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REVIEW ARTICLE

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Smartphones in the nursery: Parental smartphone use and parental sensitivity and responsiveness within parent–child interaction in early childhood (0–5 years): A scoping review

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Abstract

The omnipresence of smartphones has not stopped at the door to the nursery. It is especially important to better understand the impact of parental smartphone use on relationships at the beginning of children's lives. Babies and toddlers are essentially dependent on caregivers' sensitive and responsive behaviors within the context of the development of attachment patterns. Disturbances in parental sensitivity can have a negative impact on attachment-related interactional processes between parents and children and on child outcomes, such as self-regulatory capacity. The goal of this review is to compile existing research on the impact of parental mobile device use through technoference or absorption on parental sensitivity and responsiveness within parent–child interactions in the early years (0–5). We conducted a thorough search of the databases PsycInfo and PubMed, additionally consulting data sources such as Google Scholar and Google. In this review, we included 12 studies with a variety of methodical approaches. The research so far indicates that parental smartphone use may be associated with changes in parental sensitivity and responsiveness. Absorption in the device appears to contribute to this association more strongly than short interruptions of relating per se (technoference). However, to better understand these processes, more in-depth, longitudinal research is needed.

KEYWORDS

absorption, early years, parental responsiveness, parental sensitivity, parental smartphone use, technoference

1 | INTRODUCTION

Digitalization permeates almost all areas of modern life due to the portability of smartphones and tablets, their ever more sophisticated personalized and interactive apps, and their user friendly, appealing design. Modern information technology has become able to "mold itself around the addressee" (Fonagy, 2014, p. IIX). Many not only own portable digital devices but also frequently check devices and feel compelled to immediately answer invitations to communicate and to share personal details with others.

Smartphones' acoustic, tactile, and visual signals remind us ceaselessly of their presence; they are "always on" and speak to humans' basic need for communication (King, 2018). According to Sbarra, Briskin, and Slatcher (2019), they are designed to make use of fundamental

human evolution-based communicative attachment behaviors, such as disclosure and responsiveness. However, as King (2018) notes, the increase and intensification of digital communication might complementarily be accompanied by a decline in attention to persons who are actually present. The connection with a present other may be constantly interrupted in favor of the often widely spanned social network online (Sbarra et al., 2019). Gergen (2002) described this phenomenon as "absent presence" (p. 227) and understood it to cause fragmentation of social relationships.

Turkle (2015) explored the meaning of technology for human relationships over a decade and observed an overall decline in direct communication. Dwyer, Kushlev, and Dunn (2018) found that within the context of smartphone use and relating, people tended to feel less socially connected, were more distracted, and enjoyed direct communication less. Other researchers found that study participants reported lower levels of empathy during direct conversations in the presence of a mobile device, and that they experienced conversations as less satisfying (Misra, Cheng, Genevie, & Yuan, 2016; Przybylski & Weinstein, 2013).

These effects of smartphone use on various aspects of human relationships have been attributed to technology interference, or "technoference" (McDaniel & Coyne, 2016a, p. 85)—interruptions of social interactions through technology—and to users' "absorption" in digital devices, also termed immersion. Immersion means withdrawal of attention from the environment and focusing of attention on the device and its many online diversions and communicative options. Although technoference refers to the interruption of communication per se, absorption captures the aspects of turning the gaze "away" from the communication partner, facing the device, usually for longer time periods.

Regarding parental smartphone use in the family context, there are several findings with older children. For example, it has been reported that the older child often experiences parental smartphone use as negative. Based on interviews and observations, Turkle (2011) found that children tend to feel that they have to compete with smartphones for their parents' attention. Steiner-Adair and Barker (2013) interviewed more than 1,000 children aged 4–18 years and observed that children feel exhausted, frustrated, sad, and angry when they try to get their parents' attention away from their smartphones.

However, contrary to several studies regarding the role of smartphone use in relationships between adults or between parents and their older children, relatively little is known so far about the role of parental smartphone use and its aspects of technoference and immersion in parent–infant, parent–toddler, and parent–preschooler

Key findings and implications

1. There are indications that parental smartphone use in the presence of babies or young children might be associated with decreases in parental sensitivity and responsiveness.
2. Parental absorption in their devices seems to have a stronger impact on parental sensitivity and responsiveness than technoference (interruptions per se).
3. However, due to scarcity of studies and methodological limitations, these findings should be received with reservations and at this point cannot be translated into parenting advice or policy statements. Overall, this review highlights a need to more thoroughly assess parental smartphone use in the presence of their children and its impact on parental sensitivity and responsiveness. More in-depth and longitudinal research taking into account a broader variety of contexts families live in is needed for an understanding of the complex dynamic correlations between all factors. This research should also consider parental psychological functioning and parenting distress as potentially determining factors regarding parental smartphone use behaviors. Further studies in this area with larger sample sizes could help inform parents better and ultimately prevent future negative outcomes in children. This research could then inform public policy and make possible the formulation of research-based guidelines.

Statement of relevance to infant and early childhood mental health

Parents of young children use their smartphones frequently, often in the presence of their infants or young children. We are only beginning to understand the effects of parental smartphone use on parental sensitivity and responsiveness and thereby parent-child interactions, and ultimately child attachment formation and possibly other child outcomes. This review aims to summarize what we know so far and to emphasize what we still need to know in order to be able to counsel parents regarding smartphone use while parenting babies and young children.

relationships. Yet, most parents of babies and toddlers own smartphones and—as digital natives—are competent and frequent users of digital technologies. The rate of smartphone ownership among young adults—the age group most parents of young children belong to—is high; according to the Pew Research Center (2019), 94% of 18- to 29-year olds and 92% of 30- to 49-year olds own a smartphone. Moreover, these age groups are active users of social media; 90% and 92% of them, respectively, reported using social media regularly.

Parents' preoccupation with their smartphones while caring for babies or young children has already entered public awareness and is reflected in the term "distracted parenting" (Christakis, 2018; Klass, 2017), pointing to changes in parenting behaviors associated with parental smartphone use and sounding the alarm about negative consequences for young children.

Beyond this superficial level of discussion, it is important to investigate the more fine-grained interactional processes between parents and babies or young children to really understand the potential impact of parents' smartphone use on the parent–child relationship. Infants are born with a receptiveness for social interactions and are ready to socially interact themselves from day one; thus, from the very beginning, development takes place within relationships (Stern, 1998). Babies, toddlers, and preschoolers have been shown to depend on parental co-regulation within interactions but also to be highly sensitive to disruptions and disturbances of relational processes (Beebe et al., 2010), such as potentially through parental smartphone use.

Parental sensitivity and responsiveness have been identified to play a crucial role in these early interactional processes (Ainsworth, Bell, & Stayton, 1974). Parental sensitivity refers to the ability of parents to perceive child signals, read them correctly, and answer to them in a timely and adequate fashion (Ainsworth et al., 1974). In general, parental responsiveness is viewed as the aspect of parental sensitivity that encompasses contingency, consistency, and promptness of parental responses (e.g., Bell & Ainsworth, 1972). Parental sensitivity can be reduced due to psychiatric disorders (Moszkowski et al., 2009); (Ziegenhain & Deneke, 2012) or other forms of parental distress (Lindhiem, Bernard, & Dozier, 2010) and possibly due to distractions through smartphone use as well. Disturbances in parental sensitivity can have a negative impact on attachment-related interactional processes between parents and children and ultimately on child outcomes, such as self-regulatory capacity (Kivijärvi, Räihä, Kaljonen, Tamminen, & Piha, 2005).

Sensitive parenting on the other hand contributes to the formation of a secure attachment relationship. The formation of a (secure) attachment bond is one of the most important developmental tasks in the first year of life (Moszkowski et al., 2009). Attachment communication forms the basis of the development of brain structures; these are key for emotion processing and for modulation of stress, self-regulation, and the functional origins of the bodily self (Schore, 2015). Face-to-face communication, eye contact, and shared attention have been described as elementary elements of attachment processes and, moreover, of language acquisition and cultural learning (Tomasello, 1999).

Tronick, Als, Adamson, Wise, and Brazelton (1978) argued that very young babies are already able to build expectancies in interactions and that they react with great distress if these are not met and if they are faced with (sudden) parental unresponsiveness. Tronick et al. (1978) were able to demonstrate this with babies aged 1–4 months in the still-face experiment, which follows this protocol: Caregiver–baby dyads face each other; the babies are seated in an infant seat. In the first phase of the experiment, parent and baby are asked to interact freely with each other; in the next phase—the still-face phase—the caregiver stops reacting to the baby and looks at him or her with a neutral face. In the last phase, also called the reunion phase, the caregiver returns to normal interaction with the baby. Babies in the classic experiment typically react to their caregivers' still face with gaze aversion, a reduction of positive affect, and a heightening of negative affect. During the last phase, they usually recover and resume mutual interaction. Parental sensitivity plays an important role in these processes as well: Babies with sensitive mothers were better able to regulate emotions during the still-face phase and recovered more quickly during reunion than babies with less sensitive mothers (Rosenblum, McDonough, Muzik, Miller, & Sameroff, 2002; Tronick, Ricks, & Cohn, 1982). Infants of depressed mothers show the still-face effect as well, but they show a higher amount of positive affect, which was understood as a compensatory and probably self-soothing adaptation to a more unresponsive caregiver (Graham, Blisset, Antoniou, Zeegers, & McCleery, 2018).

Could parental smartphone use in the presence of their babies and young children lead to changes of parental sensitivity and thereby disturb relational processes between parents and young children or produce parental unresponsiveness as we see it in the classic still-face experiment? Babies and young children are well able to deal with interruptions of interactive processes with their caregivers. However, the omnipresence of smartphones with their alluring communicative features and effects of immersion and technoference might decrease parental sensitivity in an unprecedented way and disrupt the crucial processes of mutual attunement and relatedness between caregiver and their babies, toddlers, or preschoolers, especially

affecting face-to-face communication, gaze coordination, and shared attention.

This review aims to gather what is known so far about these questions and to assess further needs for research in order to better be able to counsel parents and develop helpful guidelines regarding smartphone use based on thorough knowledge.

2 | METHODS

2.1 | Current review

The research field considering the role of parental smartphone use within the family context is relatively new but has generated increasingly more research activity in the last few years. Two literature reviews (Kildare & Middlemiss, 2017; McDaniel, 2019) and two systematic reviews (Beamish, Fisher, & Rowe, 2019; Knitter & Zemp, 2020) have helped to consolidate the base of research know-how on and knowledge about the meaning of parental smartphone use within the family system. However, these previous reviews provided a less specific perspective on the topic, focusing on parent–child interaction as well as child outcomes (Beamish et al., 2019; Kildare & Middlemiss, 2017; McDaniel, 2019), or including a broader age range. Knitter and Zemp's review differentiated between four age groups (0–3 years, 4–6 years, 7–10 years, and 11–18 years) regarding the links between parental smartphone use and quality of parent–child interaction. However, as the authors explained in their review, age groups had quite a lot of overlap and the age groups of 0–3 and 4–6 years included studies with samples up to (far) ages outside their defined age range.

The goal of the present review is to provide an overview of studies exploring the associations of smartphone use of parents of babies and young children up to the age of 5 years with parental sensitivity and responsiveness, pivotal factors regarding quality of parent–child interaction and ultimately child development as well. Our review will focus "exclusively" on infancy and the preschool years and zoom in on the topic of parental sensitivity and responsiveness more specifically. Therefore, we elaborate on studies that used a modified still-face paradigm more extensively. We will also address the question whether certain characteristics of smartphone use, such as technoference or absorption, that have been identified as relevant for disturbances in relationships due to smartphone use between adults do have a specific effect on parental sensitivity and responsiveness in the context of parental smartphone use. Moreover, this review aims to point out gaps in the existing research literature and thus to identify future research needs.

2.2 | Research question

Does parental smartphone use in the presence of their child have an impact on parental sensitivity and responsiveness in parents of young children aged 0–5 years and does either technoference or absorption play a specific role in this?

2.3 | Procedures

As research on parental smartphone use in early childhood is still an emerging field, this study was conducted as a scoping review, making it possible to maintain an explorative approach and to include published empirical publications with differing ranges of sample sizes, data collection methods, and data analysis approaches that mirror the developing character of the research field.

This review was guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Extension for Scoping Reviews (PRISMA-ScR; Tricco et al., 2018); a review protocol can be requested from the main author. We conducted an extensive search of databases PsycInfo and PubMed as well as sources such as Google Scholar and Google between December 2019 and October 2020 using the literature search terms parents, interaction, and technology (see Tables 1 and 2). Some search specifications filters (classification codes and age) were used, as listed in Tables 1 and 2 as well. For PsycInfo and PubMed, the precise search strategy varied a little bit, due to their different search limitations.

References in the relevant articles were viewed and used to expand the research findings. In a first step, we screened the articles by title and abstract for their empiricism. In the second step, we checked the studies by title, abstract, and full text for eligibility.

2.4 | Eligibility criteria

Our first criterion was the language in which the articles were written; we considered studies published in English, German, French, Spanish, or Portuguese. Second, to be selected the studies had to employ an empirical approach (per quantitative or qualitative analysis), to examine the relationship between parental smartphone or tablet use (mobile digital device) and parental sensitivity or responsiveness. Third, the study sample had to be parents and their children aged 0–5 years. Two exceptions were made: The study of Lemish et al. (2020) and the study of Elias, Lemish, Dalyot, and Floegel (2020) included children aged between 2 and 6 years. The number of children within our targeted age range was not detailed

TABLE 1 Literature search key terms for the PsycInfo database

Parent terms	Interaction terms	Technology terms	Classification code
(Parent* OR	(Attitude* OR	(Smartphone* OR	2100
Dad* OR	Communication* OR	Mobile phone* OR	2750
Father* OR	Distract* OR	Cell phone* OR	2800
Paternal* OR	Interaction* OR	Mobile device* OR	2956
Mom* OR	Relation* OR	Digital device* OR	4000
Mother* OR	Attachment OR	Mobile technolog* OR	
Maternal* OR	Responsiveness* OR	Digital media* OR	
Parent-child).hw.id.ti.	Sensitivity OR	Technology NOT	
	Technoference OR	Reproductive technology).hw.id.ti.	
	Immersion).hw.id.ti.		

Note. *, truncation; hw, head word; id, key word; ti, title; 2100, General Psychology; 2750, Mass Media Communications; 2800, Developmental Psychology; 2956, Childrearing & Child Care; 4000, Engineering & Environmental Psychology.

TABLE 2 Literature search key terms for the PubMed database

Parent terms	Interaction terms	Technology terms	Age
(Parent* OR	(Attitude* OR	(Smartphone* OR	Child: birth to 18 years
Dad* OR	Communication* OR	Mobile phone* OR	Infant: birth to 23 months
Father* OR	Distract* OR	Cell phone* OR	
Paternal* OR	Interaction* OR	Mobile device* OR	
Mom* OR	Relation* OR	Digital device* OR	
Mother* OR	Attachment OR	Mobile technolog* OR	
Maternal* OR	Responsiveness* OR	Digital media* OR	
Parent-child).ab.ti.	Sensitivity OR	Technology use).ab.ti.	
	Technoference OR		
	Immersion).ab.ti.		

Note. *, truncation; ab, abstract; ti, title.

in these publications, but we assumed that a substantial part of the sample was within that age range. Due to the scarcity of studies on this topic and age range, a book chapter, journal articles, dissertations, and master theses were included. Articles on young children's smartphone use and parental use of smartphones to soothe or distract children were not included. We also excluded publications that focused on the impact of parental smartphone use on child outcomes or parenting without taking into account parental sensitivity and responsiveness.

3 | RESULTS: OVERVIEW OF RESEARCH

The systematic database search (PsycInfo and PubMed) with the keywords mentioned above yielded a total of 558 articles plus two additional articles from other sources, making a total of 560 articles. Records were then screened and further checked for eligibility by three authors of the present review. Of the 560 publications, 12 met the inclusion criteria. The flow diagram in Figure 1 presents the number of articles included and excluded.

3.1 | Characteristics of the studies included

Of the 12 included publications, eight were published research articles, three were Master's theses or doctoral dissertations, and one was a book chapter. Four of the included studies conducted an adapted version of still-face paradigm (Tronick et al., 1978). One study used an experimental design during breast-feeding interactions and another one used an experimental design in a waiting-room situation. Two naturalistic observational studies were conducted on playgrounds, whereas four studies combined playground observations with observations in eateries or waiting areas of child consultation bureaus. Two studies used qualitative analysis only, nine studies relied on quantitative analysis, and one study combined both. The studies were conducted in the following

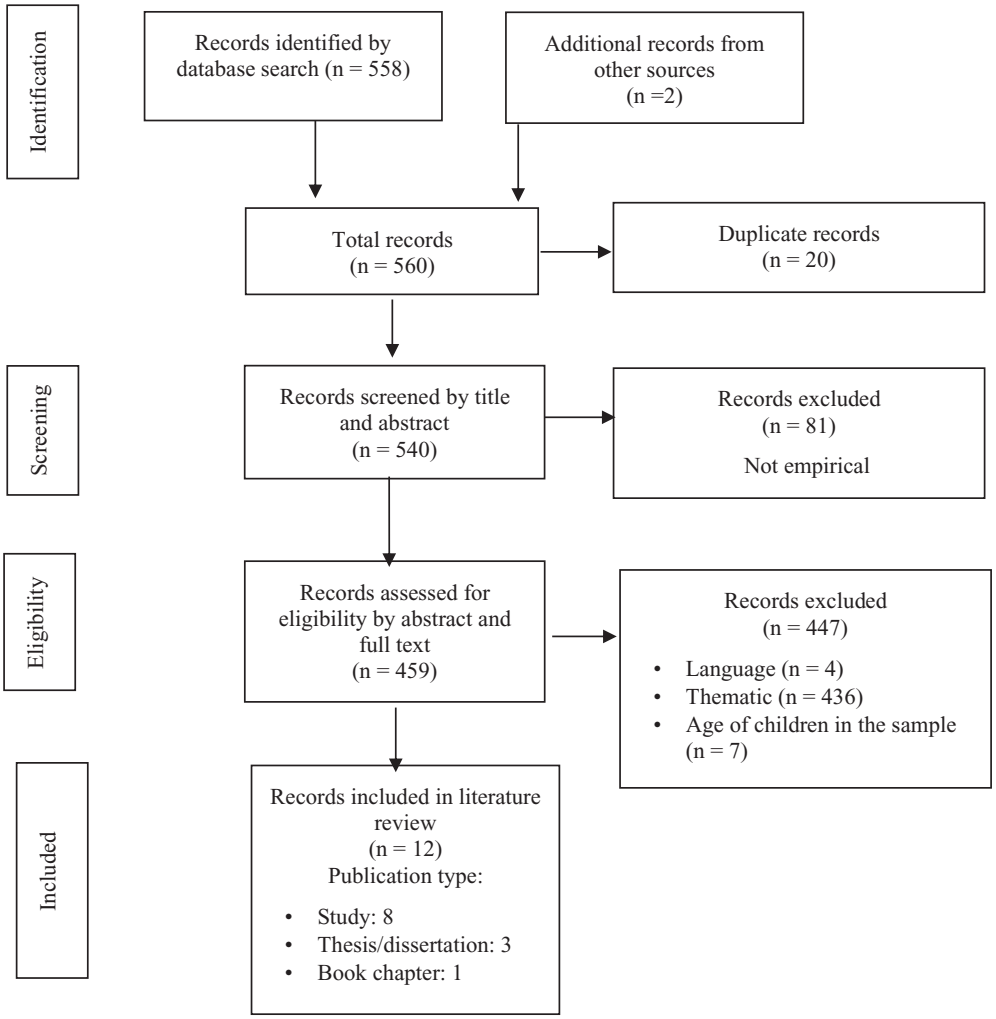

FIGURE 1 Flow diagram with the number of records included and excluded using an adapted PRISMA diagram (Moher, Liberati, Tetzlaff, & Altman, 2009)

countries: United States (five studies), United States and Israel (two studies), Canada (one study), Australia (one study), Netherlands (two studies), and Germany (one study). All included publications were thoroughly read and summarized in order to be deemed able to answer the research questions. Table 3 provides an overview of included publications.

3.2 | Does parental smartphone use in the presence of their child have an impact on sensitivity in parents of young children aged 0–5 years and does either technoference or absorption play a specific role in this?

One group of studies on the impact of parental smartphone use on parental sensitivity or responsiveness during the early years of their children has been conducted in naturalistic environments such as restaurants, playgrounds, or waiting areas (Abels, Vanden Abeele, van Telgen, & van Meijl, 2018; Elias et al., 2020; Mangan, Leavy, & Jancey, 2018; Lemish, Elias, & Floegel, 2020; Vanden Abeele, Abels, & Hendrickson, 2020; Wolfers, Kitzmann, Sauer, & Sommer, 2020).

The potential impact of smartphone use on parental responsiveness toward their children in the context of shared meals was assessed in eateries in Israel and in the United States (Elias et al., 2020). A relatively high amount of smartphone use among parents was observed, ranging from 65% of parents in Israel up to 70% of parents in the United States. About a third of parents used their smartphones between 40% and 100% of the time of the entire meal. Very absorbed parents tended to be positioned away from their children, to cease to have eye contact with them and to fail to pay attention to their children's emotional distress, to their accomplishments, their attempts to communicate, and ultimately also to their

TABLE 3 Overview of included studies

Title of study Authors (by publication year)	Research question	Sample description, country of study	Methods	Key findings
Technology and caregiver–child interaction: The effects of parental mobile device use on infants Khourochvili (2017) Master's thesis	Does maternal absorption in smartphones produce a similar effect on children as in the original Still-Face Paradigm?	29 mother–baby dyads Child age: 4–11 months Canada	Experimental study, incorporating smartphone use into the Still-Face Paradigm Mothers were asked to answer text messages on their smartphones Quantitative analysis	Babies showed similar reaction to mothers' absorption in their smartphones as to the "still face" in the original experiment Babies of mothers with more intense habitual smartphone use time needed more time to recover in reunion phase
Infants' perceptions of mothers' phone use: Is mothers' phone use generating the still face effect? Kildare (2017) Doctoral dissertation	Does maternal absorption in smartphones produce a similar effect on children as in the original Still-Face Paradigm?	34 mother–baby dyads Child age: 3–6 months USA	Experimental study, incorporating smartphone use into the Still-Face Paradigm Measurement of infants' cortisol Mothers were asked to type the alphabet on their smartphones Quantitative analysis	Similarly, to the original still-face experiment, babies were sensitive to smartphone use phase, they showed decreased gaze at mother, and augmented self-comforting behaviors and attempts to escape situation No cortisol change in infants during the phases of the still-face procedure
Mobile device use when caring for children 0-5 years: A naturalistic playground study Mangan et al. (2018)	How do parents use their smartphones while spending time with their children on playgrounds?	50 parents 25 parents were interviewed Child age: under 5 years Australia	Mixed methods: Naturalistic playground observation (20 min) 24 of the parents were interviewed Quantitative and qualitative analysis	76% of parents use their smartphones, on average for 4 min of total observation time, ranging from 0 to 17.5 min Smartphones were mostly used for typing (emails, WhatsApp, Facebook, etc.) Parents tended to ignore their children's attempts to get their attention while on their phones
Digital disruption? Maternal mobile device use is related to infant social-emotional functioning Myruski, Gulyayeva, Birk, Pérez-Edgar, Buss, & Dennis-Tiwary (2018)	Does maternal absorption in smartphones produce a similar effect on children as in the original Still-Face Paradigm?	50 mother–baby dyads Child age: 7–23 monthsUSA	Experimental study, incorporating smartphone use into the Still-Face Paradigm Children were allowed to move around and play with toys Quantitative analysis	Babies showed more negative affect and less positive affect, as well as more toy engagement and attempts to gain mothers' attention during mothers' absorption in their phones

(Continues)

TABLE 3 (Continued)

Title of study Authors (by publication year)	Research question	Sample description, country of study	Methods	Key findings
Nod, nod, ignore: An exploratory observational study on the relation between parental mobile media use and parental responsiveness towards young children Abels et al. (2018)	Is parental smartphone engagement negatively affecting responsivity to children's bids for attention?	25 parent–child dyads Child age: 0–5 years Netherlands	Mixed methods approach: Naturalistic observation for 10 min on one playground and at two child health centers Questionnaires Quantitative analysis	Parents were less likely to react to children's bids for attention when engaged with their smartphones With stronger engagement, parents' reactions were weaker and slightly delayed
The presence of smartphones and their impact on the quality of parent–child interactions Rothstein (2018) Master's thesis	What impact do smartphones have on parent–child interaction?	39 parent–child dyads Child age: 13–51 months USA	Experimental, laboratory study, smartphone switched on/off while waiting in waiting room Quantitative analysis	With smartphones switched on, parents showed significantly less affection, responsiveness, and encouragement to their children
Maternal digital media use during infant feeding and the quality of feeding interactions Ventura et al. (2019)	Does maternal occupation with digital device while breastfeeding have an impact on quality of feeding interaction?	25 mother–infant dyads Child age: mean = 19.3 weeks USA	Experimental, laboratory study, within-subject comparison of breastfeeding interaction while watching TV on tablet and while listening to classical music on 2 consecutive days Quantitative analysis	Mothers were less sensitive and showed less cognitive growth fostering behaviors toward their babies while using a tablet compared to listening to classical music
"Where are you?" An observational exploration of parental technoference in public places in the United States and Israel Elias et al. (2020)	Does parental smartphone use in eateries and on playgrounds across two cultures have an impact on parents' engagement with their children?	Playgrounds: 72 parents, 70 children (USA) 53 parents, 87 children (Israel) Eateries: 98 parents, 83 children (USA) 89 parents, 77 children (Israel) Child age: 2–6 years USA and Israel	Naturalistic observational study on playgrounds and eateries Observation time on playgrounds ranging from 15–90 min Observation time in eateries on average 31 min Qualitative and descriptive analysis	During phone use, parents tended to ignore children's interactional initiatives, missing potentially dangerous situations and being less emotionally supportive; children showed frustration and disappointment in the face of parents' unresponsiveness

(Continues)

TABLE 3 (Continued)

Title of study Authors (by publication year)	Research question	Sample description, country of study	Methods	Key findings
"Look at me!" Parental use of mobile phones at the playground Lemish et al. (2020)	What is the impact of parental mobile device use on the quality of parent–child interaction?	77 parents, 70 children Child age: 2–6 years USA	Naturalistic observational study on playgrounds Qualitative and descriptive analysis	Disengaged parents tended to not be available for children to acknowledge their accomplishments, emotionally support them or make sure they were safe. Parental mobile phone use correlated more highly with parental disengagement than other parental distracting activities.
Infants' response to a mobile phone modified still-face paradigm: Links to maternal behaviors and beliefs regarding technoference Stockdale, Porter, Coyne, Essig, Booth, Keenan-Kroff, & Schvaneveldt (2020)	Does a smartphone-adapted still-face experiment produce the still-face effect? Are parental habitual amount of technoference and beliefs about phone use in the presence of infants linked to infants' behavior in the still-face experiment?	227 caregiver–infant dyads Child age: 5–14 months USA	Mixed methods approach Experimental study, incorporating smartphone use into the still-face paradigm Online survey Quantitative analysis	Infants showed still-face effect during caregivers' engagement in their digital device. Higher parent-reported levels of habitual smartphone use in the presence of their children was associated with increased escape behaviors and object orientation in infants under 9 months. Adaptations were found in infants over 9 months.
Are parents less responsive to young children when they are on their phones? A systematic naturalistic observation study Vanden Abeele, Abels, & Hendrickson (2020)	Is parental smartphone use associated with a decrease in parental responsiveness toward their children?	53 parent–child dyads Child age: 0–5 years Netherlands	Naturalistic observations on a playground in waiting rooms of consultation bureaus Quantitative analysis	When parents were using their phones, the odds of them responding to child were five times lower than when not using a phone. Parents responses while using their phones were less timely, weaker, and showed less affect toward child
Phone use while parenting: An observational study to assess the association of maternal sensitivity and smartphone use in a playground setting Wolfers et al. (2020)	How are maternal sensitivity, frequency of smartphone use, and type of use linked for mothers visiting playgrounds with their young children?	94 mother–child dyads Subsample of 79 mothers was interviewed Child age: under 3 years Germany	Mixed methods approach: Naturalistic playground observation during 10 min Interviews with 79 mothers Quantitative analysis	48% of mothers used their smartphones for an average of 1.3 min Longer smartphone use was associated with reduced maternal sensitivity Frequency of use (technoference) showed no correlation with maternal sensitivity

safety. Children reacted to their parents' absorption in their smartphones by expressing frustration or disappointment, avoidance of interaction, or by trying to get their parents' attention through disruptive behaviors.

Playgrounds are popular early childhood environments and—due to easy accessibility—ideal for naturalistic observations. Playground studies exclusively with under 5-year olds and their parents were conducted in Australia (Mangan et al., 2018), the United States and Israel (Elias et al., 2020), the Netherlands (Abels et al., 2018; Vanden Abeele et al., 2020), and Germany (Wolfers, Kitzmann, Sauer, & Sommer, 2020). In the German and the Dutch study, parents and children were observed for 10 min, whereas in the Australian study a 20-min observation was conducted. The study conducted in the United States and in Israel observed parents and their children from diverse socioeconomic backgrounds between 11 and 116 min (the entire length of their stay on the playground).

The percentage of parents using their phones while spending time with their children at the playground varied greatly and ranged from 42.6% (Vanden Abeele et al., 2020) to 48% (Wolfers et al., 2020), up to 76% (Mangan et al., 2018), and to a maximum of 79% (Elias et al., 2020). Length of observation seemed to contribute to some of these differences—studies that observed parents over longer time periods reported a higher percentage of smartphone use among parents. The differences in use time between parents were considerable, ranging from no use time to a use time covering the entire length of the observation (Lemish et al., 2020). Context appeared to contribute to these differences as well—in the Dutch study, parents and children were observed in waiting areas of consultation bureaus additionally to playgrounds. Parents in waiting areas used their smartphone about three times less than parents on playgrounds (Abels et al., 2018). All playground studies found a tendency of parents, who were involved with their smartphones over longer time periods, to ignore their children's attempts to interact with them or to show reduced sensitivity (e.g., Wolfers et al., 2020). According to Vanden Abeele et al. (2020) and Abels et al. (2018), parents who were very absorbed in their smartphones showed less affection and their reactions to their children's bids for attention were weaker and slightly time delayed. It was noted that parents who were busy with their smartphones were less responsive to weaker child signals. Occasional, short phone use was found to be less disruptive to parent–child interaction than phone use over a longer time span (Abels et al., 2018; Elias et al., 2020; Vanden Abeele et al., 2020; Wolfers et al., 2020).

Compared with other distractions, smartphone use seemed to make it harder for parents to redirect their attention to their children (Lemish et al., 2020; Vanden Abeele et al., 2020). Interestingly, in the German playground study, there was a week correlation between social use (such as communication with family or friends) and higher maternal sensitivity (Wolfers et al., 2020).

A second group of studies regarding the impact of parental smartphone use on parents' sensitivity and responsiveness has been conducted in laboratory settings, applying an experimental design including smartphone-induced interruptions of parent–child interactions (Khourochvili, 2017; Kildare, 2017; Myruski et al., 2018; Rothstein, 2018; Stockdale et al., 2020; Ventura, Levy, & Sheeper, 2019).

One study (Rothstein, 2018) experimentally created a waiting-room situation. It was observed that parents showed significantly less affection, responsiveness, and encouragement toward their children (aged 1–5 years), when they were allowed to use their smartphones to learn about the study compared to when they were not allowed to use their smartphones. Another study (Ventura et al., 2019) found that mothers were less sensitive and showed fewer cognitive-growth fostering behaviors toward their babies during breast-feeding interactions while watching a TV show on a tablet compared to listening to classical music. Interestingly, Ventura et al. (2019) reported that infants of mothers who normally had low levels of technology use showed a significant decrease in their responsiveness to their mothers in the digital media condition. This might point to processes of adaptation in infants of mothers with a higher level of technology use.

Several experimental studies used an adapted version of the original still-face experiment (Khourochvili, 2017; Kildare, 2017; Myruski et al., 2018; Stockdale et al., 2020). Instead of unresponsively looking at their children during the still-face phase of the experiment, mothers were asked to either focus on their devices (Myruski et al., 2018), type the alphabet on them (Kildare, 2017), or answer questions from the researchers on their smartphones (Khourochvili, 2017). Myruski et al. (2018) expanded the age range for the babies in their sample; babies were aged 7–23 months. Babies and toddlers were not strapped in infant seats but allowed to move about freely and play with toys. All of the adapted still-face procedures were able to produce the familiar still-face effect. Children showed significant variations in interactive behaviors across the various phases of the experiment: When mothers stopped interacting with them and focused exclusively on their smartphones, children showed more negative affect and less positive affect (as expressed in vocalizations and facial expressions) and tried to gain their mother's attention. During reunion, more intense interaction between mother and child was observable.

Habitual parental phone use as well as beliefs about phone use played into this as well. Myruski et al. (2018) found that children of mothers with a high amount of daily

smartphone use were more reserved and less explorative during free play and reunion, and the reunion itself was also less successful. In the study of Stockdale et al. (2020), parents self-reported their daily amount of technoference and their beliefs about using smartphones in front of their infants. Younger infants (under 9 months of age) of parents who reported a high amount of technoference and who believed it was okay to use the smartphone in front of the infant showed more signs of distress during the modified still-face procedure, whereas older infants (over 9 months of age) showed a decrease in signs of distress and attenuated negative affect.

4 | DISCUSSION

Overall, drawing on the presented results from the observational and experimental studies, there are clear indications that parental sensitivity and responsiveness can be negatively impacted by parental smartphone use in parents of children under the age of 5 years. Whether these findings apply to other naturalistic contexts than playgrounds, eateries, or waiting areas remains to be assessed, as context of observation seemed to contribute to variations in use behaviors (Abels et al., 2018). Observations and assessments of associations between parental use of digital devices with parental sensitivity and responsiveness in other environments or during a wider range of activities (e.g., play interactions at home) would be necessary to get a more complete picture.

The presented study findings do not reveal whether the observed decline in parental sensitivity and responsiveness due to parental smartphone use is temporary or if sensitivity and responsiveness are lowered for longer time periods. Similarly, it remains unclear if the still-face effect on infants in the smartphone-adapted still-face studies represents a transient and possibly healthy adaptation to smartphone-related parental behavior or if there are longer lasting effects. Regarding the questions of long-term effects of parental smartphone use on parents' sensitivity and responsiveness and on child adaptation to it, it seems important to more systematically take into account habitual parental smartphone use. Some of the experimental smartphone-adapted still-face studies, that did take into account the amount of daily parental mobile technology use, reported that infants of parents with a higher amount of habitual mobile technology use tended to be more distressed by their mothers' disengagement in the experiment (Myruski et al., 2018; Stockdale et al., 2020). However, some infants of mothers with a high habitual smartphone use were less easily disturbed through maternal device use while breastfeeding (Ventura et al., 2019) and older infants (>9 months) showed a reduction of negative emotional reactions (Stockdale et al., 2020), which brings to mind the adaptations infants of depressed mothers show in the still-face experiment, such as an increase of positive affect (Graham et al., 2018). These results point to complex and probably bidirectional interactive adaptational processes.

Some parents used their smartphones for a considerable amount of time while spending time with their children on playgrounds and in eateries (e.g., Elias et al., 2020) or reported a high daily technology use time while spending time with their children (Stockdale et al., 2020). What predisposes some parents to use their phones over extended time periods in the presence of their children? The transition to becoming and being a parent in the early years constitutes a psychological challenge on many levels (Stern, 1998). Many young parents feel overwhelmed when faced with the repetitive daily routine of caring for a baby, toddler, or preschooler.

Self-determination theory postulates three innate psychological needs that constitute psychological well-being and support self-regulatory capacity—the needs for competence, relatedness, and autonomy (Ryan & Deci, 2000). All of these needs can be especially hard to meet when raising young children, because infants' and young children's needs and demands often trump parents' needs in their urgency. Not having their needs met leads to additional stress for parents. Engaging with their smartphones might provide parents with the possibility to satisfy at least some of these needs. It gives them a break from parenting demands and provides them with a feeling of control over at least some things in their lives (autonomy), allowing them to be in touch with other adults (relating), to connect to their former or present professional identities (competence) or to just enjoy something that seems exclusively theirs (autonomy). Frustration of the core psychological needs has already been shown to be associated with higher scores of internet gaming disorder (Allen & Anderson, 2018). Many parents of infants and young children feel supported by their smartphones (Chatton, 2017; Gibson & Hanson, 2013), while also experiencing a high amount of ambivalence and internal tension regarding their smartphone use (Chatton, 2017; Radesky et al., 2016).

Maybe parents' overall well-being as well as personality factors such as introversion or proneness to addictive behaviors contribute to parental phone use behaviors, too, because both on playgrounds and in restaurants, amount of smartphone-use time varied greatly between parents (e.g., see Elias et al., 2020; Wolfers et al., 2020).

According to the studies conducted in eateries and on playgrounds, parents' absorption in their digital devices seems to have a stronger impact on parental sensitivity and responsiveness toward their babies and young children than interruption per se—so called technoference

(Vanden Abeele et al., 2020; Wolfers et al., 2020). When strongly absorbed in their devices, parents tended to miss children's bids for communication or to be less emotionally supportive (Elias et al., 2020) and overall to be less sensitive (Wolfers et al., 2020). Parents seemed to miss more subtle child signals, and their reactions to their children's bids for communication were time delayed (Abels et al., 2018; Vanden Abeele et al., 2020).

The experimental studies seem to confirm these findings, because they used smartphone interruptions that created an effect of absorption in parents (typing, answering questions online or reading information, watching a TV show) and found parental sensitivity and responsiveness to be impacted. In the adapted still-face studies, babies and toddlers experienced parental absorption in their smartphones similarly to the rigid face and nonresponsiveness of caregivers in the still-face experiment (Khourochvili, 2017; Kildare, 2017; Kildare & Middlemiss, 2017; Myruski et al., 2018). However, the impact of absorption versus technoference on parental sensitivity and responsiveness needs to be assessed more systematically in order to confirm these findings. A classical still-face condition could be compared to a technoference condition with short interruptions and an absorption condition with complete parental screen engagement (face and gaze turned completely to smartphone).

Generally, it seems to be harder for children to get parents' attention when parents are busy with their smartphones than when they are occupied with nondigital activities (Lemish et al., 2020; Mangan et al., 2018; Vanden Abeele et al., 2020). This can be understood in the context of what smartphones have to offer: a competing frame of communication that binds attention and provides the user with alternative options to connect with others or to be entertained. Again, the still-face paradigm could be applied to compare parental digital distraction with parental analogue distractions and their impact on parent–child interaction more systematically.

Besides parental psychological factors and needs as well as technoference and immersion as important factors possibly contributing to smartphones' effects on parental sensitivity and responsiveness, another explanatory model for the effects of smartphone use on relationships is the displacement hypothesis (McDaniel & Coyne, 2016b; Roberts & David, 2016). It postulates that time spent with another person is being displaced by time spent on digital activities; this reduces both interaction with present others per se and the probability of shared positive experiences with others. With regard to our research question, this hypothesis would imply that time spent on a digital device reduces opportunities to show sensitive parenting and sustain attuned parent–child interactions, which was the case in the study by Elias et al. (2020) in eateries and on playgrounds both in the United States and in Israel.

Raudaskoski, Mantere, and Valkonen (2017) offer a more complex idea; they argue that while using their phones, parents withdraw their gaze from the child and redirect their gaze to a competing frame of involvement—the device screen; turning to the device interrupts direct face-to-face communication. Moreover, parental facial expressions during smartphone use convey unclear information about parents' emotional state, not allowing the child to know to what these expressions refer. Therefore, the child is unable to draw any conclusions about the parent's activity on the smartphone or about the emotional content of that activity. Raudaskoski et al. (2017) termed this phenomenon "bystander ignorance" (p. 174). Faced with a parent occupied with his or her smartphone, the opportunity to learn through imitation or shared attention and gaze exchange is (momentarily) lost to the child. The bystander ignorance hypothesis further backs up the central role of parental responsiveness regarding the effects of smartphone use on interactions and ultimately child outcomes.

4.1 | Further research

The conclusions drawn from the studies reviewed here must be understood to be preliminary. Many of the observational and experimental studies are based on sample sizes from 25 to 55 parents or parent–child pairs, with the following exceptions: Wolfers et al. (2020) included 94 mother–child dyads in their sample, Stockdale et al. (2020) assessed a sample of 227 parent–child dyads, and Elias et al. (2020) observed samples of 125 parents and their children on playgrounds and 177 parents with their children in eateries.

Regarding the small-sample studies, the distinction between everyday observations and valid conclusions seems unclear. Furthermore, because almost everyone now owns a smartphone, it is unfortunately impossible to use a control group design to find differences between parental sensitivity and responsiveness in smartphone users versus nonusers. Instead, studies could more systematically compare parents who tend to be highly absorbed by their smartphones with parents who use their smartphones only moderately and are not absorbed in it regarding their sensitivity and responsiveness toward their children as Elias et al. (2020) and Lemish et al. (2020) already did. More systematic research comparisons of the effects of technoference versus absorption on parental sensitivity are needed to confirm the cautious finding of this review that parental absorption might have a more important impact on parental sensitivity and responsiveness.

In order to be better able to counsel parents regarding their smartphone use, research that takes into account parental psychological factors such as parenting distress in connection with the satisfaction or frustration of their basic psychological needs (Ryan & Deci, 2000) is needed. Parental psychological problems (e.g., postpartum depression or anxiety) that can lower parental sensitivity additionally to possible reductions due to parental smartphone use need to be considered as well.

Due to the lack of longitudinal data, the impact of parental smartphone use on parenting and ultimately on child well-being in the early years cannot yet be understood—preliminary data from two studies point toward a stronger impact of habitually reduced sensitivity in connection with parental smartphone use behaviors over experimentally induced short-term unresponsiveness (Myruski et al., 2018; Stockdale et al., 2020). Longitudinal studies over longer time periods (e.g., from infancy to the preschool years and even beyond) would help us to better understand cause-and-effect chains.

The application of experience sampling methodology (Larson & Csikszentmihalyi, 2014) could further deepen our understanding of how parental smartphone use in early childhood affects parental sensitivity beyond momentary observations. Experience sampling methodology records what people do, feel, and think during their daily lives through randomly recorded self-reports (Larson & Csikszentmihalyi, 2014). Applied to our research question, it could give a more immediate access to a broader variety of relevant situations for parental smartphone use in the presence of their children and to changes in parents' perceptions of their smartphone use behaviors and its perceived impact on their sensitivity over time.

Another open research question is whether associations between various aspects of parental smartphone use and parental sensitivity and responsiveness are different for mothers and fathers. Most of the studies reviewed here focused on maternal smartphone use and those that did include fathers did not assess differences in smartphone use behaviors nor their possible associations with parental sensitivity.

Furthermore, a variety of aspects of the use of digital devices in early childhood need to be explored further. What is the impact of listening to podcasts, texting, using social media, reading news, getting information on baby care questions, taking pictures or videos, and so forth on parental sensitivity and responsiveness? Which use modes tend to produce absorption? Additionally, more research on cultural differences regarding parental smartphone use and relationships in early childhood is warranted, as research only just started to address this (Elias et al., 2020).

It would also be interesting to focus more systematically on aspects of parental smartphone use that may be beneficial for parent–child relatedness and child development. As was pointed out above, many parents find their smartphones helpful in various areas of being a parent (Chatton, 2017; Gibson & Hanson, 2013); this could then also have positive effects on the parent–child relationship. For example, Wolfers et al. (2020) found heightened maternal sensitivity in connection with social use of smartphones, which again stresses the importance of assessing the specific uses made of digital devices.

4.2 | Limitations

Due to the scarcity of studies in this relatively young research area, we conducted no rigorous selection of studies included. Conclusions overall seem to point to effects of parental smartphone use on parental sensitivity and responsiveness in early childhood. However, the conclusions are still preliminary. Positive aspects of parental smartphone use have not been researched systematically in this review.

5 | CONCLUSIONS

There are indications that smartphone use in the presence of their children does have an impact on parental sensitivity and responsiveness, especially due to parents' absorption in their devices. However, a need for more longitudinal, multimethod research with larger sample sizes has been identified. This review may contribute toward defining future research topics in the area of parental smartphone use in early childhood, which in turn would eventually make it possible to advise parents of young children regarding their smartphone use and to design preventive measures where needed.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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