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Interactional theory of childhood problematic media use

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Abstract

The growth of mobile device access and ownership has yielded many opportunities and challenges for raising healthy digital media consumers. As adoption of mobile and internet-connected devices has increased among children, concerns for healthy child development have been expressed regarding excessive or problematic use. Although much theoretical and empirical work has been conducted evaluating adolescents' and adults' risks for dependence on various screen media (e.g., Gaming Disorder, Internet Addiction), little theoretical consideration has been expounded regarding the etiology and maintenance of problematic media use earlier in childhood (i.e., under age 12 years). The purpose of this paper is to propose a theoretical framework through which to investigate problematic media use in early childhood. Our theory, the Interactional Theory of Childhood Problematic Media Use (IT-CPU) merges developmental and clinical psychology theories, with communication and human-computer interaction perspectives. We outline distal and proximal factors that we hypothesize contribute to the development of problematic media use in childhood, and emphasize maintaining factors that could be targets for intervention. Finally, we provide recommendations for an interdisciplinary research agenda to test our proposed theory and inform experimental trials to prevent and treat childhood problematic media use.

KEYWORDS

addiction, childhood, mobile device, parent, persuasive design, problematic, theory

1 | INTRODUCTION

The growth of mobile device access and ownership has yielded many opportunities and challenges for raising healthy digital media consumers. Children at younger ages are being given their first mobile devices, such as Tablets and Smartphones, using them for several hours per day (Radesky et al., 2020). Mobile device design has allowed more independent use (i.e., through touchscreens and voice commands), and hundreds of thousands of apps and platforms are now marketed to young children for educational or entertainment purposes (Radesky et al., 2020). Many of these apps and platforms collect persistent identifiers to improve marketing to youth (Zhao et al., 2020), or are designed with engagement-promoting persuasive design features that children may not be able to resist. As adoption of mobile and

internet-connected devices has increased among children and online digital media use has drastically increased (Rideout & Robb, 2019), concerns for healthy child development have been expressed regarding excessive or problematic use (Common Sense Media, 2018). Although much theoretical and empirical work has been conducted evaluating adolescent' and adults' risks for dependence on various screen media (e.g., Gaming Disorder, Internet Addiction; Brand, Young, Laier, Wölfling, & Potenza, 2016; Dong & Potenza, 2014; Young & Brand, 2017), little theoretical consideration has been expounded regarding the etiology and maintenance of problematic media use earlier in childhood (i.e., under 12 years of age). To our knowledge, no theoretical perspective on the emergence of problematic media use has been proposed.

Given that children are quickly growing in their adoption of mobile devices and have increased in their digital media consumption

(Rideout & Robb, 2019), it is critical for the study of children's media use that we form a theoretical basis from which to further investigate how problematic media use emerges and is maintained. Furthermore, this is a subject of frequent discourse among the public and researchers alike (i.e., what contributes to problematic use and are there long-term sequelae?); articulating a theory upon which to examine problematic media use is needed. Our proposed theory integrates aspects of numerous disciplines (e.g., clinical psychology, developmental psychology, communications, developmental-behavioral pediatrics, human-computer interaction) to best capture the complex development of screen-media-related problems in childhood. In this paper, we will first describe how children are currently consuming digital media and distinguish non-concerning media use from problematic use. Next, we will introduce our framework and the risk factors that, in concert with proximal processes (i.e., maintaining factors), influence the development of problematic media use in young children. Maintaining factors (or proximal processes contributing to chronic problems with media use) will be theorized. Finally, we will conclude with recommendations for future research and clinical investigations.

2 | CURRENT DIGITAL MEDIA USE IN EARLY-MIDDLE CHILDHOOD

The past decade has seen a notable growth in access to mobile devices, such as Tablets and Smartphones, among toddlers, preschoolers, and school-age children (for the purposes of this paper, we are focusing on children under age 12 years, an age range in which problematic media habits have not been extensively studied, but in which the foundation of children's relationships with media form). Indeed, research has found that by age 4 years, between one-third and three-quarters of children have access to their own mobile device (Kabali et al., 2015; Radesky et al., 2020; Rideout, 2017). Additionally, the options or types of media use have expanded to this younger demographic, with an explosion of available streaming content. For example, Common Sense Media documented a doubling in children's digital/online video viewing from 2015 to 2019 (Rideout & Robb, 2019); Nielsen documented a nearly 5 hr increase in weekly streaming TV exposure among youth 12 years and younger, from 2016 to 2018 (Nielsen, 2018).

The vast majority of research on changes in children's media consumption has focused on access to mobile devices and amount of time spent on different apps or digital media. The majority of time that children spend using digital media is still spent watching television (TV), although how children view TV shows has dramatically changed. For example, children are more likely to watch TV shows on streaming apps, such as Netflix and Hulu. YouTube and YouTube Kids are also very commonly used by young children (Radesky et al., 2020) to watch both TV episodes (which aired on television networks) and content originating by Youtube creators (e.g., "let us play" gaming videos, challenges, vlogs, how-to videos). Not only have the type and quantity of content changed, but mobile apps and interactive platforms also differ in important ways that influence child usage behavior, including persuasive design that aims to promote engagement, data collection about user behavior that informs marketing efforts, commercialization of child digital activities, and immersive virtual experiences (see Meyer et al., 2019). All of these aspects of the digital environment need to be considered when conceptualizing the development of prolonged, problematic media use in young children, who may be especially susceptible to influences of interactive design, just as they are with advertisements (John, 1999).

Distinguishing typical, benign media use from problematic use in children represents a major scientific and clinical knowledge gap in the field. We do not deny the fact that children's engagement with prosocial, age-appropriate, and educational can bring forth positive outcomes. Our focus in this paper, however, is on when and how problematic media use emerges during childhood. In the absence of clear methods for making a distinction between problematic use versus normative use, professional society, and clinical guidelines (e.g., American Academy of Pediatrics, 2016; Canadian Paediatric Society, 2019; World Health Organization, 2019) tend to warn against prolonged or inappropriate types of media use on a population scale, without clarity on helping parents understand when they should worry when their child has a problem. As a result, some parents may worry excessively about the risks of media use, while others may not realize signs of problematic media use in their children. We propose a framework that, when tested by empirical research, may aid in the creation of more precise medical guidelines and clinical implications by focusing on these constructs (and their synergistic influences across contexts and time): (a) the child's strengths and vulnerabilities; (b) the impact of systems within which children are nested (i.e., families, peers); and (c) media design aspects that contribute to and maintain problematic media use habits.

3 | PROBLEMATIC MEDIA USE IN EARLY-MIDDLE CHILDHOOD

It is of great importance to outline what we define as "problematic" media use and distinguish it from normative use. First, it is critical to state that the number of hours of screen time should not be used, exclusively, to determine if a child is having problematic media use. When we use the term "problematic," we are referring to excessive use that interferes with the child's functioning. Focusing on functioning is essential when assessing child behavioral or developmental disorders, as impairment in functioning is what differentiates normal variation from a pathological level of a behavior. Parents or other caregivers may say that their child is "addicted" to screens or that they are "obsessed" with getting online or getting access to their mobile device. Although these terms are used colloquially to convey parents' concerns about persistent requests for screen time and preoccupation with screen media, we prefer using the term problematic for a few key reasons. First, children live in the context of their households (and many other nested levels of influence, for example, schools, peers) and, prior to adolescence, will most typically have individuals responsible for setting limits or controlling their access to screens. In line with Bronfenbrenner and Morris (2006), interactions between children and their spheres of influence (e.g., parents/family, schools,

culture) drive development, and increase (risk factors) or decrease (protective factors) risk for developmental psychopathology, such as behavior disorders. Second, although behavioral addictions have been identified in adolescents and adults, we argue that youth will exhibit problematic (at-risk) use that may precede disordered use. Third, others have contended that using the term "addiction" can be misleading and counter to clinical efforts to support a healthy use of screens (per Radesky in Klass, 2019).

This approach diverges from that in adolescents and adults, in which research and clinical diagnoses (e.g., Gaming Disorder now being included in the ICD-11) focus on addictive behaviors with gaming and social media. Instead, our theory focuses on a potential precursor to Gaming Disorder (and thus, research on behavioral addictions in adolescence and adulthood are outside the scope of this article; see Young & Brand's, 2017 I-PACE model for this older population). With these caveats in mind, problematic media use in childhood has been conceptualized as excessive use leading to dysfunction in a major domain of a child's development: social, behavioral, or academic (Domoff et al., 2019a). Currently, one measure exists that assesses symptoms of problematic media use (Domoff et al., 2019b; Problematic Media use Measure, or PMUM). Adapting criteria listed as potential symptoms of Internet Gaming Disorder (IGD), as defined in the Diagnostic and Statistical Manual, fifth edition (DSM-5; APA, 2013), the PMUM is a parent report form on the frequency of the nine symptoms of IGD, applied to screen media broadly, in children under age 12 years. The DSM-5 criteria for IGD are a good starting point for defining problems with media use earlier in development for two main reasons. First, they offer the first set of plausible symptoms reflecting the construct of disordered use of specific types of screen media (i.e., gaming). Second, the DSM-5 lists these criteria under a section of conditions worthy of future study—highlighting the importance of investigating whether some or all of these symptoms best account for disordered gaming.

The nine criteria, outlined broadly in the DSM-5 (APA, 2013), but applied to screen media generally, are: (a) preoccupation with screen media, (b) tolerance (or needing greater amounts of screen media), (c) escape (i.e., using media to escape or relieve negative affect), (d) loss of interest in other activities, (e) withdrawal (i.e., psychological experience of withdrawal when not allowed access to screens), (f) lack of control over use, (g) psychosocial consequences due to use, (h) deception (hiding use or lying to access screens), and (i) serious problems due to use (Domoff et al., 2019b). At least five of these symptoms within the past month would indicate problematic use, but clinical interview to confirm its impact on the child's functioning and to rule out other contributing factors is necessary.

4 | INTERACTIONAL THEORY OF CHILDHOOD PROBLEMATIC MEDIA USE

Prior to describing the components of the Interactional Theory of Childhood Problematic Media Use (shortened to IT-CPU), we would be remiss not to emphasize the developmental framework through which our theory draws inspiration and influence. We should note that, as an interdisciplinary theoretical paper, we use theoretical premises and tenets from developmental and clinical psychology disciplines (among others); thus, the framework we are proposing incorporates multiple theories into an overarching model for both research and clinical utility.

As Bronfenbrenner (1979) proposed, children develop within spheres of influence, which interact with each other. In other words, children do not grow or develop in a vacuum—parents/other caregivers, peers, and, technology each influence child development (and children also exert influence on these individuals/groups). In his later work, Bronfenbrenner emphasized the role of proximal processes (Bronfenbrenner, 1995; Bronfenbrenner & Ceci, 1994; Bronfenbrenner & Evans, 2000; Bronfenbrenner & Morris, 2006; cited in Ashiabi & O'Neal, 2015) and delineated the Process-Person-Context-Time model (PPCT or bioecological model). In these formulations, proximal processes exert a "more powerful influence on developmental outcomes than contextual factors" (Ashiabi & O'Neal, 2015, p. 1).

In the microsystem, those individuals close to the child impact proximal and situational factors that lead to screen media use and the emergence of problematic use. The outer levels of influence in Bronfenbrenner's model (e.g., exosystem) contribute to more distal factors likely linked to origins of problematic media use. In addition to Bronfenbrenner's conceptualization, our theory incorporates social learning and behavioral principles (e.g., reinforcement) to explain how proximal factors and maintaining factors interact to contribute to and maintain problematic media use during childhood, respectively. We argue that a child's problematic media use is multifactorial and complex—requiring an understanding of the ways in which children interact with their environment to impact development (e.g., family and dyadic factors). Similarly, childhood problematic media use is likely impacted by multiple, intersecting factors within the spheres in which children are nested; processes (what we refer to as "maintaining factors") are the mechanisms linking proximal (and distal) risk factors to negative outcomes (i.e., problematic media use). Finally, we add to these contributors the role of technology and persuasive design; in other words, features of a child's preferred digital media may also contribute to problematic use. As we articulate our theorized causal and maintaining factors next, we integrate developmental science perspectives and the role of persuasive design to inform the study of problematic media use. Please see Figure 1 for a pictorial depiction of IT-CPU.

4.1 | Distal factors

As outlined in Figure 1, distal factors are early risk factors for childhood problematic media use, that exert their influence on proximal factors (and upon which proximal factors exert influence). We should note that distal factors, in themselves, do not confer additive risk to youth; rather, distal factors suggest susceptibility, or risk factors that, in concert with their impacts on proximal factors, lead to the emergence of problematic media use over time.
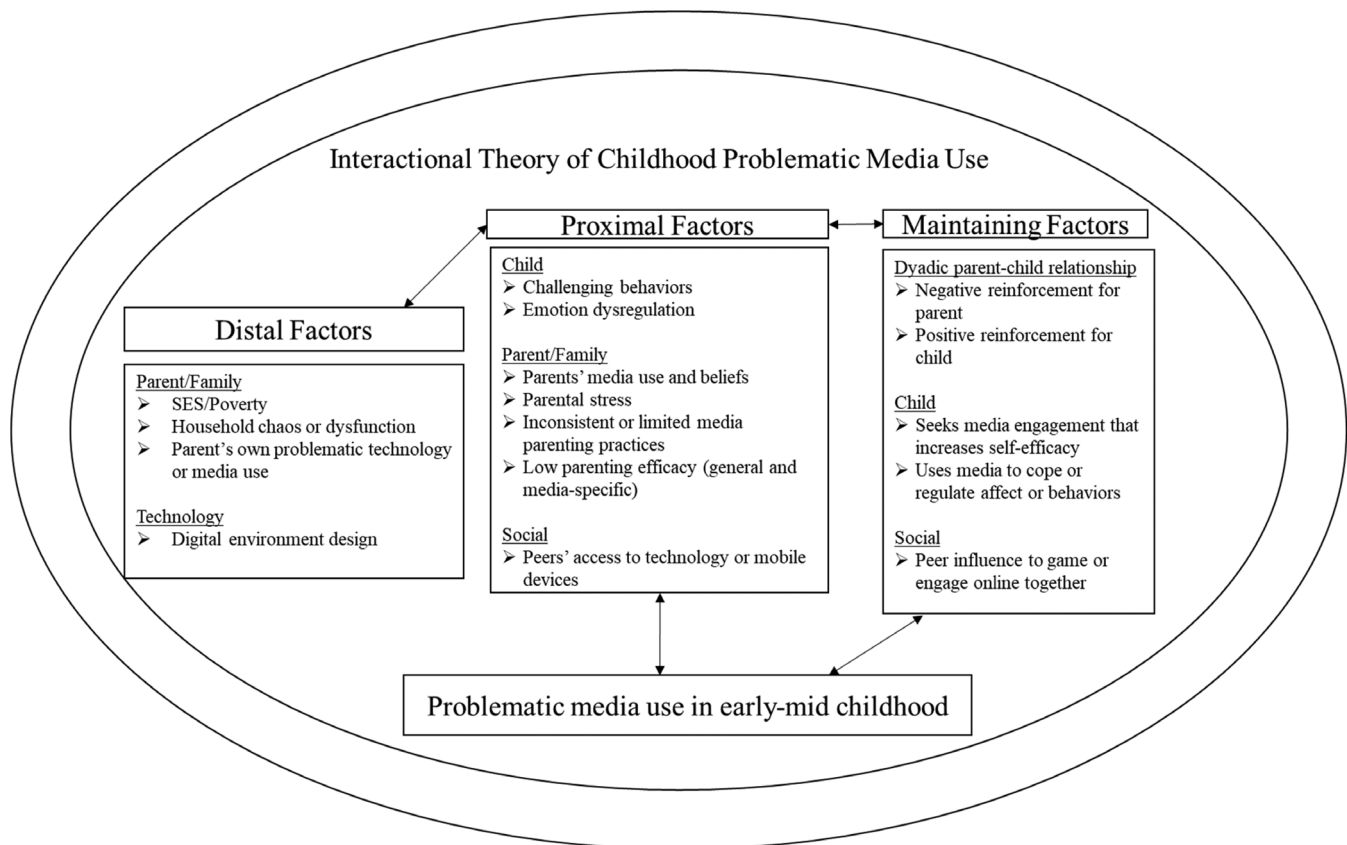
FIGURE 1 Interactional Theory of Childhood Problematic Media Use. *Note.* The proposed theory draws heavily from Bronfenbrenner and Morris' (2006) PPCT model. Specifically, double-headed arrows are placed to emphasize the interactions across person, context, and processes ("maintaining factors"), which we propose bring forth greater or reduced risk for problematic media use. Distal, proximal, and maintaining factors are terms we use, based on Persons's (2012) case formulation for cognitive-behavior therapy. Though not pictured, interactions across factors, and the emergence of problematic media use, occur over time, and should be tested via longitudinal analyses

4.1.1 | Family level

Research has indicated that children who live in households with lower socio-economic statuses have higher amounts of screen time (Fletcher, Whitaker, Marino, & Anderson, 2014). Additionally, household chaos or lack of routines and structure in the home, also correspond to greater duration of screen media use (Emond et al., 2018). Although research has not been conducted on genetic contributors to problematic media use in childhood, parents' own problematic use of screen media has been linked to adolescents' disordered gaming (Liu et al., 2019). Thus, it is likely, as with other childhood psychopathology, that parents' own history of problematic media use may be a distal factor.

4.1.2 | Digital environment design

What is unique about problematic media use during childhood, as compared to other maladaptive behaviors that arise in childhood, is that many of the digital products that children use are designed to prolong duration of use (Goodrow, 2017), keep users coming back

daily (Gray, Kou, Battles, Hoggatt, & Toombs, 2018), and provide a tailored feed of content that matches the child's interests. We hypothesize that such engagement-promoting design features, most created with behavioral reinforcement principles in mind (Fogg, 2009), are difficult for young children to recognize or resist. Moreover, this may be particularly difficult for children with self-regulation difficulties, limited impulse control, or executive dysfunction (see "Child" section). Recent analyses of the top-downloaded apps marketed to young children show that persuasive design features are highly prevalent, in the form of encouragements to make in-app purchases (Meyer et al., 2019), view advertisement videos (Meyer et al., 2019), or praise the child for minor accomplishments (Meyer, Schrier, Weeks, & Radesky, 2020). In addition, use of autoplay on streaming video platforms has been associated with higher parent reports of child behavior dysregulation when transitioning away from media (Hiniker, Suh, Cao, & Kientz, 2016), while fast-paced and gamified interactive media make it more difficult for parents to get children's attention during Tablet play (Hiniker, Lee, Kientz, & Radesky, 2018).

However, it is not known whether interactions between a child's vulnerabilities and persuasive design techniques lead to more prolonged use, displacement of regulatory behaviors such as sleep, or

preferences for digital activities that provide external reinforcement—or whether these design features' effects are equal across all children. It has been hypothesized that children with mental inflexibility and restricted interests, including children with autism spectrum disorder, might prefer YouTube or video feeds that provide preferred content, and therefore resist the non-preferred activities that abound in school or home (Lane & Radesky, 2019). Finally, although data collection is highly prevalent from children's apps (Zhao et al., 2020), it is unknown whether children with more impulsive gameplay or purchasing behavior might become targets of third-party marketing companies. More needs to be investigated regarding the interaction between persuasive design, child vulnerabilities, and problematic media use during childhood so that ethical design approaches can be instituted in children's digital environments.

4.2 | Proximal factors

Proximal factors refer to antecedents to problematic media use which, over time, contribute to the maintenance of childhood problematic media use via the maintaining factors/processes. In other words, proximal factors may bring forth instances of problematic use earlier in childhood; over time, we propose that these proximal factors interact with maintaining factors to synergistically influence more severe problematic media use later in childhood. We outline the likely proximal factors by child, parent/family, and social factors.

4.2.1 | Child

Challenging behaviors in the child, such as non-compliance when directed by parent to engage in an undesirable activity and emotion regulation concerns (e.g., difficult temperament or negative affectivity proneness) are likely proximal factors for problematic media use. These behavior and emotion regulation problems have been shared by parents as reasons for using mobile devices or other screen media as a behavior management tool around mealtime (Domoff et al., 2016), when they need peace and quiet in the home (Radesky et al., 2016), to calm toddlers down when upset (Radesky, Peacock-Chambers, Zuckerman, & Silverstein, 2016), and to gain behavioral compliance in other settings (Radesky, Eisenberg, Kistin, et al., 2016). When given a device to self-soothe or as an incentive to complete undesirable tasks, children miss opportunities to learn self-regulation, and delay of gratification. Parents also miss the opportunity to practice their own self-regulation and mentalization about their child's emotional state when using media as a calming tool for their child, and this may make it harder to handle negative behaviors in the future.

4.2.2 | Parent/family

In addition to child factors, it is important to note that parents' own technology use (Lam & Wong, 2015; Lauricella, Wartella, & Rideout,

2015), their beliefs about media/screen time effects, and media-specific parenting practices likely contribute to childhood problematic media use (e.g., Hefner, Knop, Schmitt, & Vorderer, 2019; van den Eijnden, Spijkerman, Vermulst, et al., 2010). First, children imitate and model their parents (see maintaining factors for a review of dyadic influences; also proposed by Hefner et al., 2019). Children learn to copy their parents' behaviors at an early age (Bandura & Walters, 1977); it is likely that children's relationship to technology is learned from observing their parents' or other caregivers' mobile device use. If parents are tethered to their device or preoccupied with checking apps and notifications, this may be modeled to children and influence children's conceptual development about how technology is used. At the same time, parents who frequently use technology during parent–child activities are less likely to have sensitive and reflective mental working models of their child's behavior (Radesky et al., 2018), and thus, may feel less equipped for managing child negativism. Finally, parents describe withdrawing from stressful family interactions by using their mobile devices (Radesky, Kistin, Eisenberg, et al., 2016b), which is more common with high parenting stress levels (McDaniel & Radesky, 2018), and this may informally teach children that technology can be used as a self-regulation strategy.

Research on parents' beliefs about their children's media use may also contribute to problematic media use. For example, parents have endorsed beliefs that may increase their children's access to and use of screens. For example, lower-income parents have described hopes that interactive technology will be more educational for children and help them succeed in a job market that is increasingly technological (Radesky, Eisenberg, et al., 2016). Although distinct from online videos and gaming, these perceived outcome expectations may associate with greater screen media use and a higher likelihood for problematic media use (Park & Park, 2014), particularly since many apps labeled as "educational" have highly reinforcing design in the form of golden tickets, gameplay items, virtual toys, tokens, and other gamified elements (Meyer et al., 2020). Finally, media-specific parenting practices, such as setting limits for children and scaffolding healthy use are likely buffers against the development of problematic media use (Chang et al., 2019; Nielsen, Favez, Liddle, & Rigter, 2019). On the other hand, lack of parental guidance, structure, limits, and communication about digital media may increase risk for problematic media use (Meeus, Eggermont, & Beullens, 2019). Children may learn to regulate their use via parental scaffolding of balanced digital media use. For example, Meeus et al. (2019) found that parents' inconsistent mediation of mobile media use predicted greater problematic media use via disrupted emotional and behavioral self-regulation in pre- and early-adolescents. Finally, parents' stress levels and low parental efficacy (in general, not specific to media parenting), likely contribute to using screens as a behavior management tool (Radesky et al., 2016). For example, parents with lower perceived parenting control were more likely to give a mobile device to their children to calm them down or keep them quiet (Radesky et al., 2016). In turn, children miss opportunities to learn to self-regulate and both parents and children begin to associate screens with a reduction in negative affect (e.g., irritability, frustration, boredom) and stress.

4.2.3 | Social

Children begin comparing themselves to peers early on (Rhodes & Brickman, 2008). While social comparison is often most obvious as individuals become adolescents, the pressures to be similar to peers and to obtain similar possessions is already present in early childhood. As technology becomes increasingly present in the daily lives of young children, access to devices is one more point of comparison (Aoki & Downes, 2002). When making an effort to manage their preschooler's screen-use, parents cite the difficulty caused by societal pressure to own and use media-related technology (He, Irwin, Bouck, Tucker, & Pollett, 2005). In adolescence, ownership of the newest model of smartphones is often seen as a status symbol that elevates their position in a peer group (Abeele, Antheunis, & Schouten, 2014). Ownership of and access to the newest technologies is one way that children can ensure acceptance into peer groups, which they become increasingly concerned with during elementary school (Banerjee & Dittmar, 2008). While there is limited research on this specific social pressure for children, parents in the United States witnessed this type of pressure for access to technology in the Webkinz craze that spread across the country in 2007. Webkinz stuffed animals were one of the first in a trend of "web/toy hybrids" in which children needed to own a physical toy to participate in an online social network (Wohlwend, Vander Zanden, Husbye, & Kuby, 2011). When the popularity of these toys spread among children, it was not through advertisements. Instead, it was through word-of-mouth: six-year-old children were engaging in "viral marketing" (Druin, 2008). This type of marketing resulted in 1 million users registering for the online community between 2005 and 2007, more than $20 million in retail sales in less than 24 months, and children spending an average of 2 hr on the website per visit (Hawn, 2007). This salient example indicates the necessity of further research evaluating the effects of peer access to technology on an individual child's problematic media use, particularly requests for access to screens and desire for ownership of screen devices.

4.3 | Maintaining factors

We conceptualize children's problematic media use as a pattern of maladaptive behaviors around digital media use. As described above, children may start to use media for soothing when experiencing negative emotions or needing to regulate their state (i.e., sleep), because it is highly reinforcing and becomes a preferred activity, because the technology design itself prolongs engagement, or because of parent attitudes or behaviors around media use. Principles of reinforcement (for both the parent and the child) and social learning theory explain how problematic media use is maintained. Next, we use these theoretical bases to describe the maintaining factors (what Bronfenbrenner & Morris, 2006, call "processes") and their linkages to problematic media use in children.

4.3.1 | Dyadic/parent–child relationship factors

Observational research (Domoff et al., 2019c; Radesky et al., 2014) and recent systematic reviews (e.g., Schneider, King, & Delfabbro, 2017) have shed light onto interactive and dyadic influences of family members on each others' mobile device use. Principles of reinforcement explain how conflictual parent–child interactions may contribute to ongoing problematic media use. If a child is particularly susceptible to rewarding features of digital media, they may be more likely to refuse to stop digital media use (e.g., Hiniker et al., 2016) or persistently request for access to digital media. These behaviors, as with other oppositional behaviors, may create stress for parents, especially those who feel low parenting efficacy or who have already high levels of stress. To escape this experience, a parent may choose to hand over a device, in order to reduce the negative child behaviors. Through that process, a parent experiences negative reinforcement (an undesirable state/experience was removed) and the child experiences positive reinforcement. In turn, these interactions make more likely that the child will continue to not comply when limits around digital media are set. Experiencing reinforcement for non-compliance maintains the problematic media use. Similarly, the parent learns that the digital media appeases their child, which becomes an easier response than trying to use behavioral management or emotion regulation strategies with the child. Displacement of both parent and child practice at co-regulation (i.e., a parent staying calm while helping a child understand their emotional state and problem-solving together) may make it more difficult to access these skills over time.

4.3.2 | Child factors

The development of self-efficacy and self-regulation in childhood can have long-lasting impacts on an individual's behavior. According to social-cognitive theory, children with high self-efficacy, or belief in their ability to enact a specific action, develop coping skills for managing stressors and persevering when challenged (Bandura, 1999). Indeed, low self-efficacy in childhood has been linked to both depression and problematic behaviors (Bandura, Pastorelli, Barbaranelli, & Caprara, 1999), while adolescents with high self-efficacy also experience lower levels of problem behavior, achieve higher grades, and attain greater social popularity (Caprara, Barbaranelli, Pastorelli, & Cervone, 2004). Research has established an association between low self-efficacy and addiction in adolescents and adults, with some evidence suggesting a specific link to internet addiction (Fischer-Grote, Kothgassner, & Felnhofer, 2019; İskender & Akin, 2010; Khang, Kim, & Kim, 2013; LaRose, Lin, & Eastin, 2003; Young & Rodgers, 1998). There is a lack of research concerning the specific association between self-efficacy and problematic media use in young children; however, there have been developments in research concerning child self-regulation. Infants who are difficult to soothe (i.e., low self-regulation) are often exposed to more screen media, while toddlers with low self-regulation are more likely to develop

behavior indicative of problematic media use (Radesky, Silverstein, Zuckerman, & Christakis, 2014). Additionally, longitudinal research has found that better self-regulation skills at 4 years of age predict lower media use at 6 years (Cliff, Howard, Radesky, McNeill, & Vella, 2018). Whether excessive media use in childhood decreases self-regulation skills or lack of self-regulation skills increases use of media, long-term associations have been found between self-regulation and problematic media use (Gökçearslan, Mumcu, Haşlaman, & Çevik, 2016; LaRose & Eastin, 2004; Van Deursen, Bolle, Hegner, & Kommers, 2015).

4.3.3 | Social

Peers play an important role in the maintenance of problematic media use in children, typically reinforcing the use of technology. For children as young as 5 years of age, parents perceive friends as having an influence over what type of digital media is requested, particularly influencing children's opinions about television and online gaming (Edwards et al., 2015). Other research has found that parental perception of this influence in preschool-age children varies across countries (De Decker et al., 2012). Video game play is one area in which social influence from peers is commonly evident, due to the social nature of many games. Children are often motivated to play video games because of the social components involved, particularly if they are socially anxious in their "offline" environment (Desjarlais & Willoughby, 2010; Ferguson & Olson, 2013). In addition to connecting with "real-life" friends, many children play online multiplayer games in order to connect with online friends, further reinforcing gameplay (Wolak, Mitchell, & Finkelhor, 2003). Similar to video games, smartphone use is often motivated by social factors. Among young adolescents, smartphones are seen as a tool to facilitate interpersonal connections among peers (Blair & Fletcher, 2011). While peers have an influence on the amount of screen time consumed by children, they also influence risky behavior online, such as joining social networking platforms restricted to individuals 13 and older. When examining factors involved in a child's decision to engage in underage use of social networking websites, encouragement from friends was an important influence (Barbovschi, Macháčková, & Olafsson, 2015). Overall, the potential to interact with peers likely increases children's motivation to use media devices.

5 | FUTURE RESEARCH DIRECTIONS

The purpose of this paper was to articulate our framework for understanding the etiology and maintenance of problematic media use during childhood. To advance theoretically-driven research, based on multiple disciplines germane to children's media use, the Interactional Theory of Childhood Problematic Media Use details distal factors, proximal factors, and maintaining factors worthy of further study. We draw particular attention to two tenets of Interactional Theory. First, we argue that research on children's problematic media use must

diverge from simplistic studies of screen time correlates. In other words, we posit that multiple levels of influence, in addition to factors intrinsic to the child, drive problematic media use. Therefore, research investigating these theoretical origins or risk factors should consider microsystem and extended levels of influence (and their interactions across these levels). Second, we view problematic media use as developing over time, with the maintaining factors serving as the processes linking proximal factors to problematic media use. As such, research using experiments or randomized controlled trials that specifically target the theorized mechanisms are necessary to test the veracity of Interactional Theory. Similarly, longitudinal studies that incorporate not just change at the individual level, but also dyadic influences, are recommended, and should not neglect the core principles of Bronfenbrenner and Morris' (2006) PPCT model (see Tudge et al., 2016 and Tudge, 2016 for a review of applications of bioecological theory).

Specific research questions arise related to the components of Interactional Theory. For example, regarding distal factors, familial or genetic risk factors for problematic media use have yet to be explored. We would expect there to be a greater risk for problematic media use if a child has a parent with a history of behavior addictions or problematic media use, such as Gaming Disorder. Research on whether apps or digital products with more persuasive design features (or powerful reward systems) contribute to greater problematic media use is warranted. For example, purchasing loot boxes when gaming has been linked to physiological arousal in adults (Brady & Prentice, 2019) and adolescents who play mobile games with loot boxes are more likely to engage in problem gambling (Zendle, Meyer, & Over, 2019)—suggesting a link between persuasive design elements and problematic use. Relatedly, conducting experiments that remove or reduce persuasive and reinforcing features (e.g., turning off autoplay; taking away recommendation feeds; using child-centered design with input from families) would help clarify if these technology-specific features can reduce the development of problematic media use. Likewise, do design changes that set limits or help the child plan and regulate their own use reduce the development of problematic media use? Would containing children's media within a "walled garden," in which no advertising or data collection were allowed, reduce the development of problematic media use?

In terms of proximal factors, future research should consider both how proximal factors interact with each other, and with risk and maintaining factors. For example, how do child characteristics, such as executive functioning, emotion regulation, and other temperament, cognitive, or sensory traits respond to digital products with different content or levels of persuasive design? Another research question relates to parents' compulsive use of technology or use to cope with stress—does viewing parents' compulsive or stress-related use impact children's conceptualizations of technology and usage behaviors? Regarding maintaining factors, research could explore whether children who are frequently allowed to use technology to relieve distress or boredom are more likely to develop problematic media use. Similarly, would problematic media use worsen parent and child self-efficacy around emotion regulation strategies and social

competencies? It is also valid to study whether and how technology may become a maintaining factor. For example, if third-party data brokers or "behavioral insights" companies keep data about child users, can they identify children with problematic use (and if so, do they target these children with advertisements)?

6 | CONCLUSION

The purpose of this paper was to describe a developmentally-informed model of the risk and maintaining factors of children's problematic media use. Given the growth in children's mobile media "ownership" and the concern for problematic media use, it is important to set a foundation from which to investigate potential harms associated with screen media use during childhood. As this area of research is still quite nascent, and is of great interest to the public, it is critical that future research is theoretically-driven and considers the interactions across many levels of influence in a child's life. Testing the IT-CPU has the potential to yield promising prevention and intervention targets. Clarifying how, and for whom, problematic media use develops is necessary for the development of healthy digital media consumers.

CONFLICT OF INTEREST

Dr. Domoff is on the board for the Smart Gen Society. She regularly receives honoraria to present on problematic media use at non-profit organizations, schools, and hospital/health systems. Dr. Radesky is a paid consultant for Melissa & Doug Toys. She receives grant funding from Common Sense Media. Until April 2019, Dr. Radesky was paid to write articles for PBS Parents.

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