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Tantrums, toddlers and technology: Temperament, media emotion regulation, and problematic media use in early childhood

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Abstract

Parents regularly use media to help regulate their child's difficult emotions, particularly for those with a more difficult temperament. However, no research has examined how this may be related to the development of problematic (or addictive-like) media use in early childhood. The purpose of the study was to examine associations between temperament, parental media emotion regulation, and problematic media use in young children, using both questionnaires and observational data. Participants included 269 toddlers (2–3 years old) and their parents, who completed several observational tasks and questionnaires. Analyses revealed that higher levels of media emotion regulation was associated with more problematic media use and more extreme emotions when media was removed in toddlers. Additionally, temperament (specifically negative affect and surgency) was related to problematic media and extreme emotions and was mediated by media emotion regulation. Parents should avoid using media as a primary way of regulating their children's emotions as this may be related to the development of problematic media strategies during infancy.

Keywords

Media emotion regulation; Problematic media; Temperament; Infancy; Screen media; Toddler

Children ages zero to three years old are using media at increasing rates (Rideout, 2017), with 75% to 96% of infants using media daily (Mack, 2012; Rideout, 2013, 2017). Nationwide, parents report young children (younger than two years old) consume an average of one hour of screen media per day (Rideout, 2017). These numbers suggest that very

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young children consume media on a regular basis. A few studies have found that parents often use media as a way to calm or distract their young children when they experience strong emotions (Radesky et a., 2016). This is potentially problematic, given that toddlerhood is a critical time for learning basic emotion regulation (Shin & Kemps, 2020). Using media as a means of escaping difficult emotions is one risk factor for developing a technology disorder later in life (e.g., Gentile, 2009), thus, parents promoting media to distract children from their emotions may be a risky strategy. However, these relationships have only been studied in adolescence and adulthood, whereas problems with media likely develop much earlier in life. The purpose of the current study is to examine how parental strategies involving child media emotion regulation is associated with problematic media use in young children, using both survey and observational data.

Infants and Toddler Media Use

Young children use media for a variety of reasons, and effects differ based on the context and content of the media environment (Barr & Linebarger, 2016). For example, video chatting (e.g. FaceTime and Zoom) allows families to connect and build relationships with grandparents, extended relatives, or physically absent parents, despite physical distance (McClure & Barr, 2016; McClure, et al., 2015). Adults are responsive to infants' needs while video-chatting, helping develop positive social-emotional skills (McClure, et al., 2017). Additionally, viewing educational media tends to result in positive outcomes for toddlers, including higher vocabulary, numeric skills, school readiness, and emotional development (Fisch, et al., 1999; Pecora, et al., 2006; Rasmussen et al., 2016).

However, infant and toddler media use, under different circumstances, may be linked to several adverse outcomes. Such outcomes may include low cognitive development (Tomopoulos, et al., 2010), poor language development (Zimmerman, et al., 2007), decreased attention span (Nikkelen et al., 2014), and poor self-regulation (Radesky, et al., 2014). These outcomes seem to be especially prevalent for infants who use media alone or to regulate negative emotions (Levine, et al., 2019). This final context (which we call media emotion regulation), may be important to understanding how media may influence the development of young children.

Media Emotion Regulation

Media emotion regulation refers to the practice of using media to regulate difficult emotions (Radesky et al,. 2016). For example, if a child is throwing a tantrum at the grocery story, a parent may give them a phone to try to regulate their emotions and help them calm down. Infants who have higher media exposure tend to experience a hindered ability to self-regulate in general (Radesky, et al., 2014). However, little research has examined using media specifically as a form of emotion regulation. Emotion regulation, an important skill with developmental roots in infancy, has long term implications on coping and resilience (Shin & Kemps, 2020), attachment and regulation strategies (Girme, et al., 2020), and later substance use (Liu & Ma, 2019). Infants and toddlers rely on external support to learn emotion regulation skills (Kopp, 1989). Thus, when parents offer screens, for instance a video or a phone, to a distressed infant or toddler in attempt to soothe or solve problematic

emotions, the child's ability to learn positive emotion regulation strategies may be hindered (Gordon-Hacker & Gueron-Sela, 2020) and problematic media use (such as relying on media for coping) may emerge. While on occasion, in unique or stressful environments (e.g., hospital visits, airplane flights, or long road trips), soothing infants and toddlers with media makes practical sense – however, media emotion regulation can be maladaptive when it plays a consistent and normal part of a child's everyday life (Radesky & Christakis, 2016).

More recent research has examined longitudinal links between maternal media emotion regulation strategies with infants and negative emotionality in toddlerhood (Gordon-Hacker & Gueron-Sela, 2020). The little research that exists is somewhat mixed. Despite theoretical indications, this research found no bi-directional longitudinal link between use of media to regulate negative emotions at 18 months and negative emotionality at 26 months (and vice versa). However, children with heightened negative emotionality (negative affect) were significantly less likely to be given media to regulate negative emotions, the opposite of the research hypothesis. These findings suggest that temperament is a significant nuance in the continuing media emotion regulation conversation, although more research is needed, especially as no research has examined how these are related to problematic media use. We examine associations between these variables in the current study.

Problematic Media Use

Problematic media use is defined as excessive media use that interferes with the child's functioning (Domoff et al., 2020). Problematic media use captures a dysfunction in social, behavioral, and/or academic development due to excessive or maladaptive media use, exemplified in the following behaviors; loss of interest in other activities, preoccupation with media, withdrawal from others, high tolerance for media, and deception surrounding media (Domoff et al., 2019). That is, a core aspect is dysfunction brought about due to a lack of appropriate self-regulation.

The vast majority of research on this topic is with adolescents and adults, with a strong focus on gaming disorders and internet addictions (Brand et al., 2016; Gentile et al., 2017; Plante et al., 2019; Young et al., 2017). Research is just beginning, however, to examine the development of problematic media use during early childhood (Domoff et al., 2020). Because of the developmental stage of early childhood, infants and toddlers may exhibit problematic or at-risk media patterns but remain unaddicted. These problematic media patterns, however, may lead to later disordered or addictive media patterns in adolescence or adulthood (Domoff et al., 2020).

Theoretically, media emotion regulation may be associated with the development of problematic media use. Media emotion regulation may lead children to develop an over-reliance on media and not learn other more adaptive self-regulatory strategies, especially when they are upset. This may increase the likelihood that children would be overly focused on media as a primary coping mechanism. Indeed, one of the markers of problematic media use involves using media as coping tool, with these children tending to show strong emotions when they are unable to use media anymore (Domoff et al., 2020). Thus, it is likely that media emotion regulation and problematic media use are linked at a young age.

Emotional Reactivity

Emotional reactivity (or strong emotional reaction) to the removal of media potentially indicates developing problematic media use patterns in infants and young children. For infants and young children, transitioning away from media is often a difficult experience for both the child and the parent, with 93% of interviewed parents reporting that, at least sometimes, their toddler throws tantrums, whines, or resists ending media use (Hinker et al., 2016). Another study of adolescent media use at bedtime linked emotion regulation challenges with difficulty disengaging from media (Clifford et. al., 2020). However, little research has examined emotional reactivity in the context of media use, particularly patterns of media emotion regulation and problematic media use, especially for infants and toddlers.

Bioecological Perspective and Media Emotion Regulation

Theoretically, temperament, media emotion regulation, and problematic media use may be related. We use the Bioecological theory and the Interactional Theory of Childhood Problematic media (IT-CPU) to frame this study. According to Bioecological theory, *proximal processes* are the enduring patterns of interaction (Merçron-Vargas, et al., 2020) which drive human development (Krebs, 2009; Bronfenbrenner & Evans, 2000). Viewing patterns of media emotion regulation as proximal processes allows for better understanding of the mechanisms driving these processes (Bronfenbrenner & Evans, 2000). Building off of Bronfenbrenner's theory, the IT-CPU theory, acknowledges proximal processes are the central component in shaping patterns of long-term problematic media use in young children (Domoff, Borgen & Radesky, 2020). Specifically, the consistent reciprocal interactions between the child, the parent, and the media make up the proximal processes which impact media emotion regulation. These proximal processes are influenced by both environmental and biological factors and either positively or negatively affect child long-term development (Merçon-Vargas, et al., 2020).

Bronfenbrenner added biological factors to his earlier versions of Bioecological theory under the umbrella of *person* with three main characteristics: force characteristics (inherent internal characteristics: motivation or temperament), resource characteristics (internal resources: prior experiences, intelligence or educational opportunities) and demand characteristics (easily discernable or visible characteristics: e.g., age, sex, or skin color) (Bronfenbrenner & Morris, 1998).

Force characteristics (e.g., temperament) interact with the environment to produce different outcomes, regardless of resources or demand characteristics, by encouraging healthy or unhealthy proximal processes (Bronfenbrenner & Morris, 2006; Merçon-Vargas, et al., 2020). For example, a child's temperament affects sleep patterns (Kim, et al., 2020), behavioral inhibition (Troller-Renfree, et al., 2019), social development (Séguin & MacDonald, 2016), and eating and exercise patterns (van den Heuvel, et al., 2016). These behaviors exemplify proximal processes that are significantly influenced by a child's temperament. Difficult temperaments interact with other individuals or objects, discouraging healthy proximal processes. In contrast, easy temperaments more often encourage healthy

proximal processes (Bronfenbrenner & Morris, 2006). Thus, temperament may be important in framing the relationship between media emotion regulation and problematic media use.

Temperament and Media Emotion Regulation

By viewing media emotion regulation patterns as a proximal process, a bioecological lens raises awareness that force characteristics of a child (e.g. temperament) have an impact on the patterns in a child's life which, over time, teach emotion regulation skills. These characteristics affect proximal processes by influencing parents' responses to and treatment of their child and their child's emotions (Laukkanen, et al., 2013). Opinions differ on the stability of temperament over an individual's lifespan. Some scholars believe in a static temperament, where parents must learn to adapt to their child to encourage healthy development (Kopala-Sibley, et al., 2018). In contrast, research also indicates that temperament develops overtime, shaped by parents and the environment (Mathesius, et al., 2016). Research surrounding toddler media use and media emotion regulation supports both views of temperament.

In terms of media emotion regulation, some research indicates that children with difficult temperaments may be more likely to be given mobile media devices to cope when upset compared to children with easy temperaments (Radesky et al., 2016). Additional research has found a link between difficult temperament and media emotion regulation problems (Gordon-Hacker & Gueron-Sela, 2020). This may suggest that temperament guides the proximal processes of parents teaching their children media emotion regulation. In contrast, another study observed preschool-aged children who were high users of media lost their temper and had more difficulties calming down when excited compared to children with low media use (Twenge & Campbell, 2018), suggesting that media use can also have an impact on the development of temperament. However, both bioecological theory and IT-CPU have an antecedent view of temperament in relation to the proximal processes guiding development (Domoff et al., 2020; Bronfenbrenner & Morris, 1998). Thus, for this study, we approach temperament with a fixed perspective.

Together with Bioecological theory, IT-CPU encapsulates a wide range of important factors influencing proximal processes including environment, context, and time (Bronfenbrenner & Evans, 2000; Domoff et al., 2020; Tudge et al., 2009). This paper tests some contextual factors (patterns of parent media use, parent education), but are not the primary focus of our analysis.

Study Aims and Hypotheses

There is very little research on temperament and media emotion regulation, with no research examining associations with early markers of problematic media use. We examine these associations in the current study in a sample of toddlers between the ages of 2–3 years old, using both questionnaire and observational data.

We hypothesize that a difficult temperament will be associated with both problematic media use and emotionality when media are removed, and these associations will be mediated by media emotion regulation (See Figure 1). In other words, parents will utilize media more to

manage their children's difficult emotions, especially if the child has a difficult temperament. Children may then rely on media to manage emotions in general, and will show more problematic behavior around media, including increased negative emotions when media are taken away.

Methods

Participants

Data for this study came from Wave 3 (2019) in-home participants of Project M.E.D.I.A., a longitudinal study following children from prenatal to adulthood, specifically focusing on how family processes (measured observationally and from survey responses) affect media use, social development, personality, and temperament. Participants were recruited who lived in the Denver Colorado area at Wave 1, and all in-home participants still live in the Denver area. A total of 269 infant-primary caregiver dyads were in home participants. Infants were on average 29.58 months old (SD = 3.83 months), 132 were male, 115 were female, with 3 missing. Primary caregivers were primarily female (female = 265, male = 4). Approximately 59% of primary caregivers were Caucasian, 9% Black, 22% Hispanic or Latinx, 2% Asian American, and 5% mixed or other. Approximately 63% of primary caregivers were married, 14% were single-never married, 12% had an unmarried partner living with them, 1.5% were divorced, and 2% were separated from their partner. 22.7% of primary caregivers had completed High School or equivalent or less, 35% had completed some college or a vocational degree, 27% had completed a bachelor's degree, 16% had completed a graduate degree. 11.9% of primary caregivers reported a combined household income below $20,000, 24.2% reported a household income above $20,000, but below $50,000, 25.3% reported a household income above $50,000, but below $80,000, 25.3% reported more than $80,000, but less than $100,000, and 14.2% reported a household income above $100,000. 31% received public assistance at the time of data collection, 4.8% received public assistance in the past year, but were not currently receiving public assistance, and 15.6% had received public assistance in the past, but not in the last year.

Measures

Temperament.—Temperament was measured using the 36 question Early Childhood Behavior Questionnaire Short-form (ECBQ-SF; Putnam, et al., 2006). The ECBQ-SF is a widely used measure of three domains of child temperament: surgency/extroversion, negative affect, and effortful control. Parents report on a seven-point Likert type scale on their child's behavior in the last seven days. If the child has not engaged in the described behavior the parent in told to select "Does not apply." Responses range on a seven-point Likert scale from 1 *(Never)* to 7 *(Always).* The surgency/extroversion subscale includes 12 items and example items include "When offered a choice of activities, how often did your child decide what to do very quickly and go after it?" and "When a familiar child came to your house, how often did your child seek out the company of the child?" The surgency subscale was found to be acceptably reliable (α = .86). The negative affect subscale includes 12 items and example items include "While having trouble completing a task (e.g., building, drawing, dressing), how often did your child get easily irritated?" and "When approached by an unfamiliar person in a public place (for example, the grocery store), how often did your

child cling to a parent?" The negative affect subscale was found to be reliable (α = .74). The effortful control subscale includes 12 items and example items include "During daily or evening quiet time with you and your child, how often did your child enjoy just being quietly sung to?" and "When engaged in play with his/her favorite toys, how often did your child play for more than 10 minutes?" The effortful control subscale was found to be acceptably reliable (α = .70).

Problematic Media Use.—Parents reported on children's problematic media use using the nine item Problematic Media Use Measure Short Form (PMUM-SF, Domoff et al., 2019). The PMUM was designed to assess multiple domains of media interference, typically associated with addiction or problematic use in children under twelve, including loss of interest in other activities, preoccupation with media, withdraw, tolerance, deception, and serious problems due to use. Parents answer on a five-point Likert-type scale from 1 *(Never)* to 5 *(Always).* Example items include "When my child has had a bad day, screen media seems to be the only thing that helps him/her feel better" and "The amount of time my child wants to use screen media keeps increasing." Items are summed and higher scores are indicative of increased problematic media use by young children. The scale showed adequate reliability (α = .80).

Media Emotion Regulation.—Parental use of media to help their child regulate their moods and emotions was assessed using the eight-item scale developed for this study. Parents were asked to rate how often they engage in a series of activities regarding using media to manage their child's emotions and moods on a five-point Likert scale from 1 *(Never)* to 5 *(Always).* Table 1 shows a full list of items for this measure. Items were averaged and higher scores indicate more media use to regulate emotion and mood. The scale showed adequate reliability (α = .87).

Emotional reactivity in the absence of media.—To study emotional reactivity in the absence of media, children viewed a five-minute clip from *Daniel Tiger's Neighborhood,* which focused on social-emotional needs (Santomero, 2012). This is a very popular television show for young children and the specific episode that was shown specifically models what to do when angry. We wanted to see if children would be emotionally reactive even after viewing this type of media when removed. Parents were instructed to have their child watch the show as they normally would, including any normal parent-child processes. This interaction was recorded. The clip ended unexpectedly after five minutes, right in the middle of the episode. Children were filmed for an additional two minutes after the clip was finished to assess emotion reactions when media is removed. The research assistant recording the participants was located on the side of the participant rather than directly in front to minimize distraction during the task and to ensure mobility if the child left the frame.

A group of four undergraduate, trained research assistants (3 female, 1 male) coded the 2 minutes after media was removed to examine both mild and extreme emotional reactivity. Emotional reactivity was rated in 15-second intervals, with 0 = behavior absent, 1 = behavior present. A "Mild" code was given when the child was having a mild, yet negative reaction following the end of the clip. This behavior included the child talking about the media and

displaying physical signs of mild distress (e.g., whiny tone of voice, furrowed brow, frowning, pouting). An “Extreme” code was given when there were more severe reactions, such as screaming, throwing a tantrum (i.e. throwing self on ground), crying, wrestling the parent for control, etc.). Approximately 20% of videos were coded by all raters. Inter-rater reliability was adequate for both mild (Krippendorf’s $\alpha = .84$) and extreme emotion (Krippendorf s $\alpha = .78$).

Parent media use.—Parent media use was utilized as a control variable in the current study, as parent media time has been hypothesized to be related to child problematic media use (Domoff et al., 2020) and also may be related to the likelihood that parents would give their child a media device to attempt to regulate their emotions. Parents were asked to note the daily frequency with which they used a variety of media during the week and also the weekend (which were averaged). Participants answered seven questions using a six-point Likert scale from 1 *(Not used)* to 6 *(More than 4 hours).* Participants recorded their daily use for seven different types of media including television, using the computer, reading books or magazines, playing video games, using apps, listening to music, and using social media. Such self-report measures of time with the media are widely used and have been shown to be a moderately reliable measure of time spent using the media (Rideout, et al., 2013, 2017).

Analysis plan

A path analysis using structural equation modelling using observed variables was conducted to examine the association between temperament (negative affect, surgency, and effortful control), problematic media use, and emotional reactivity to removal of media, with media emotion regulation as a potential mediator. Analyses were conducted using Mplus (version 8.4). We first present preliminary analyses (gender differences, and bivariate correlations) before presenting the main analysis.

Results

Preliminary Analysis

A Multivariate of Analysis of Variance revealed a non-significant multivariate effect for gender on the major study variables, $F(7, 215) = 1.57$, $p = .157$. As a result, we do not control for gender in the main analyses.

Media emotion regulation was positively correlated with problematic media use, parental media time, negative affect, and negatively correlated with effortful control. Additionally, problematic media use was positively correlated with media time, negative affect, and negatively correlated with effortful control. See Table 2 for bivariate correlations.

Main Analysis

A path analysis using SEM was constructed using Mplus (version 8.4). Temperament (negative affect, surgency, and effortful control) was modeled to predict problematic media use and emotional reactivity when media are removed as mediated by media emotion regulation. Age, parental education, parental marital status and parental media time were

used as covariates. Model fit was adequate, χ^2 (12) = 26.81, p = .008; CFI = .944, RMSEA = .072. See Figure 1 for model.

Negative affect (β = .25, p <.001) and surgency (β = .18, p = .007) were both positively associated with media emotion regulation, while effortful control (β = −.14, p = .04) was negatively associated with this construct. Media emotion regulation was positively associated with problematic media use (β = .22, p = .001). Temperament did not directly predict problematic media use once media emotion regulation was added to the model (even though these relationships existed at the bivariate level).

Emotional reactivity was less straightforward. Negative affect was negatively associated with both mild (β = −.16, p = .006) and extreme (β = −.15, p = .023) emotional reactivity when media was removed. Additionally, media emotion regulation was positively associated with extreme emotional reactivity only (β = .37, p = .002).

In terms of controls, parental media time was positively associated with media emotion regulation (β = .44, p <.001) and negatively associated with extreme emotional reactivity (β = −.26, p = .001). Age was positively associated with surgency (β = .47, p <.001). Marital status was positively associated with problematic media use (with higher scores indicating unmarried status), (β = .54, p < .001). Additionally, parental education was negatively associated with media emotion regulation (with higher scores indicating higher levels of parental education), (β = −.12, p = .03)

We then examined indirect effects of media emotion regulation, by conducting bootstrapping analysis based on 2000 bootstrap resamples. Using bootstraping may adjust for some non-normality in the data and represents a more conservative, but robust technique as compared to traditional maximum likelihood methods (e.g., Walker & Smith, 2017). Bootstrapping showed with 95% confidence that media emotion regulation mediated the relations for negative affect (standardized indirect effect β =.055, p = .01), surgency (standardized indirect effect β = .04, p = .049), but not effortful control (standardized indirect effect β = −.031, p = .078) on problematic media use. Additionally, there was a significant indirect effect for surgency (standardized indirect effect β = .068, p = .032), and negative affect (standardized indirect effect β =.091, p = .012), but not effortful control (standardized indirect effect β = −.05, p = .061), for extreme emotional reactivity when media are removed.

Discussion

This study examined associations between temperament, media emotion regulation, problematic media use, and emotionality when media are removed. By viewing media emotion regulation as a proximal process, we understood that characteristics of the child (e.g., temperament) could be significant aspects of this proximal process. We hypothesized that parents would utilize media more to manage children's difficult emotions if children had a difficult temperament. We further hypothesized that children who engaged in media emotion regulation more often would show more problematic media use and strong emotions when media are taken away. Our hypotheses were supported, but with nuance.

Overall, we found a consistent positive relationship between media emotion regulation patterns and problematic media use. Based on our theoretical foundation (Domoff, Borgen & Radesky, 2020; Bronfenbrenner & Evans, 2000), this was unsurprising. Parents who reported using more media to regulate their infants' difficult emotions also reported more problematic media behaviors in their infants. This finding works in tandem with existing literature surrounding emotion regulation development (Gordon-Hacker & Gueron-Sela, 2020; Domoff et al., 2020) to support the claim that media emotion regulation processes may have long-term maladaptive consequences (e.g. Shin & Kemps, 2020; Girme, et al., 2020). Our findings demonstrate a link between media emotion regulation processes and problematic media use and should be further studied and discussed to better help parents raise emotionally healthy and resilient children in a world becoming increasingly media dependent. We particularly welcome longitudinal research on this topic, as our study only examined cross-sectional relationships and in children who were quite young in age when media patterns are just beginning to emerge.

Temperament

Temperament played a significant role in these relationships, though the direct of the results was not always in the expected direction. Negative affect was positively associated with media emotion regulation processes. This aspect of temperament helps us understand how force characteristics of an infant can drive the proximal processes to promote parents' use of media emotion regulation. Toddlers with difficult temperaments (high negative affect) tend to be given media to regulate their emotions more often than toddlers with easy temperaments (low negative affect), perhaps because media simply, quickly, and efficiently calms a difficult child.

Additionally, difficult infants (high negative affect) may be given media more often in general to not only regulate negative emotions in the moment, but also to distract and avoid negative emotions (also a facet of media emotion regulation, see Table 1, Question 1). Perhaps parents, knowing their child frequently experiences unpleasant emotions on a regular basis, may give their infant media more often to avoid an emotional meltdown. Thus, difficult infants may develop an emotional dependence on media to regulate their emotions both in times of distress, and to avoid unpleasant emotions altogether through distraction.

Negative affect significantly correlated with problematic media use at a bivariate level (though this fell out of the model when media emotion regulation was added, suggesting a fully-mediated indirect effect). Based on our theoretical foundation, we would suggest that this mediated indirect effect provides evidence that perhaps temperament (specifically negative affect) guides the development of problematic media use through the media emotion regulation processes. As children with difficult temperaments are given media to calm down or avoid problematic emotions, they become more dependent on media at all times, and not just to "deal" with unpleasant emotions.

Surgency (or extroversion) was also positively related to media emotion regulation. This second facet of temperament lends greater understand to how force characteristics drive the proximal processes surrounding media emotion regulation. Like infants with high negative affect, infants with high surgency can be demanding. Infants high on surgency are perhaps a

little more wild or talkative, and seem to demand more interaction from parents. Thus, when these children become upset or experiences negative emotions, the parents are more “spent”, and may attempt to help their child regulate these negative emotions with depleted resources. This perhaps could explain why parents with high surgency children more often used media emotion regulation strategies than parents of children with lower surgency, as media emotion regulation is perhaps a simpler and less demanding strategy to help deal with a young child’s negative emotions. The third facet of temperament, effortful control, was less associated with media emotion regulation than the other two. This relation was not significant, suggesting more research should be conducted to understand how or whether this force characteristic has an impact on the proximal processes around media emotion regulation, subsequent problematic media use, and emotional reactivity upon the removal of media. It is certainly possible that this relationship manifests over time and is less apparent in a cross-sectional study (e.g., Eisenberg et. al., 2005; Pace et. al., 2019).

These findings surrounding the various facets of temperament primarily support our theoretical argument based on Bioecological Theory and IT-CPU, that force characteristics significantly influence proximal processes, which in turn affect development. These findings carry significance for modern parents, who want their children to develop into functional and happy adults, but often struggle to navigate the prevalence of media in today’s world (e.g., Nelissen & Van den Bulck, 2017).

Emotional Reactivity

We also found that media emotion regulation was positively associated with extreme emotional reactivity when media were removed. In other words, infants who had higher levels of media emotion regulation from their parents tended to tantrum with extreme emotion when media were taken away. This finding is consistent with the problematic media association and may be a risk factor for the child developing issues surrounding media.

Mild emotional reactivity, however, was not associated with media emotion regulation. Two possible ways of understanding this finding are of note. First, perhaps infants who experience high media emotion regulation patterns may be less inclined to mild reactivity. Negative affect and surgency were both positively correlated with emotional reactivity, suggesting that possibly media emotion regulation patterns are more present in extremely reactive children. Both negative affect and surgency could connote highly reactive temperaments. Interestingly, effortful control was the only facet of temperament that was not significantly related to media emotion regulation, perhaps indicating that media emotion regulation is not used often for children who display greater levels of self-control and are perhaps less reactive in general. Another possible explanation may be that mild emotional reactivity might be too nuanced to capture only with outward observations. Future research should be conducted using additional methods to measure emotional reactivity, such as using heart monitors to better capture mild emotional reactivity and allow us to understand the nuances around emotional reactivity that are less outwardly discernable (Sloan, 2004).

Negative affect was also indirectly negatively associated with extreme emotional reactivity in response to media being withdrawn. Based on our theoretical foundation this is surprising. Bronfenbrenner hypothesized that proximal processes would entrench patterns of behavior

and expectation in developing individuals (Bronfenbrenner & Evans, 2000; Domoff, Borgen & Radesky, 2020). The infants given media more often to regulate their emotions engage in the proximal processes around media emotion regulation more often. These infants form expectation around these processes, and when disrupted, we would hypothesize that they would be unable to cope adaptively since their primary tool for coping with negative emotions (media) had been removed. However, this was not the case in terms of extreme emotions. Potentially infants with high negative affect are not only given media just to regulate their emotions, but also to prevent negative emotions altogether. This pattern would introduce nuance to the proximal processes guiding media emotion regulation patterns. If infants are given media all the time, not just to regulate their emotions, then perhaps the infant, upon the removal of media, expects the media to return shortly after, resulting in a less upset child. These children would expect media always, not just when upset, and would not necessarily be emotionally reactive. Research should continue to examine these relationships in the future, as our findings were not straightforward.

Contextual Features

Bioecological theory and IT-CPU sensitize us to the importance of contextual factors on proximal processes (Bronfenbrenner & Evans, 2000; Domoff et al., 2020; Tudge et al., 2009). This paper specifically tested characteristics of the parent that created an environmental context for developing infants. We found that lower education and higher personal parental media use were significantly related to higher media emotion regulation. These findings are consistent with previous research (e.g., Rideout & Hamel, 2006) indicating that parent media use and education predict infant media use and extend it to the context of media emotion regulation. These findings present important implications for educators and policy makers. Likely, high media-centric parents have different attitudes towards media than low media-centric parents (Nikken & Schols, 2015). High media-centric parents could feel less worried about the dangers of high media use, which in turn could make them more likely to use media emotion regulation strategies with their infants. Thus, educators could specifically help high media-centric parents understand the potential negative consequences of media emotion regulation patterns for infants.

Implications of the Study

We, like most researchers, believe that what we are studying has implications beyond the specifics detailed in the statistics. If the reader will allow us to speculate, we would like to describe the broader picture that partially motivates this research. We have noticed that many families take young children with them to restaurants and other public places. Children are often not as interested in the activity as the parents, and they become restless and begin to fuss. We have observed that many parents manage this interruption by giving the child a smart phone or tablet to play with. The child quiets down and the parents are able to continue to eat their meal without disruption. To the parents, this likely feels like a win-win - the child is happy and the parents are happy. But if we consider what is really happening here and the longer-term consequences, this may actually be a lose-lose scenario.

As noted, a primary developmental task of early childhood is to learn emotional self-regulation and behavioral self-regulation (e.g., Shin & Kemps, 2020). By providing media as

a distraction whenever a child is fussy or bored, the parent is taking away the opportunity to learn that these emotions are acceptable to feel, and instead reinforces the idea that unpleasant emotions are something to try to get away from. Furthermore, it reinforces the idea that emotions are due to external conditions and controlled by the outside. This is already a dominant idea in American culture - that if you're feeling anxious or depressed, you should go buy something (e.g., "retail therapy"), or that you should take a pill, or do something else to distract yourself. Distraction is a type of coping, but it is classified as "negative" coping, because it does nothing to actually make the situation better, and if one is in a difficult situation it can actually make things worse to simply try to ignore the problem. Perhaps worse still, emotions are not simply epiphenomenal - a reaction to something that "happens to" us. They can be, but more importantly, they are a form of human awareness, knowledge, and even wisdom. Anger, for example, is often a clear-sighted awareness that something is not right or not fair. If we constantly distract ourselves when unpleasant emotions arise, we are depriving ourselves of the opportunity to learn from our own inherent wisdom.

To return to the child who is taught from a young age that difficult emotions are something to be avoided, to distract ourselves from by looking outside and changing our environment, what might the consequences be? When that child has grown and is trying to establish intimate and committed relationships, what happens when problems occur in the relationship? Will she ignore the problems until they grow too large to be solved? Will he feel that the only reasonable way to deal with the difficult feelings is to make an environmental change - that is, to find a new partner? We worry that the biggest problem of providing young children with media at an early age, especially as an emotion-regulation strategy, is that it will make social-emotional connection with other humans much harder because they will not have learned that negative emotions can be tolerated, worked with, and even learned from. This may extend to other contexts outside of interpersonal relationships, including when the child is faced with failure, boredom, or mental health issues. This is, of course, simply our speculation, but as developmental scientists, we care deeply about what makes healthy development easier or more difficult. The present results that early media emotion regulation predicts increased concurrent problematic media use and more emotion problems when media aren't allowed is a beginning of support for these speculations. Given that there are other data demonstrating that using media as a coping mechanism is predictive of greater functional problems rather than fewer in late adolescence (e.g., Plante et al, 2019), we believe this is a topic that warrants concern and research.

Limitations and Future Research

This study has a number of strengths including quasi-experimental design to measure emotional reactivity, and an economically and racially diverse sample. However, like all research, it is not immune from various limitations. First, measures of temperament and media emotion regulation behaviors were based on parent reports. Despite the frequency of practice to study children's behavior, results should be understood in light of potential bias when reporting media emotion regulation patterns with infants. Nonetheless, there is little reason to believe that any bias about temperament would influence the hypotheses tested here in a systematic fashion.

The cross-sectional design is another limitation. The design did not allow us to look at the development of media emotion regulation and problematic media use over time, despite theoretical weight. This study is, however, a part of an ongoing longitudinal study, and we hope to be able to follow participants' trajectories and better understood the interaction between temperament, media emotion regulation, and problematic media use over time. Future research should engage with these research questions longitudinally to look at stability of these interactions over time. Although some research has linked both parent's media habits to children's media use (Lauricella et. al., 2015), we only explored the primary caregiver's media use. Thus, future research should explore how both parents' media use affect media emotion regulation patterns and problematic media use, not just the primary caregiver.

Conclusion

Although further research is required to better understand the proximal processes guiding media emotion regulation and the development of problematic media use, our results suggest that media emotion regulation may be problematic in promoting healthy infant media use and emotion regulation. Every human being experiences varied emotions, making healthy emotion regulation development essential for infants and young children. We believe that based on both theoretical foundations and our subsequent results that media play a significant role in this developmental process. We hope that future research will continue to seek to understand the long-term implications of media emotion regulation patterns and problematic media use, exploring additional contextual and person characteristics to help raise emotionally healthy children.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Highlights

1. Media emotion regulation was associated with problematic media use in toddlers.
2. Parents used media emotion regulation at different rates depending on child temperament.
3. Parents should avoid using media as a primary way of regulating their children's emotions.

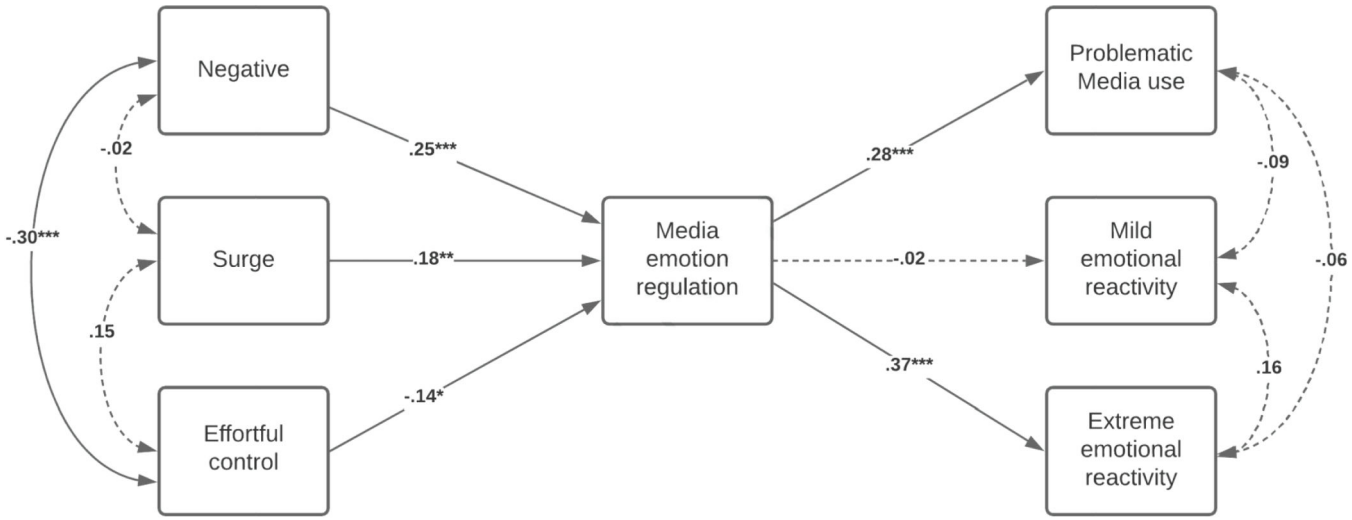

Figure 1:

Path analysis of temperament, media emotion regulation, problematic media use, and emotional reactivity

Notes: Standardized values are shown. Additionally, error terms for endogenous variables and covariances are not shown. Solid lines represent significant effects while dashed lines represent nonsignificant effects. Control variables (child age, parental media use, education, and marital status) are not included in the figure. Additionally, main effects between temperament and endogenous variables are also not shown in the figure. Additional statistics can be obtained in the supplemental information. *$p < .05$; **$p < .01$; ***$p < .001$.

Table 1:

Media emotion regulation items

How often do you give your child a cell phone, tablet, or other media device to help keep him/her calm when you're out in public?
After your child gets upset, how often do you allow your child to watch a television show (on any device) to help him/her calm down?
When at restaurants and your child begins to get fussy, how often do you allow your child to play with your phone or another media device to help him/her calm himself/herself down?
How often do you have your child watch TV/DVDs on any media device as a way of calming down before bed?
How often does your child want to use electronic media (e.g., TV/DVDs, tablets, phone, video games) as a way to help regulate his/her mood?
When at the store and your child gets upset, how often do you allow your child to play with your phone or another media device to help him/her calm himself/herself?
How often do you pass your child your phone or other media device when your child gets fussy while driving somewhere in the car?

Table 2:

Bivariate correlations for major variables

		1.	2.	3.	4.	5.	6.	7.	M (SD)	Range
1.	Media emotion regulation	---							2.14 (.78)	1–5
2.	Problematic media use	45***	---						1.72 (.54)	1–5
3.	Parent Media time	51***	29***	---					1.96 (.51)	1–6
4.	Negative affect	.35***	.22***	.21***	---				3.06 (.70)	1–7
5.	Surge	.02	−.01	−.19**	−.15*	---			5.54 (.65)	1–7
6.	Effortful control	−.23***	−.15*	−.15*	−.31***	.27***	---		4.81 (.65)	1–7
7.	Mild emotional reactivity	.01	−.08	.06	−.16*	.09	.02		.62 (1.20)	0–6
8.	Extreme emotional reactivity	.12	.02	−.08	−.04	.02	.01	.16*	.14 (.70)	0–7