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Ph.D. THESIS

„The correlates of media multitasking in early adolescence - executive functioning and self-regulation”

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1. THEORETICAL FRAMEWORK

1.1 Research relevance

Digital Media is one of the cultural instruments that has become central for human functioning in almost all life domains in one of the shortest times in history (Schaffer, 2010). As an age group, adolescents engage with digital devices to a great extent and report frequent media multitasking, or performing multiple media and non-media activities at the same time (Rideout, 2015; Smahel et al., 2020). This media behavior unfolds against the backdrop of a cognitive system that undergoes significant development and is highly plastic and permeable to experience during adolescence (Blakemore & Choudhury, 2006; Galván, 2014, 2021). This raised the question of the potential impact of media use on cognitive development, especially Executive Functioning. These processes underlie self-regulation and goal-directed behavior (Diamond, 2013; Miyake et al., 2000) and show some of the most notable changes during adolescence (Best & Miller, 2010). The media behavior that is most consistently related to Executive Functioning at various ages, including adolescence, is Media Multitasking. Associations with both positive (Elbe et al., 2019; İmren & Tekman, 2019; Murphy & Creux, 2021) and negative cognitive outcomes have been found (e.g., Cain & Mitroff, 2011; Magen, 2017; Uncapher et al., 2017; Wiradhany & Koerts, 2021). Multiple types of Media Multitasking behavior have been identified in adolescents (Carrier et al., 2009; Rideout, 2015; Smahel et al., 2020; Soldatova et al., 2019), each having a slightly different task context and associated with somewhat different outcomes.

Because it is central for self-regulation, Executive Functioning is relevant for individual adaptation across major life domains, both during adolescence and during later adult years (Cortés Pascual et al., 2019; Holmes et al., 2016; Miller et al., 2012; Tomaszewski Farias et al., 2009). Thus, if some ways of engaging with media are indeed associated with negative and/or positive variations in cognitive processes that underlie Executive Functioning, then

finding out what these potential consequences are for each of these behaviors might help identify adaptive and dysfunctional media habits and help individuals focus on fostering the former and discouraging the latter. At the same time, investigating the individual characteristics that predict these different ways of using media might help understand who is more inclined to engage with it dysfunctionally and intervene in a timely manner to correct these behaviors. Adolescence is an important moment for intervention in this regard, because individuals continue to build and refine their digital skills in this period, in a more self-directed manner, and media habits that are formed now tend to be perpetuated into adulthood (Krahé, 2015).

1.2 Media Multitasking Behavior

Media Multitasking (MM) involves simultaneously engaging in two or more activities, out of which at least one entails a media device or content (Baumgartner & Sumter, 2017; Brasel & Gips, 2011; Parry & le Roux, 2019). One can perform MM either by engaging in multiple media activities at once (media multitasking with other media activities – MM-M, e.g., browsing Instagram while listening to music) or by combining media and non-media activities at the same time (media multitasking with non-media activities – MM-NM, e.g., watching a movie while eating) (Parry & le Roux, 2019). When MM-NM includes a media and a school activity, we speak about Academic Media Multitasking (MM-A) (van der Schuur et al., 2020). While these forms of MM are often combined under the umbrella term of "media multitasking", they involve task combinations that require various cognitive processes to be engaged to different extents, as illustrated in section 1.3.3 of the main thesis manuscript. This means that they might appear under somewhat distinct conditions and may be associated with different patterns of cognitive outcomes. This supports their separate investigation in relation to Executive Functioning and to relevant predictors.

MM can either be approached as a continuous variable (e.g., Baumgartner et al., 2014, 2018; Ralph & Smilek, 2017), or as a grouping variable, with researchers distinguishing between two (Duff et al., 2014) or three (Shin et al., 2020) MM engagement groups, depending on participants' scores on specific MM measures (e.g., the Media Multitasking Index, Ophir et al., 2009): light media multitaskers (LMMs) – individuals who engage in infrequent MM, intermediate media multitaskers (IMMs) – individuals who engage in moderate MM, and heavy media multitaskers (HMMs) – individuals who engage in frequent MM (Shin et al., 2020). Usually, scores pertaining to MM with other media activities are used to generate these extreme groups.

1.3 Executive Functioning

The term Executive Functioning (EF) is used to refer to a collection of cognitive processes that modulate and coordinate mental activity in support of goal-directed behavior (Barkley, 2012; Huizinga et al., 2006; Miyake & Friedman, 2012; E. E. Smith & Kosslyn, 2007). Starting from the diverse perspectives on EF structure and interactions that are discussed in section 1.4.2.2.1 of Chapter 1, the present thesis will focus on a wider range of executive processes, in order to adequately sample their potentially relevant relationships to Media Multitasking behavior. Five processes will be investigated: (1) Inhibitory Control, (2) Working Memory and (3) Task-Shifting, which have been most widely studied in the literature, as initially modelled by Miyake et al. (2000) and later by Diamond (2013), as well as (4) Self-Monitoring and (5) Executive Functioning in support of Emotional Control, as more complex aspects of Executive Functioning pertaining to meta-self-regulation (E. E. Smith & Kosslyn, 2007) and emotional regulation (Zelazo & Cunningham, 2007).

Inhibitory Control reflects the capacity to voluntarily stop an automatic or pre-prepared response, when required by (task) context. It involves resisting and solving significant conflict

between the response that is most activated, but inadequate for the task, and that required by task demands (Miyake et al., 2000). It also reflects the ability to resist and resolve interference from task-irrelevant internal or external stimuli so that task-focus can be maintained (Diamond, 2013).

Working Memory refers to the capacity to store, manipulate and upgrade task relevant information in mind while working to achieve a goal (Baddeley, 2012; Diamond, 2013).

Task-Switching refers to the ability to shift between two or more tasks, mental operations or, more generally, mental sets, in response to changing task or contextual demands (Monsell, 1996; Miyake et al., 2000).

Self-Monitoring will be conceptualized in a broader sense, as reflecting an individuals' capacity to assess ones' ongoing behavior (E. E. Smith & Kosslyn, 2007), as well as its consequences (Guy et al., 2004).

Executive Functioning in support of Emotional Control will be conceptualized as reflecting the capacity to modulate affective aspects of behavior in an appropriate and adaptive manner (Guy et al., 2004).

At various ages, EFs in all five domains (inhibition, working memory, task switching, emotional control and self-monitoring) have been related to overall screen time/media use (e.g., Corkin et al., 2021; McMath et al., 2023; Oswald et al., 2020), to specific media activities, such as video-gaming (e.g., Alho et al., 2022; Blumberg et al., 2013; Dye et al., 2009; Moisala et al., 2017) and dysfunctional social media use (e.g., Aydın et al., 2020; Reed, 2023; Soares et al., 2023), and to Media Multitasking (e.g., Alzahabi & Becker, 2013; Baumgartner et al., 2014; Murphy & Creux, 2021; Ophir et al., 2009; van der Schuur et al., 2015). In the case of Media Multitasking, EFs are strongly involved in effectively managing the continuous rapid shifts between two or more (media) activities (Brasel & Gips, 2011). More specifically, inhibitory control and shifting must coordinate to support the situational fast transition from one task to

another (i.e., disengaging from one task, orienting towards a second task, establishing, and maintaining attentional focus on the latter task). For every shift, continuous working memory update would be required to be able to access content that is relevant for each task, resume the interrupted task and perform all activities in a seemingly continuous manner. This dynamic is thought to "train" media multitaskers' cognition into better EF (Alzahabi & Becker, 2013; Elbe et al., 2019) or, on the contrary, to reduce their capacity to effectively manage cognitive processes and resources, leading to diminished EF performance (e.g., Cardoso-Leite et al., 2016; Ophir et al., 2009; van der Schuur et al., 2015).

EF was studied in the present thesis in two roles: as an outcome that is predicted by Media Multitasking and as predictor of Media Multitasking behaviors. Among others, the predictive role of EF is supported by the scarce, but relevant longitudinal results indicating that lower levels of EF, as measured directly (Kräplin et al., 2020; Song, 2022) or as is found in ADHD (Thorell et al., 2022), predict more dysregulated forms of media use. This indicates that *EF deficits* might make individuals more vulnerable to media-related internal or external stimuli and increase the likelihood of engaging with media during other media or non-media activities. In turn, some correlational results showing *higher levels of EFs* in individuals who engage more often in Media Multitasking can be interpreted as indicating that more effective EFs might facilitate Media Multitasking. For example, a greater working memory capacity (Murphy & Creux, 2021), in combination with a higher confidence of an individual that they can (media) multitask effectively (Pollard & Courage, 2017) might increase their likelihood of performing MM.

EFs role as an outcome of Media Multitasking is targeted by most research on this subject and is based on many correlational and some longitudinal results indicating more difficulties in multiple areas of cognitive control with increasing Media Multitasking frequency (e.g., Baumgartner et al., 2018; Kong et al., 2023; Magen, 2017; May & Elder, 2018; Nikkelen

et al., 2014; van der Schuur et al., 2015; Wiradhany & Koerts, 2021; Wiradhany & Nieuwenstein, 2017). For example, young adults and adolescents who engage in heavy levels of MM (heavy media multitaskers; HMMs) show lower levels of inhibitory control, manifested as lower resistance to interference from irrelevant internal and external information, higher susceptibility to distraction and a lower capacity to filter distractors (Baumgartner et al., 2014; Cain & Mitroff, 2011; Kong et al., 2023; May & Elder, 2018; Moisala et al., 2016; Murphy & Creux, 2021; Ophir et al., 2009; Ralph et al., 2015). A more nuanced discussion regarding these aspects can be found in section 1.4.2.2.2 of the thesis.

1.4 Temperament

Temperament is biologically based and reflects relatively stable tendencies across development; it is associated with different needs for activity, stimulation and socialization, and with variations in the ability to respond to and regulate these needs (Rothbart et al., 2011). Because media use can take so many forms and is so easily customizable to individual needs and interests, it can be effectively adapted to various temperamental tendencies and capacities for self-regulation. Thus, temperament might be a factor that favors one type of media behavior over another, contributing to the way in which media will be used, will come to stimulate the individual and impact their functioning further.

Temperament is conceptualized in the present thesis in line with the definition discussed by Putnam et al., (2001) and Rothbart & Bates (2006). It reflects "constitutionally based differences in […] motor, emotional and attentional responses to internal and external stimuli" (i.e., reactivity) "and [in] processes serving to modulate reactivity" (i.e., self-regulation), including approach/withdrawal, inhibitory control, and effortful control of attention, that are subjected in time to genetic, maturational, and environmental/experiential influences (Putnam et al., 2001, p. 163). As modelled by Putnam et al. (2001) and Rothbart & Bates (2006),

temperament includes dimensions that tap into an individuals' self-regulatory resources and abilities (i.e., Effortful Control, EC), physical and emotional reactivity (i.e., Surgency, SUR; Negative Affectivity, NA) and sociability (i.e., Affiliativeness, AFF).

Results in the literature indicate that lower levels of Effortful Control and an increased need for stimulation, that is associated with higher levels of Surgency (Putnam et al., 2001) are associated with a tendency to report overusing media and greater levels of technology addiction (Duff et al., 2014; Li et al., 2016; Pace et al., 2019; Sanbonmatsu et al., 2013; Vondráčková & Šmahel, 2015; Yang & Zhu, 2016; Zhang et al., 2015). It was also found that some aspects of Negative Affectivity are linked positively with some aspects of dysfunctional media use, such as Problematic Internet Use (Li et al., 2016; Zhang et al., 2015). To our knowledge, the Affiliativeness temperamental dimension, as conceptualized by Putnam et al. (2006), has not been studied in relation to media behavior so far. However, the sociability facet of this trait might be relevant for certain media behaviors, such as social media use, as it reflects a tendency to seek and enjoy closeness with other people, which can be enabled by media. Since social media is known to facilitate multitasking (Pea et al., 2012), it could be speculated that a greater activity around such platforms may result in more Media Multitasking for individuals higher in Affiliativeness.

Thus, results concerning temperament indicate that lower levels of temperamental self-regulation (Effortful Control), a higher need for stimulation and positive emotionality (Surgency) and a higher level of Negative Affectivity and need for socialization (Affiliativeness) may be associated with more intense media behaviors, including Media Multitasking. However, their role in usual levels of Media Multitasking, that can be found in the general population of adolescents, has been seldom explored. This gap in research is addressed by the current thesis.

1.5 Media Use Motivations

Media Use Motivations refer to reasons for which people are driven to engage with media (Kononova & Chiang, 2015) and which can be informed by individual needs (Rubin, 2009). This factor originates in the Uses and Gratifications Theory (see sections 1.5.2 and 1.6.2.4 in the Thesis manuscript for details) that centers on the dynamics between the needs that lead to media use and the needs that media use satisfies in order to better understand general media behavior (Rubin, 2009), Media Multitasking (Wang & Tchernev, 2012) and their effects. These needs can spring from individual traits and give rise to certain Media Use Motivations, which further predict media engagement. Thus, in order to better understand media (multitasking) behaviors, we must understand the motivations that lead people to engage with media in such a way.

Studies that relate Media Use Motivations to media habits mostly target Media Multitasking and indicate relevant positive relationships with a long list of motivations, usually in adult samples: gaining information (cognitive), socialization, enjoyment (emotional), efficiency and habit (addiction) (Hwang et al., 2014; Kononova & Chiang, 2015), control (Kononova & Chiang, 2015) and avoidance motivations (García-Oliva & Piqueras, 2016). Some motivations that are common in adolescence include: creating relationships and connecting with others online, satisfying a need for control, regulating, and enhancing emotions, constructing and validating to ones' identity (Throuvala et al., 2019), procrastinating or evading school demands or reducing boredom (Thomas et al., 2021). These latter motivations, however, were only studied qualitatively in relation to Media Multitasking, not quantitatively. Thus, the present thesis will extend these results to study Media Use Motivations and their role for media (multitasking) behavior in early adolescence.

In the present thesis, Media Use Motivations are not subsumed under a specific model. But, drawing on the diverse types of motivations that have been shown previously to be

relevant, the present thesis will focus on four large categories of motivation. These have been most consistently related to media behavior more generally and are considered to be potentially relevant for Media Multitasking behavior: self-regulation (including motivations pertaining to emotional and cognitive regulation), entertainment, socialization and automaticity (or habit/addiction) (García-Oliva & Piqueras, 2016; Hwang et al., 2014; Kononova & Chiang, 2015; Sherry, 2001; Thomas et al., 2021; Throuvala et al., 2019; Wang & Tchernev, 2012).

1.6 The Differential Susceptibility to Media Effects Model

One of the most comprehensive models of media behavior emergence and effects is the Differential Susceptibility to Media Effects Model (DSME), developed by Valkenburg & Peter, 2013). This model integrates various previous models that target only specific parts of the relationship between different predictors, media behaviors and their potential effects. It also offers a framework that can integrate and explain the various differences in results that have been observed in media and media multitasking studies, as illustrated previously, while offering an adequate starting point for finer grained research questions. While it does not target Media Multitasking itself, it can easily be customized to accommodate this type of media behavior. This model constitutes the conceptual framework that guided the research in the present thesis and organized its findings. It will be presented shortly below.

The DSME model proposes a number of relationships between media use, media effects and individual characteristics, which are schematically represented in Figure 1, below (Valkenburg & Peter, 2013). We will approach each of these propositions further.

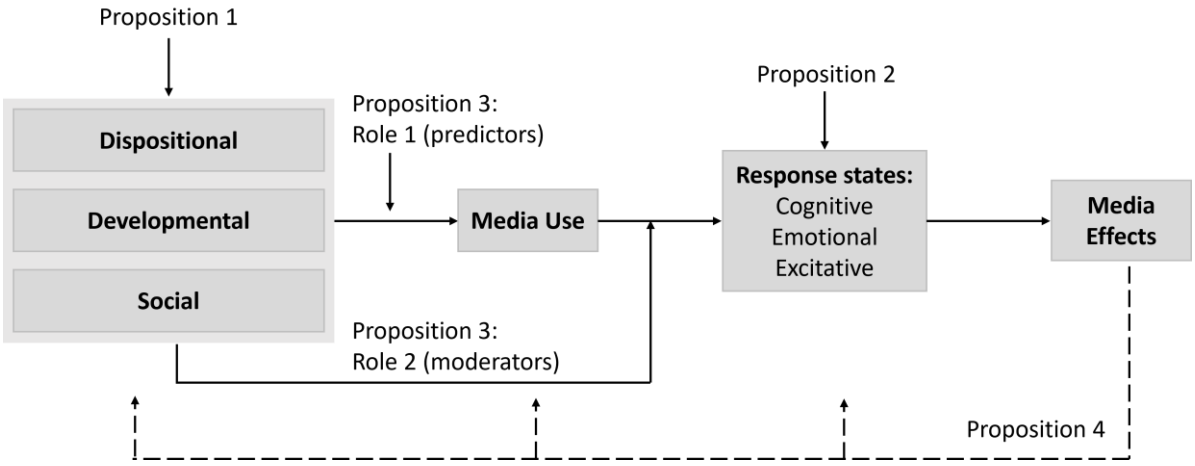

Figure 1. A representation of the four propositions of the Differential Susceptibility to Media Effects Model, as adapted from Valkenburg & Peter (2013).

One of the models' propositions is that media exerts its short- and long-term effects indirectly, through the emotional, cognitive and physiological („excitative", in the original article) response states that it generates (Valkenburg & Peter, 2013). More specifically, each media activity requires a specific way of modulating attention and a certain amount of cognitive effort to understand and navigate its content (i.e., cognitive state). Further, each media activity is associated with a specific emotional reaction to the content (i.e., emotional state) and with different degrees of physiological arousal or different types of physiological reactions (i.e., excitative state). Thus, a certain media activity is more likely to be associated with a different combination of cognitive, emotional, and physiological states than others. For example, watching an action movie is more likely to be associated with higher levels of physiological activation, moderate or high positive emotions and a moderate level of cognitive effort. In contrast, listening to slow music is more likely to produce low physiological arousal, but low arousal affective states and low cognitive effort. The DSME Model posits that media effects depend on the specific combination of response states that emerged as a result of engaging with media. Given the evidence in the literature, it is likely that media effects are stronger and affect

the individual on the longer term when all response states are high, than when all are low (Valkenburg & Peter, 2013).

The second and third propositions posit that the emergence of media effects also depends on (is conditioned by) three "differential-susceptibility variables" (Valkenburg & Peter, 2013, p. 226): dispositional (e.g., sex, temperament, personality, values or other traits that have a certain stability in time), developmental (i.e., differences in social, cognitive or emotional ability that are due to maturational processes) and social (i.e., external aspects of the environment at the micro, meso, or macro contextual levels, as conceptualized by Bronfenbrenner (1979). These variables are thought to (1) predict how an individual is likely to engage with media in the first place (e.g., whether he chooses to listen to slow music or watch a horror movie) and (2) moderate the effects media engagement has on an individual's response to media engagement (e.g., their physiological and emotional arousal when watching a suspenseful movie). In other words, pre-existing and somewhat stable individual characteristics influence the choice of media activity and the specific form of media engagement. This media activity will be associated with a certain combination of response states, but these response states can be experienced as more or less pronounced depending on the individuals' characteristics. For example, an individual with a higher sensibility to low intensity stimuli may be more likely to engage with low-physiologically arousing media (e.g., listening to slow music) and more likely to experience more pronounced physiological responses by engaging with high arousing media (e.g., more agitation when listening to hard rock music).

Lastly, the DSME model posits that media effects are also part of a feedback loop. Once they emerge, they further influence the Differential Susceptibility Variables, the choice of media behavior and the response states associated with this behavior (Valkenburg & Peter, 2013). For example, as has been shown with some mechanisms involved in the relationship

between aggressive media contents and behaviors (Brockmyer, 2015; Cardwell, 2013), repeatedly engaging with highly stimulating media activities (physiological, affective, and cognitive) might lead to a habituation or desensitization to this kind of content, which might lead to seeking ever more stimulating media activities that may produce the same level of arousal. Further, consuming this kind of content and experiencing the increased need for stimulation as a result may lead to changes in the individuals' social environment, as parents may decide to limit access to such media content to prevent it from becoming an issue (Valkenburg & Peter, 2013).

As illustrated, the DSME model attempts to explain media behavior and its potential effects in a comprehensive, multifactorial way. It analyzes this behavior in terms of specific media activities and specific media effects, as well as in terms of individual and contextual characteristics that modulate media choices, the response the individual has to using media and the conditional effects media behavior generates. It is a comprehensive and versatile model that can help explain and explore various relationships between individual, contextual and media variables. Thus, this model was used in the present thesis to guide the exploration of the relationship between Media Multitasking and individual cognitive functioning, as well as their

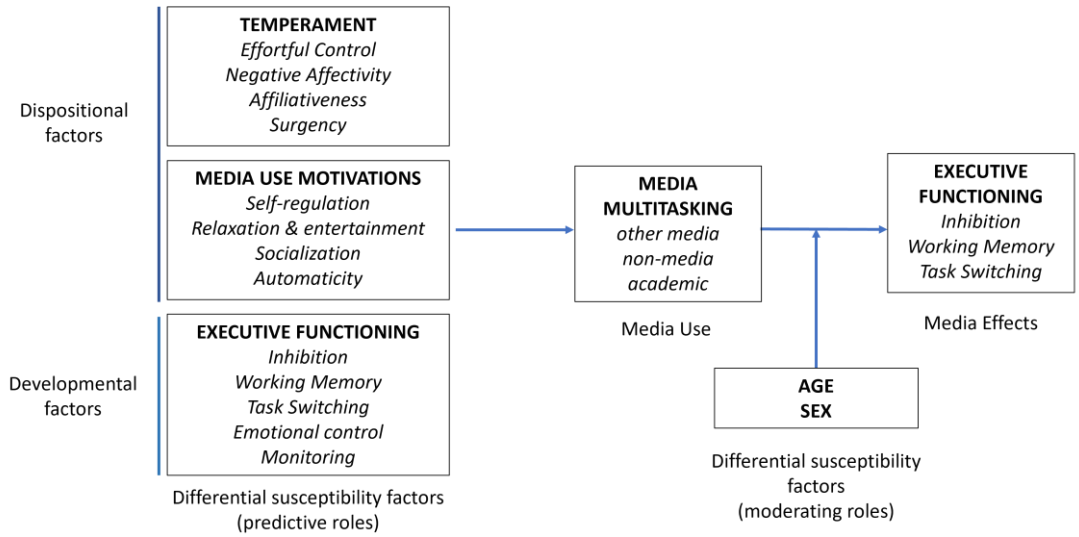

Figure 2. Differential Susceptibility to Media Effects Model, as applied to the current thesis.

conditional links. The way in which the model is applied to the present thesis is illustrated in Figure 2 and will be described next.

The facet of media behavior that is targeted in this research is Media Multitasking, a way of engaging with media that has been theorized and shown to be related to changes in youth cognitive style (e.g., Baumgartner et al., 2014, 2018; van der Schuur et al., 2015). Three types of Media Multitasking will be examined: MM with other media activities, MM with non-media activities and academic MM. Executive Functioning is the cognitive domain that is investigated as an outcome of Media Multitasking and includes five facets: Inhibitory Control, Working Memory, Shifting, Emotional Control and Monitoring (Guy et al., 2004; Miyake et al., 2000; Miyake & Friedman, 2012; Diamond et al., 2013). Three main Differential Susceptibility factors are included: Executive Functioning with its five facets, as developmental factor, and Temperament and Media use Motivations as dispositional factors. Age and sex are also explored as Differential Susceptibility Factors, but only in their role of moderators in the relationship between Media Multitasking and Executive Functioning.

2. OBJECTIVES AND GENERAL METHODOLOGY

The overall objective of the present thesis is to explore the predictors and outcomes of Media Multitasking behavior in early adolescence, centering on Executive Functioning, Temperament and Media Use Motivations.

Three studies were carried out in the service of this overall objective, each centered on one of three lines of inquiry:

(1) Investigating the Executive Functioning outcomes associated with Media Multitasking behavior and the conditional character of this relationship.

(2) Investigating the differential predictors of Media Multitasking behavior.

(3) Investigating the proximal antecedents (predictors) and consequences (outcomes) of Media Multitasking behavior in three types of media users, using a combination of data driven, quantitative and qualitative methods.

The first two lines of inquiry had correlational designs and used regression-based, quantitative methods to explore the overall predictors and outcomes associated with different types of Media Multitasking. The third research direction was based on a combination of data-driven, quantitative and qualitative methods, that allowed the identification of three groups of media multitasking adolescents and the exploration of the proximal dynamics of their media behaviors. All studies targeted different types of Media Multitasking and various combinations of predictor and Differential Susceptibility Variables.

3. ORIGINAL CONTRIBUTIONS

3.1 Study 1. The relationship between Media Multitasking Behavior and Executive Function in Adolescence – a Replication Study

Study 1 aimed to investigate the Executive Functioning outcomes of Media Multitasking and the moderating role of sex and age in this relationship, as potential Differential Susceptibility Variables. The main focus was on replicating the method and design used by Baumgartner et al. (2014) and on testing the replicability of media-related findings in a different culture than the original study. A secondary aim was to extend these findings by investigating the conditional character of media-related cognitive outcomes, as proposed by the DSME model, by studying the moderating role of sex and age. Thus, this study targeted Proposition 1 from the DSME model, which states that media effects are conditional and depend on individual Differential Susceptibility Variables (Valkenburg & Peter, 2013).

3.1.1 Method

Participants

Participants were middle school students from two urban public schools in Romania. The sample consisted of 296 young adolescents (166 girls – 56.1%, 130 boys – 43.9%) aged between 10y 5m and 15y 2m (M = 12.9, SD = 1.04). Out of these, 179 adolescents also completed three cognitive performance computerized tasks (see Procedure). Children who only completed the questionnaires were kept in the sample due to the availability of data on MM and self-reported EF.

Instruments

Media Multitasking behavior and Media Use. The Romanian translation of the Media Use Questionnaire (MUQ; Baumgartner et al., 2014; Ophir et al., 2009) was used to measure

Media Use (time spent with media) and two types of Media Multitasking Behavior: with **other media activities** (MMI-M; e.g., television viewing, listening to music or using social media) and with **other non-media activities** (MMI-NM) (e.g., doing homework, eating, using transportation). The first section of the questionnaire evaluates time spent in nine media activities and the second section measures the two types of Media Multitasking. Both MMI-M and MMI-NM were analyzed in continuous form. MMI-M was also used to generate two extreme groups (heavy media multitaskers – HMM = upper 25% of participants; light media multitaskers – LMM = lower 25% of participants).

Executive Functioning deficits. Self-Report. The Romanian version of the Behavior Rating Inventory of Executive Function – Self Report (BRIEF) (Guy et al., 2004) was used to measure self-reported EF difficulties. Only 3 of the 8 subscales in the BRIEF were used in the present study: Inhibition, Shifting and Working Memory.

***Executive Functioning. Computerized tasks*.** One performance task was used for each facet of Executive Functioning.

***Inhibition*.** The Eriksen Flankers Task was used to measure inhibitory control (Ridderinkhof & van der Molen, 1995).

Working Memory. The Digit Span Task (Wechsler, 2003) was used to measure Working Memory.

Task-Shifting. The Dots-Triangles Task (Huizinga et al., 2006) was used to measure task-shifting ability.

Control variables. Age, sex and Media Use (time spent with media on an average day) were used as control variables.

Procedure

The study had two steps – (1) Completion of the BRIEF and MUQ and (2) Completion of the computerized tasks. Children completed the two questionnaires in the classroom (20-40

minutes), in counterbalanced order. They were then scheduled to perform the three computerized tasks, in groups of 1-5 children, in a quiet room, each on an individual laptop.

3.1.2 Results and discussions

The present study aimed to be a direct replication of the study conducted by Baumgartner et al. (2014) concerning the relationship between MM and EF in adolescents. Results support part of the findings of the initial endeavor, but also highlight some diverging patterns of relationships. Our study replicated the following results of the research conducted by Baumgartner et al. (2014): (1) Higher engagement in MM with media activities (MMI-M) predicted significantly more self-reported difficulties in WM and inhibition; (2) Neither MMI-M, nor MMI-NM significantly predicted performance on the three EF computerized performance tests; (3) In the extreme group analysis, HMMs reported more EF difficulties in WM, inhibition and shifting than LMMs; (4) No significant difference between HMMs and LMMs was found in the performance on the WM computerized test. In contrast, the following results were not in concordance with the findings in the study of Baumgartner et al. (2014): (1) MMI-M did not predict significantly more self-reported EF shifting difficulties; (2) MMI-NM did not predict self-reported EF difficulties in any of the three domains; (3) The extreme group analysis indicated that HMMs responded significantly faster than LMMs in the Dots-Triangles task on both repeat and switch trials; (4) HMMs responded significantly faster than LMMs on the Flankers Task, irrespective of trial type.

A strong point of this study was that it measured two kinds of Media Multitasking, as opposed to other studies, and analyzed them both in continuous form and in an extreme group approach, that is often used in media studies. It also involved both self-reported and performance-based measures of EFs, which helped nuance the findings. The results indicated, on the one hand, **that the two types of MM were differentially related to EF outcomes** –

only MM with other media activities predicted problems in various EF domains; MM with non-media activities did not, which was in contrast to the Baumgartner et al. (2014) study. In line with Baumgartner et al. (2014), these relationships also indicated **variations in the statistical significance of the results depending on methodological choices**, such as whether EFs were measured by self-reports or by performance tests and whether MM was in a continuous or in an extreme group form. Importantly, the results found for the continuous variable form also held in the extreme groups approach, but this latter approach was more sensitive to relationships that were not evident in the continuous approach. More specifically, MM in this study was positively related to self-reported EF problems in Inhibition and Working Memory, but not in Shifting. This latter relationship was found to be significant, however, when comparing Light Media Multitaskers to Heavy Media Multitaskers in the extreme group approach. MM in either form was not, however, related to EFs as measured by performance tasks. Corroborated, these results can partly explain the mixed results in the media literature regarding the relationship of MM with EF outcomes.

As pertaining to the second aim of the research, the study showed that, indeed, **some of the outcomes that are related to MM are conditional, but that this is not the case for all kinds of MM, nor for all facets of EFs**. More specifically, this study showed that adolescents at the beginning of this developmental period were more susceptible than older adolescents to the Inhibitory Control difficulties that are associated with MM with other media activities. In this latter group, engaging in multiple media activities at the same time was not related to more EF problems in inhibition. This moderation effect was not found for EF problems in Working Memory, the only other aspect of EF that was also significantly related to MM with other media activities.

Together, the findings of Study 1 contribute to the aim of the thesis, to the DSME model and to the wider literature by showing that, indeed, some Media Multitasking effects are

conditional, while others are not. More specifically, this study has showed that: (1) only some types of MM (i.e., those with other media activities) are associated with EF problems and that it is important to approach MM more granularly when targeting its potential effects; this was found because the study measured multiple types of MM; (2) some of these relationships are moderated by age, which indicates that Media Multitasking effects are not uniform across development and that there could be an important vulnerability period to negative media effects at the beginning of adolescence, especially for inhibitory control; (3) methodological choices influence the effects that can be observed, which indicate a potential explanation for the various mixed results in the media literature. The discrepancies in results between this study and the one of Baumgartner et al. (2014) also indicate that some aspects of MM outcomes may also vary with cultural context. Even if this variable is not directly measured in the study, results must be set and discussed within the cultural and temporal context in which they were observed.

3.2 Study 2. The "Me" in Media Multitasking: the role of Temperament, Media Use Motivations and Executive Functioning in adolescent Media Multitasking

Study 2 investigated the predictors of MM and was centered on Proposition 3 of the DSME model, which states that Media Use is predicted by various Differential Susceptibility Variables, which also moderate its effects. Because MM outcomes and their conditional character were already targeted in Study 1, Study 2 centered specifically on the predictive role of three Differential Susceptibility Variables: Temperament and Media Use Motivations, as dispositional variables, and Executive Functioning, as a developmental variable. This study also centered on two specific kinds of MM: MM with other media activities, also targeted in Study 1, and academic MM, introduced here because it had been part of the MM with other non-media activities in Study 1, but has important implications for academic achievement that justify studying it separately from other kinds of non-media activities.

3.2.1 Method

Participants

Participants were middle school students from 4 urban public schools in Romania. The sample consisted of 97 early adolescents, aged between 11 and 14.58 years (M = 12.76 years, SD = 0.90 years, 54 females – 55.7%, 43 males – 44.3%).

Instruments

Media Multitasking. A Romanian translation of the Media Multitasking Measure – Short Form (MMM-S; Baumgartner et al., 2017) was used to measure time spent with media (TT, control variable) and MM. In Section 1 (time spent with media) participants indicated how much time they spent watching TV, sending messages, and browsing social media sites on an average day in the last two weeks (1 = not at all to 8 = more than 5 hours). Section 2 (for MM)

targeted the four most frequently combined media activities in adolescence (see Baumgartner et al., 2017).

Executive functioning problems. The Romanian version of the Behavior Rating Inventory of Executive Function – Self Report (BRIEF) (Guy et al., 2004) was used to measure self-reported EF difficulties. Five of the 8 subscales in the BRIEF were used in the present study: Inhibition, Shifting, Working Memory, Monitoring and Emotional Control.

Temperament. The Romanian version of The Early Adolescence Temperament Questionnaire (EATQ – SR; Ellis & Rothbart, 1999; translated by Țincaș, Benga & Geangu, 2010) was used to measure the four temperamental dimensions: Effortful Control (EC), Surgency (SUR), Negative Affectivity (NA) and Affiliativeness (AFF).

Media Use Motivations. To assess a variety of Media Use Motivations identified in the literature, we constructed 15 items starting from theories regarding Media Use Motivations (Jeong & Fishbein, 2007; Kononova & Chiang, 2015; Wang & Tchernev, 2012) and from the results of previous studies (García-Oliva & Piqueras, 2016; Thomas et al., 2021; Throuvala et al., 2019). The 15 items were grouped in four Media Use Motivations categories, based on a principal component analysis with varimax rotation (total variance explained: 57.68%): **(1) self-regulation** (cognitive avoidance, self-motivation, concentration, regulating negative emotions, mental/physical stimulation); **(2) relaxation & entertainment** (entertainment, play, relaxation, time passing); **(3) socialization** (non-school related knowledge, communicating with friends and family); **(4) automaticity** (procrastination, habits, background activity).

Control Variables. Age in months, sex, average time spent with media and average time spent in school activity were used as control variables.

Procedure

Questionnaires were completed online, using password protected SurveyMonkey links. Due to questionnaire length, they were split into two groups (each with an individual link) and

participants were asked to complete them in two different days (Day 1 – time spent with media, MM, Media Use Motivations, and Temperament; Day 2 – EF deficits, time spent in school activities). Each parent was contacted by phone to establish two suitable days when the adolescent could complete the questionnaires. On each of the two days, participants received an individual message (on a parent's phone/mail or on a personal phone/mail if provided by the parent) containing the link towards the corresponding questions, a password to access it and an individual identification code.

3.2.2 Results and discussions

The results bring support for the third proposition of the DSME model and indicate multiple pathways that may lead to MM in adolescence. They show that all three types of variables (Executive Functioning, Temperament and Media Use Motivations) differentially predict the two kinds of MM (with other media activities and with academic activities). Importantly, **each type of MM is significantly predicted by different facets of these differential susceptibility variables**. For example, temperamental Negative Affectivity (positively), temperamental Affiliativeness (negatively) and EF difficulties in Inhibitory Control (positively) are significantly predictive of MM with other media activities. Thus, MM with other media activities seems to be more readily predicted by emotional aspects of temperament and by difficulty inhibiting relevant emotional or habitual media-related stimuli. In contrast, temperamental Effortful Control (negatively) and EF difficulties in Monitoring (negatively) are predictive of academic MM. Thus, academic MM seems to be more tied to variables that pertain to more effortful and voluntary self-regulation. It also seems to arise through two pathways – a more involuntary one, potentially associated with lapses in self-regulation (lower Effortful Control), and a more strategic one, associated with better self-regulation (lower EF problems in monitoring). Only Media Use Motivations relating to self-regulation and

automaticity predicted both types of MM in the same way, positively, indicating a certain overlap in the pathways that are associated with the different kinds of MM. This study adds to findings in the wider literature and lend credence both to a Deficit Perspective of MM emergence (Valkenburg & Peter, 2013; van der Schuur et al., 2015), associated with lower self-regulatory ability, and to a Strategic Perspective on it (e.g., Ralph et al., 2014, 2015; Ralph & Smilek, 2017), associated with better self-regulation. Both of these warrant further investigation.

Another important aspect pertaining to this study is that it was conducted at the debut of the COVID-19 pandemic in Romania. This created a context that, in some regards, anticipates the changes in media use that are likely to be seen in the future, as media infuses more and more aspects of the day-to-day life. It was also a unique context, that seemed to amplify certain relationships. For example, the pandemic created both a surge of negative affectivity, in the form of anxiety, depression, and other emotional difficulties (e.g., Bera et al., 2022; Branje & Morris, 2021), and an increase in the need to use media, for a wider array of activities (e.g., Eales et al., 2021; Marciano et al., 2022; Wong et al., 2021). These changes might have accentuated the relationship between high temperamental Negative Affectivity and increased Media Multitasking activity that was observed in the study. While this relationship is likely to hold outside of a pandemic, given that temperamental traits tend to be stable across time and contexts, this unique "natural experiment" allowed us to observe it better. This result seem to both support the existing proposition of the DSME model, that the macro context in which the individual is immersed might be relevant for media engagement, but also to indicate another potential role of context – that of moderator in the relationship between certain predictors and media (multitasking) behavior. Context is a central element in various theories of development and has been shown to moderate the relationship between developmental predictors and

outcomes (Barsalou, 2010; Bronfenbrenner, 1979; L. B. Smith & Thelen, 2003; Vygotsky, 1978).

As such, Study 2 (a) brought forward supporting evidence for the predictive role of a few dispositional, developmental and (implicitly) contextual variables from the DSME model as applied for multiple types of MM, (b) identified differential pathways for the emergence of MM behaviors and (c) offered potential evidence that would contribute to the extension of the DSME model by discussing the moderating role of context (and possibly other Differential Susceptibility Variables) in the relationship between relevant predictor variables and MM. This is the first study, to our knowledge, to do so.

3.3 Study 3. Using complex networks analysis and functional analysis to study self-regulation and Media Multitasking in early adolescence

Study 3 was comprised of two sub-studies, with related objectives. The aim of Study 3a, a partially methodological one, was to explore the ways in which predictors and Media Multitasking behavior coagulate in media user profiles in a data-driven way. Study 3b, further aimed to explore the proximal dynamic of media behavior and Media Multitasking, as proposed by the DSME model, inside each of the media user profiles that was obtained in study 3a.

3.3.1 Study 3a

As opposed to previous studies, that used regression based analyses (Baumgartner et al., 2014) or extreme group comparisons (Alzahabi & Becker, 2013; Ophir et al., 2009) to study the relationship between pairs of variables relevant to MM, this study involved a community detection approach to Complex Network Analysis (CNA) to allow individuals to agglutinate in specific media user groups based on a *combination* of all our variables of interest at once, including MM.

Complex Networks Analysis (CNA) has been used more recently in psychological science to investigate complex and dynamic relationships between multiple variables of interest (Borsboom & Cramer, 2013; Cardoso-Leite et al., 2021). Simply put, a complex network is a graphic that contains nodes, representing variables or individuals, and the edges or links between them, reflecting the relationships or interactions between the nodes. These networks are usually modelled starting from large datasets and their implicit structures instead of very specific theories (Albert & Barabasi, 2001). A data driven approach such as this can be useful in the beginning stages of theory-building in a research field, when theory is not yet solid and

more exploratory studies can be useful in identifying potential relationships that can further be investigated more in depth through more specific designs (Cardoso-Leite et al., 2021).

While there are multiple ways of generating such networks (Albert & Barabasi, 2001; Borsboom & Cramer, 2013), we used a community detection approach for the present study - a method that helps identify sets of nodes that have aggregated into groups (i.e., communities) with specific common properties (Fortunato, 2010; Mester et al., 2021). More specifically, individuals that exhibit very similar patterns of scores are positioned closer to each other in this network, have stronger links between them and, thus, constitute a community (Fortunato, 2010). We expect that, if, indeed, there are multiple types of media users, characterized by specific combinations of MM behavior, temperaments and EF problems, then multiple, fairly delimited communities should emerge in this analysis. This approach is an indirect way of investigating how individual traits and media measures combine at the intraindividual level to describe media behavior and its potential determinants.

We first modelled the network and identified the emerging communities. In order to ascertain that the resulting groups were not a mere statistical artifact, we calculated modularity indicators for the network (i.e., how separate emerging communities are) and conducted a multiple analysis of covariance (MANCOVA) in which we compared all emerging groups on the 11 measures of EFs, Temperament and MM, controlling for age and time spent with technology.

3.3.1.1 Method

Participants

Participants in this study were a subset of early adolescents (N = 41) who participated in Study 2. The final group consisted of 21 females and 20 males (N = 41), aged between 11 and 14.5 years-old (M = 12.43, SD = 0.93), from three public urban schools.

Instruments

Media Multitasking. A Romanian translation of the Media Multitasking Measure – Short Form (MMM-S; Baumgartner et al., 2017) was used to measure time spent with technology (TT, control variable) and MM. In Section 1 (time spent with technology) participants indicated how much time they spent watching TV, sending messages, and browsing social media sites on an average day in the last two weeks (1 = not at all to 8 = more than 5 hours). Section 2 (for MM) targeted the four most frequently combined media activities in adolescence (see Baumgartner et al., 2017).

Executive Functioning problems. The Romanian version of the Behavior Rating Inventory of Executive Function – Self Report (BRIEF) (Guy et al., 2004) was used to measure self-reported EF difficulties. Five of the 8 subscales in the BRIEF were used in the present study: Inhibition, Shifting, Working Memory, Monitoring and Emotional control.

Temperament. The Romanian version of The Early Adolescence Temperament Questionnaire (EATQ – SR; Ellis & Rothbart, 1999; translated by Țincaș, Benga & Geangu, 2010) was used to measure the four temperamental dimensions: Effortful Control (EC), Surgency (SUR), Negative Affectivity (NA) and Affiliativeness (AFF).

Control variables. Age and time spent with media were used as control variables for the group comparisons.

3.3.1.2 Results and discussions

Study 3a employed a data-driven method, the community detection approach to Complex Network Analysis, for the first time in media studies. This method organized participants bottom-up in three distinct groups, based on their scores on Temperamental and Executive Functioning measures, as well as Media Multitasking. This grouping of participants was based on the implicit regularities both in their scores on relevant predictors (Temperament and EFs)

and on the relevant outcome (Media Multitasking). Based on their two MM scores, we decided to term the three groups as is often done in the literature: group1 - light MMs (LMMs), group 2 - intermediate MMs (IMMs), and group 3 - heavy MMs (HMMs) (Shin et al., 2020). Descriptive data is available in Figure 3, below.

LMMs scored lowest on both MMIs, all five EF problems domains and lowest in two out of five temperamental dimensions: Surgency, Negative Affectivity. This group scored highest on the Effortful Control dimension and had moderate scores on Affiliativeness.

IMMs were characterized by intermediate scores on both MMIs, all EF problem domains and the Effortful Control and Negative Affectivity temperamental dimensions. However, this group scored highest on the Surgency and Affiliativeness temperamental dimensions.

HMMs scored highest on both MMIs, reported the most frequent EF problems on all 5 domains. It scored lowest on the Effortful Control and Affiliativeness temperamental dimensions and highest on the Negative Affectivity temperamental dimension, while scoring moderately on temperamental Surgency.

The differentiation between these three groups was also validated using quantitative methods (MANCOVA), which indicate significant differences between various pairs of groups on various aspects of individual variables and Media Multitasking. This study was the first one to use such a combination of methods to generate and describe various groups of media users and the individual characteristics that describe them. It offered an alternative to the often-used method of creating extreme Media Multitasking groups in a top-down fashion (Alzahabi & Becker, 2013; Ophir et al., 2009; Shin et al., 2020), which introduces potential unwanted variation because of the criteria used to distribute participants into groups (e.g., quartile vs. decile based) and because of the decision to eliminate the middle group of participants (e.g.,

Alzahabi & Becker, 2013; Ophir et al., 2009 vs. Shin et al., 2020), thus reducing variance to some extent.

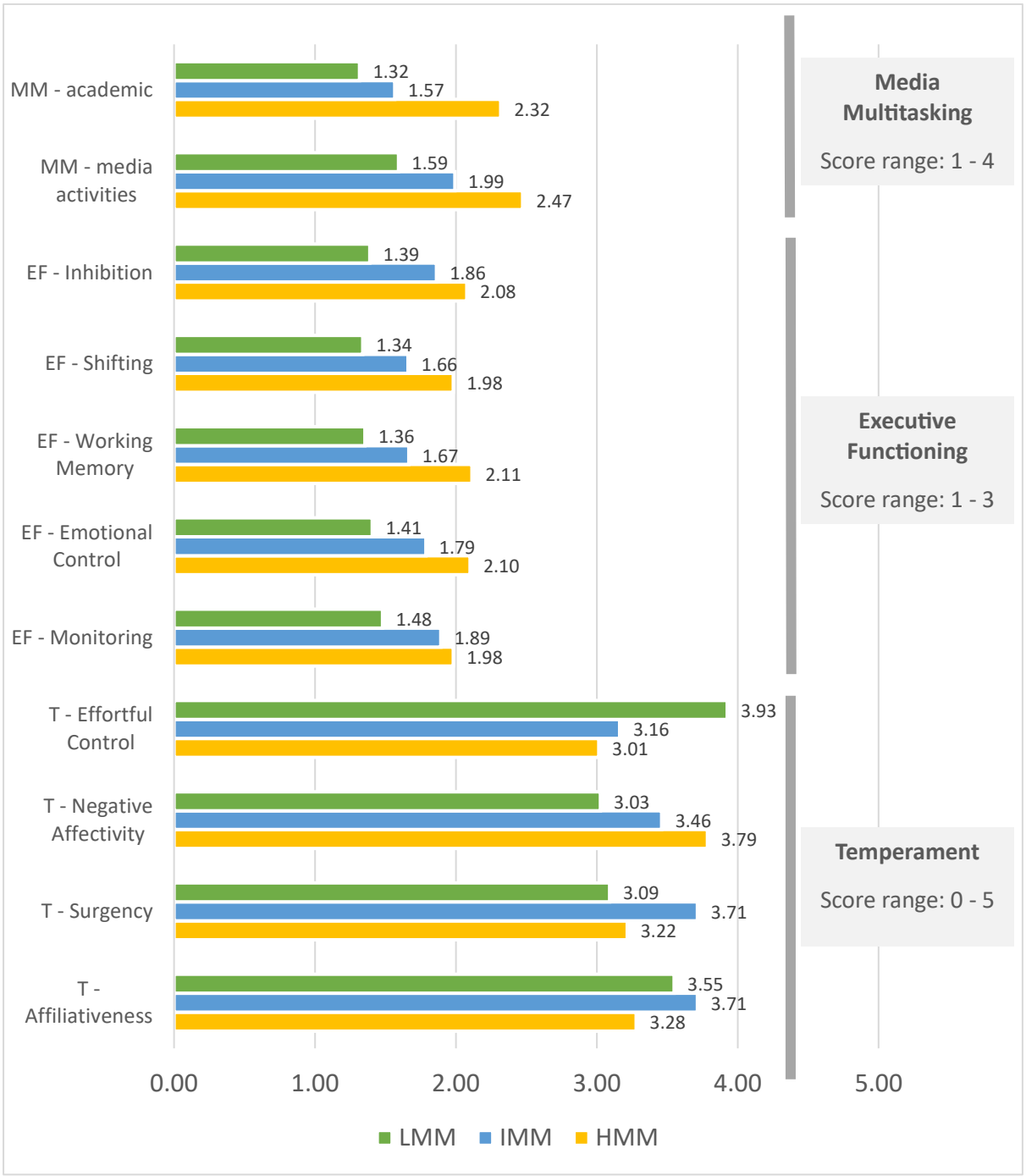

Figure 3. Descriptive mean scores on the 11 dimensions that contributed to the community generation in the complex network analysis for each of the three emerging groups.

3.3.2 Study 3b

In Study 3b, we used qualitative methods to conduct an in-depth functional analysis of media behavior for two individuals from each of the emerging groups in Study 3a. Our aim was to investigate the similarities and differences between prototypical individuals from each group regarding the functional relationship between individual and media related factors, with the overarching purpose of gaining insight about potential differences in the mechanisms that drive and maintain media behavior in their groups of origin. These mechanisms can then be targeted in further studies using quantitative methods and larger samples.

Functional analysis or assessment (FA) is a procedure that is used in behavioral interventions in order to identify the function of a specific behavior and the individual factors that functionally determine (antecedents) and maintain (consequences) that behavior (Miltenberger, 2015). This procedure is based on the assumption that "behavior is lawful" and its occurrence is governed by environmental and intraindividual factors (Miltenberger, 2015, p. 246). Once this information is gathered, one can manipulate these contingencies in order to model the way in which the target behavior manifests (its frequency, intensity, duration, or latency). Thus, in order to conduct a functional analysis of a behavior, one must gather information about four elements: 1. The specific, operational target behavior and its function for the individual; 2. The antecedents, or the factors that precede the behavior and favor/determine its occurrence; 3. The co-occurrences, or the factors that co-occur with the target behavior and can motivate its initiation and/or maintenance; and 4. The consequences of the behavior, or the specific reinforcements and punishments one obtains from performing the behavior (Miltenberger, 2015).

3.3.2.1 Method

Participants

Participants in Study 3b were chosen from among those that constituted the three emerging groups in Study 3a - 6 early adolescents, one boy and one girl from each group, since the literature indicates gender differences in media activities (Baumgartner et al., 2014) (M age = 13.25, SD = 1.20).

Instruments

Semi-structured interview. The FA was conducted through a one-hour semi-structured interview. The questions that were included in the interview were structured in four sections, so as to tap into the four components of a FA:

1. Operationalizing media behavior (the types of media activity the adolescent engaged in, the activities they combined when MM, including academic MM or other kinds of MM, true media multitasking vs task-switching frequency, the devices they owned and used most frequently, the frequency and duration of these activities in a school weekday, during weekends and during vacation; device/media overuse);

2. Antecedents of Media Use and MM (general reasons for using media and MM, specific expectations and objectives for using media, social and physical environment, internal states, traits that favor Media Use and MM, media related habits);

3. Media Use and MM co-occurrences (general experience during Media Use and MM and when not using media at all, cognitive and emotional experiences during media use and MM);

4. Consequences of Media Use and MM (general consequences, initial goal attainment, cognitive, emotional and social consequences).

Some of the questions we included were also designed to investigate the role of specific EF or temperamental traits in technology use, especially for those dimensions that differed in

an unusual way between the communities in Study 3a (e.g., temperamental Surgency or Affiliativeness).

Procedure

We sought to include the one boy and one girl from each emerging group who: 1. Had the closest scores to their corresponding group means on the two MM behaviors and the three dimensions that differed significantly between all three groups in Study 1 (EF problems in Shifting and Working Memory and temperamental Negative Affectivity); 2. Had the scores on the other dimensions as close to the group means as possible; and 3. Their parents and themselves agreed to participate and provide interview data for this study. This helped us choose the participants with the highest prototypicality for their group of origin, which aided the potential for generalizing our findings from individual-level to group-level. The interviews were conducted online, using a Google Meet link sent on the parents' email address, and were recorded with the consent of each participant. They lasted between 40 and 70 minutes.

3.3.2.2 Results and Discussion

Study 3b further explored the differences between the three emerging groups in more detail, by conducting individual functional analyses of media behavior for prototypical individuals in each of the three groups identified in study 3a. In other words, this study explored (1) how general media behavior and Media Multitasking was manifested in each of the three groups, (2) what were the proximal antecedents of these behavior and (3) what were their co-occurrences and proximal consequences for a sample of individuals in each group. To a certain extent, study 3b explored the entire dynamic of media behavior proposed by the DSME model, as it is experienced qualitatively by specific individuals; it investigated the proximal predictors/antecedents of media behavior, the form of media behavior, the short-term/immediate cognitive, affective, and physiological states that result from media

engagement and their longer-term consequences. To our knowledge, this method of functionally analyzing media behavior was also done for the first time in the media literature. It helped identify both similarities and differences in the correlates of Media Use and Media Multitasking in the three types of users identified in Study 3a. As pertaining to the first part of the DSME model, it showed, for example, that the physical context is relatively uniform with regard to objective device availability for all three groups (i.e., how many and what kinds of devices are available for personal use), but that individuals with different temperamental characteristics increase or decrease this availability by modulating device proximity (e.g., putting the phone away by LMMs vs keeping it close at all times by HMMS) or planning media activity (e.g., planning specific intervals for media engagement for LMMs vs. filling all free intervals with media engagement by HMMs). This offers support for the ideas that emerged in Study 1 and Study 2 that (social) **context may also play a facilitative or inhibitory role for other relevant predictive relationships that include Media Multitasking**. It also showed that negative affect is generally associated with lower media engagement and Media Multitasking, but that some media activities (e.g., listening to music) can be widely used for self-regulation in negatively valenced situations, regardless of temperament or executive functioning difficulties.

The study also helped gain some insight into the immediate impact of Media Use and Media Multitasking on emotional, cognitive and physiological response states, the second part of the DSME model. It showed, for example, that, engagement in Media Multitasking or using certain apps that offer a lot of packed content is associated with short-term attentional scattering and that media overuse leads to temporary cognitive fatigue. However, these immediate consequences were dampened by taking technology recovery breaks that helped return to a homeostatic cognitive and physiological functioning, especially in the case of girls. There was no report of significant medium-term cognitive effects associated with Media Use or Media

Multitasking (on working memory, for example). However, engaging with media did seem to accentuate pre-existing attentional lapse tendency in the case of HMMs. On the one hand, these findings raise important questions regarding the way in which the immediate changes (or lack of changes) associated with media engagement lead to the long-term differences that are observed at the cognitive level in large-scale studies. On the other hand, it provided evidence for the conditional effects of MM that are proposed by the DSME model, in that individuals who are more predisposed towards certain physiological, emotional or cognitive states are more likely to experience media effects that are congruent with these predispositions.

4. CONCLUSIONS AND GENERAL DISCUSSIONS

The overall objective of the research that is comprised in the present thesis was to investigate the correlates of media behavior in early adolescence, centering on Executive Functioning and individual characteristics relevant for self-regulation. The aim was to identify both predictors and outcomes of media behavior, as well as potential factors that may be associated with fluctuations in these relationships, thus offering potential explanations for the frequent mixed relationships in the literature (e.g., Elbe et al., 2019; van der Schuur et al., 2015; Wiradhany & Nieuwenstein, 2017). Overall, each of the three studies contributed to one or more parts of the overall objective of the present thesis, that of gaining insight into the correlates of Media Multitasking behavior: Study 1 brought evidence for the role of Executive Functioning as a conditional outcome of Media Multitasking, Study 2 found evidence that supported differential predictors of Media Multitasking and Study 3 offered insight both into the way in which Media Multitasking combines with its specific predictors in media user profiles and into the proximal predictors (antecedents) and outcomes (consequences) of general media behavior and Media Multitasking behavior, at the individual level. In pursuit of the overall and individual objectives of the present thesis we examined multiple types of Media Multitasking behavior, their outcomes and predictors, we used multiple ways of measuring Executive Functioning to investigate its role as a predictor and outcome of Media Multitasking and employed a novel combination of data-driven, quantitative and qualitative methods to study the granular dynamics of Media Multitasking behavior at the individual level.

4.1 Theoretical contributions & implications

Table 1. *Summary of main theoretical contributions of the present thesis.*

The thesis brought forward evidence that support the Differential Susceptibility to Media Effects Model (Valkenburg & Peter, 2013), as applied to Media Multitasking behavior in early adolescents, a media behavior and an age group that were not studied through the lens of this model before.
The studies in the present thesis targeted and brought evidence supporting multiple Proposals of the DSME model; until recently, research on this model was centered dominantly on the conditional effects of Media Use and Media Multitasking, and less on the predictive role of Differential Susceptibility Variables.
The studies in the present thesis brought evidence supporting the future extension of the DSME model, by indicating a potential moderating role of context in the relationship between relevant Differential Susceptibility predictors and Media Multitasking.
The studies in the present thesis contributed to a more granular understanding of Media Multitasking behavior, by showing that sub-types of Media Multitasking are differentially predicted by individual Differential Susceptibility Variables and are associated with different outcomes.
The thesis also brought forward evidence for the existence of a potential vulnerability period to media effects, the beginning of early adolescence, when individuals are more likely to report negative Executive Functioning outcomes (Inhibitory Control) related to Media Multitasking.
The results support both a role of Executive Functioning as an important Media Multitasking predictor and one of Media Multitasking outcome, thus creating a basis for investigating the bidirectional relationship between Executive Functioning and Media Multitasking.

4.2 Methodological implications

Table 2. *Summary of main methodological contributions of the present thesis.*

Media Multitasking behavior was studied in three variable forms – as a continuous variable, as a top-down extreme group variable and as a bottom-up (data-driven) grouping variable.
The method and design of a previous study was replicated, and its findings were extended by including relevant moderating variables.
A novel approach to generating media user groups in a data-driven way was used.
Functional analysis was used for the first time to study the proximal antecedents, co-occurrences and consequences of Media Use and Media Multitasking.
A novel combination of methods was also used to study Media Multitasking predictors and proximal dynamic – combining data-driven, quantitative, and qualitative analysis.

4.3 Practical implications

Table 3. *Summary of main practical implications of the present thesis.*

The thesis facilitates a more thorough assessment of Media Multitasking behavior, by underscoring the importance of including combinations of different types of activities in Media Multitasking measurement.
The thesis also indicates relevant individual characteristics that are likely to precede and predict Media Multitasking engagement in ways that have been associated in the literature with difficulties in Executive Functioning or academic tasks and outcomes.
The thesis also helped identify a potentially relevant period of vulnerability to media effects, which can constitute the target of a closer monitoring of media behavior, as well as potential preventive programs.

The thesis offered insight into the ways of using media that are more likely to be adaptive and less likely to be detrimental; it also indicated specific behaviors (strategies) that can help prevent dysregulated media use and potential detrimental outcomes of media engagement.

4.4 Limitations

The studies included in the present thesis, as well as the overall thesis, also present some important limitations, that must be considered when interpreting the results. The first of these limitations concerns the correlational nature of the design and, implicitly, of the observed relationships. While the thesis combined the use of multiple methods to study the correlates of Media Multitasking from multiple points of view, the design is a correlational one. As a result, the thesis offers little evidence to support causal claims regarding the direction in which the outlined relationships unfold.

A second relevant limitation concerns the decreased power for the analyses conducted in Study 2, especially those concerning Temperament. An error led to fewer participants completing the Effortful Control subscale and, thus, caution must be taken when interpreting these results. However, while the analyses were underpowered, the results can be considered somewhat robust. Supplementary analyses with the entire sample that excluded the Effortful Control dimension and used the data from all participants in the sample of Study 2 indicated that the relationships are likely to be preserved even with a reduced number of participants.

Another important aspect that could limit the generalizability of results in the present research is the fact that some variation was inadvertently introduced in the performance tasks of Study 1. Because of limited information availability regarding the computerized performance tasks in the replicated study, some structural aspects of the three tasks varied between the two studies. This might have led to variations in the scores obtained in these tasks

between Romanian and Dutch adolescents. However, the results concerning these tasks were similar in the two studies.

Another limitation of the current thesis, to some extent, is the fact that it studied Media Multitasking behavior both in a normal, pre-pandemic context, as well as during the pandemic itself. The fact that two of the studies were carried out during this latter, unusual time limits, to some extent, the generalizability of the observed relationships for post-pandemic times. This specific context is very likely to have changed the dynamics of media behaviors significantly, and to introduce factors or interactions between factors that could not have been anticipated and controlled. This would lead to observing some relationships that may not be maintained after the end of this experience. While some of the changes in digitalization and academic work have continued after the pandemic was over, many of these contextual aspects returned to their pre-pandemic status. Importantly, the pandemic also reduced the availability and willingness of adolescents (and their parents) to participate in (online) studies. This is a limitation in two ways – first, it is possible that only adolescents with some unmeasured traits accepted to participate in such studies, thus limiting the generalizability of the results to this self-selected population. Secondly, it made it hard to gather enough participants to conduct sufficiently powered analyses and yield reliable results. Thus, the results obtained in the present thesis must be replicated outside of such a specific context, with a greater sample, in order to be able to understand the extent to which they apply to the post-pandemic context.

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