles in this association. First, certain children may be more likely than others to use developmentally inappropriate media, which in turn may elicit ADHD-related behaviors. Second, the relationship between media use and ADHD-related behaviors may be stronger for particular children. Therefore, the second aim of this dissertation is to examine individual susceptibility in the relation between media use and ADHD-related behaviors. Specifically, this dissertation will focus on two types of susceptibility factors as distinguished in the DSMM: dispositional susceptibility (i.e., susceptibility due to dispositional factors, like children's genetic make-up) and social susceptibility (i.e., susceptibility caused by factors in children's social environment, like parent behavior).

A third gap in the current literature is that little is known about causality in the media-ADHD relation. As aforementioned, there is argumentation for why media use may elicit ADHD-related behaviors, as well as for why ADHD-related behaviors may cause differences in media use. As proposed by the DSMM as well as by the reinforcing spirals model (Slater, 2007), both processes may work simultaneously. However, most existing longitudinal studies on the media-ADHD relationship have been conducted from a media effects perspective and did not consider these reciprocal relationships. Those that did have resulted in different conclusions concerning causality (Gentile, Swing, Lim, & Khoo, 2012; Johnson, Cohen, Kasen, & Brook, 2007; Stevens, Barnard-Brak, & To, 2009). Therefore, the third and final aim of this dissertation is to examine the causal direction in the media-ADHD relationship.

Dissertation Outline

Consistent with the three aims, this dissertation consists of three parts with a total of five empirical studies. The following sections summarize the five studies. All studies are either published, under revision, or submitted for publication. The content of each chapter in this dissertation is equal to the published or submitted studies. The studies are self-contained, each chapter therefore has its own abstract, introduction, discussion, and reference list and can be read individually. After presenting the individual chapters, the dissertation concludes with a general discussion.

Part 1: Examining the Specific Media Use Behaviors Associated with ADHD-Related Behaviors

The first part of this dissertation addresses the first aim: describing differences

in media use associated with ADHD-related behaviors. This is accomplished through a meta-analysis summarizing existing empirical studies on the relationship between media use and ADHD-related behaviors (Chapter 1) and a television diary study examining what content young children watch and how they respond to that content, in relationship to their ADHD-related behaviors (Chapter 2).

Chapter 1: Meta-analysis

Chapter 1 reports on a quantitative meta-analysis of studies investigating the relationship between screen media use and ADHD-related behaviors in children and adolescents up to the age of 18. Within this meta-analysis, four outcomes were distinguished: inattentiveness, hyperactivity, impulsivity, and composite ADHD (i.e., combined measures of inattentiveness, hyperactivity, and impulsivity). The main goal of this study was to calculate an average effect size of the relationship between media use and these four outcomes. In addition, three possible moderators were examined: media content (i.e., violent content, fast pacing, and overall time spent using media), media type (i.e., television, video games), children's age, and children's sex. In total, this meta-analysis included 45 empirical studies. A final goal of this chapter was to identify important gaps in the current body of literature.

Chapter 2: A television diary study of television use and responses

Chapter 2 presents a detailed look into young children's (ages 3-7) television use, in relationship to their ADHD-related behaviors. First of all, this study examined the association between children's ADHD-related behaviors and their amount of television viewing in general and specific content viewing (i.e., violent/scary and educational). Furthermore, it investigated children's arousal and attention responses when viewing television in general, and when viewing specific content. Finally, it tested sex differences in all aforementioned relationships. To examine these relations, this study combined a survey with a comprehensive four-day television diary, filled out by children's parents ($N = 865$). The television diary enabled a close examination of what content children actually watched and how they responded to that content.

Part 2: Factors Influencing Susceptibility to Media Use and the Media-ADHD Relationship

The second part addresses the second aim of this dissertation: examining the role of individual difference factors in the media-ADHD relationship. This part consists of two chapters, each examining a different type of individual susceptibility

distinguished in the DSMM (Valkenburg & Peter, 2013). Chapter 3 focuses on the role of genetic variation (i.e., dispositional susceptibility), while Chapter 4 focuses on the role of parental mediation practices (i.e., social susceptibility).

Chapter 3: Genetic disposition

Chapter 3 investigates the role of children's genetic disposition in the relationship between violent media use and children's ADHD-related behaviors. In line with the premises of DSMM, this study examined whether genetic disposition is directly related to violent media use, and thereby indirectly related to ADHD-related behaviors, and whether it moderates the relationship between violent media use and ADHD-related behaviors. To answer these questions, genetic data were combined with parent-report surveys of 1,612 children (5-9 years). This study focused on a specific gene variant that has repeatedly been linked to ADHD: the 5-HTTLPR polymorphism.

Chapter 4: Parental media mediation

Chapter 4 focuses on the role of parental media mediation (i.e., the way parents handle their child's media use) in the relationship between media violence and ADHD-related behaviors in early adolescents (10-14 years). This survey study ($N = 1,017$) distinguished two commonly studied mediation strategies, namely restrictive mediation (i.e., rule-setting) and active mediation (discussing media content), and how these strategies are communicated to the adolescent: in a controlling (i.e., using punishment, threat, or shame), inconsistent (i.e., being alternately strict and permissive), or autonomy-supportive (i.e., being encouraging and considerate of the child's perspective) way. Two models were tested. For restrictive mediation, this study examined whether parents' restrictive mediation styles directly related to adolescents' violent media use, and indirectly related to adolescents' ADHD-related behaviors via violent media use. For active mediation, this study investigated whether parents' active mediation style moderated the relationship between violent media use and ADHD-related behaviors.

Part 3: Directions of Effect

The last part of this dissertation, consisting of one chapter (Chapter 5), addresses the third aim of this dissertation: to examine the causal direction of the media-ADHD relationship.

Chapter 5: Examining reciprocity

The empirical studies described in the previous chapters all employed a correlational design. As such, an association between ADHD-related behaviors

and media use could be established, but the question of causality remains. Also from previous literature, little can be concluded about whether a relationship over time exists and what the causal direction of this relationship is. The fifth chapter of this dissertation therefore aimed to extend current knowledge about the causal direction in the media-ADHD association by conducting a three-wave longitudinal study (with one-year intervals) among 1,032 adolescents (10-14 years old). Next to examining causal direction, this study examined content differences (i.e., overall media use versus violent media use), format differences (i.e., television versus games), and sex and age differences.

General Discussion

The general discussion will provide an overview of the main findings and the general conclusions of this dissertation. Further, it will presents the implications of the findings and several directions for future research.

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