Technology and Child Development: The Effect of Parental Mobile Use on the Behaviour and Emotion Regulation of 3 and 4 Year Old Children

Josie Frappart

6763537

Abstract

Parental use of mobile phones in the presence of children has been linked to reductions in optimal child development. This study investigates whether parental mobile phone use is associated with children's behaviour and children's emotion regulation ability. Thirty mothers and 2 fathers (N = 32) of 32 children between the age of 3 and 4 years old (Child M_{age} = 45 months) participated in the study. Parents completed an online survey which consisted of a combination of standardised and bespoke measurements relating to their phone use and their children's behaviour and emotion regulation. Parent reported screen use indicated no relationship with children's behaviour or emotion regulation. Additionally, parent screen time statistics indicated no relationship between children's behaviour and emotion regulation. Contrary to previous literature so far, the current study suggests that there is no general effect of parental mobile use (looking at both reported screen time and screen time statistics) on children's behavioural and emotional development. Current literature suggests that parental use of mobile phones around children may be altering the interaction children require from parents to reach optimal behavioural and emotion regulation development. Recruitment took place during the Covid-19 pandemic, therefore the results gathered may have been affected by unique variables relating to the imposed lockdown by the government.

Technology in our homes has been increasing over the last few decades. We are in touch with friends, family and colleagues with a quick and instant text message, audio call or video call. Screens are used on a daily basis and are arguably a vital part of work life, schooling, information, leisure and socialising. These multimodal devices have completely changed the way in which we go about our daily lives (Campbell, Ling, & Bayer, 2014). Mobile phones for example can have significant benefits in terms of social contact and support and ease of virtual communication (Gibson & Hanson, 2013). However, some research to suggest that the effect of mobile use in the presence of others does in fact effect person-to-person dynamics and communication proficiency (Oduor et al., 2016). Much concern has been attributed to parental use of mobiles and the ever-increasing presence they have during family activities such as mealtime, playtime and bedtime (McDaniel & Coyne, 2016). These shared activities with children are vital times to be fostering children's social and emotional development (Bornstein, Tamis-Lemonda, Hahn & Haynes, 2008). Yet, what effect is the use of mobile phones by parents having on children's social and emotional development? Research is now focusing on the socio-emotional behaviour exhibited by children in response to parental mobile phone use, however this area of research is just at the beginning. So far research has focused more particularly on parental mobile phone use and how this effects parental responses to children's bids for attention (Radesky, Silvertein, Zuckerman & Christakis, 2014). However, little focus has been directed at parental mobile phone use and the social and emotional behaviour exhibited by children. In particular, little research has looked at the effect that parental mobile phone use may have on 3 and 4 year old children's social and emotional behaviour. If increased parental mobile phone use does have an association with increased child behaviour problems and decreased emotional regulation ability, then this will provide some insight into the impact of parental mobile use on younger children. In addition,

it will inform caregivers and adults who work with children about the effects of mobile phones in the presence of children.

Behaviour exhibited by children and their ability to regulate their emotions are two vital aspects of child development. At a younger age it is primarily the parent's role to positively foster and stimulate the development of behaviour and emotion regulation in children (Saarni, Campos, Camras & Witherington, 2007). Therefore, if parental mobile phone use is increasing in the family domain and in the presence of children, what role is this having on children's development, particularly their behaviour and emotion regulation abilities? The development of positive behaviour requires consistent guidance, rules and praise implemented by parents. Additionally, positive emotion regulation development requires reappraisal and direct attention to specific events in which children require appropriate regulation of their emotions (Davis & Levine, 2012).

Until now, much research has focused on parental responsiveness to child bids for attention and child-parent interactions when in the presence of media and screens in general. For example, Kirokorian, Pempek, Murphy, Schmidt and Anderson (2009) observed children and their caregiver who were exposed to background TV whilst being told to simply spend some time together relaxing. For the first half an hour the TV displayed adult oriented material and for the second half an hour the TV was switched off. As predicted in relation to previous studies focusing on TV media and parent-child interaction (Christakis & Garrison, 2009; Stupica, 2016), it was observed that caregivers became much less interactive with their children when the TV was on. They responded less to their child's bids for attention and thus the social behaviour of the children reduced in response to this decrease in caregiver responsiveness and stimulation, such that there was a noticeable decrease in eye contact and reduced initiation of communication from the child. When caregivers were responsive to bids for attention the response from the caregiver was more passive, emphasising the phenomenon

of ‘absent presence’ (Gergen, 2002). This demonstrates the impact that distraction by media and screens in general can have on the quality and responsiveness of parent-child interaction. This occurrence has been related to parental mobile phone use and whether this produces the same effect of responsiveness and interaction as seen by parental media and screen use. Hiniker et al. (2015) went further to look more specifically at mobile absorption by caregivers and the amount of time they attended to their child. Further to Kirkorian et al. (2009) it was observed that 56% of the time caregivers did not respond at all to children’s bids for attention when using their mobile phones, they gave no verbal or passive response. However, in the case where the caregiver was distracted due to conversations with other caregivers, attending to another child or staring into space, they tended to respond promptly to children’s bids for attention. This suggests that mobile phones in particular as a source of distraction are severely impacting, and in some cases, inhibiting completely the responsiveness and interaction between caregiver and child (Radesky et al., 2014).

Whilst little research has concerned child emotion regulation specifically in relation to parental mobile use, it is well recognised that mobile devices distract parents from face-to-face interaction with their children, which is crucial for child development (McDaniel & Radesky, 2018; Myruski et al., 2018; Radesky et al., 2014). For example, regular parental mobile use during parent-child interactions could decrease the quality of social exchange by reducing the opportunities for instant emotional feedback, which is essential for developing emotion regulation (Field, 1994). For parents to effectively shape and guide their child’s emotional skills it is paramount that they understand their child’s mental state and motivations behind certain behaviours. This then allows parents to help their child calm down, identify feelings and problem-solve (McDaniel & Radesky, 2018). However, with the added element of parental phone use there seems to be a reduced understanding from parents of their children’s mental states and intentions (Rosenblum, Dayton & McDonough, 2006). It is

therefore important that we understand the extent to which parental mobile use is affecting children's development.

Research has thus turned to investigating how parental responsiveness and interactions with children change with an increase in mobile phone use. It has been found that parental mobile phone use around children is in fact linked to fewer interactions between parent and child (Radesky et al., 2015), as well as reduced responsiveness to children's bids for attention (Hiniker et al., 2015) and the nature of the parental response if any is given, has been seen as more hostile and negative (Radesky et al., 2014).

McDaniel (2013) coined a particular word 'technoference', which refers to technology interference, describing the distraction of caregivers due to mobile phone technology and its effect on caregiver-child interactions. Following this, McDaniel and Radesky (2018) looked particularly at caregiver-child relationships, phone use and child behaviour. It was found that the technoference in caregiver-child interactions was associated with increased externalising and internalising child behaviour, as reported by both mothers and fathers. Therefore, it would appear that behaviour of children during parental mobile use does tend to worsen. McDaniel and Radesky (2018) further developed their focus on technoference and looked at how the behaviour of children aged 0-5 years of age changed over time in response to parental mobile use. Parents reported firstly that in stressful situations in response to difficult child behaviour they would withdraw from parent-child interactions with the use of their mobile devices, and secondly, that the more time they spent on their mobiles the worse child behaviour became over time. This suggests an unhealthy cycle of parent-child interaction avoidance, heavily impacting child behavioural development in the long run. At each of the 3 time points, 1 month, 3 months and 6 months after base measurements, technoference in parent-child interactions lead to greater externalising behaviour, child externalising behaviour predicted greater parental stress and parenting stress predicted later technoference at time point 2 and 3,

leading to an increase in both internalising and externalising behaviour. Internalising behaviour such as withdrawal was seen as a long-term consequence, only at time point 3 in response to a build-up of technoference, parental stress and externalising behaviour over time. On the other hand, externalising behaviour appeared as a more immediate and short-term consequence of technoference. Additioanlly, there was found to be a difference between fathers and mothers in that fathers appeared to report less technoference, with 9.6% of fathers reporting no technoference at all. This demonstrates the first direct link between parental mobile use during parent-child activities and the reported child behavioural difficulties that would seem to occur as a result. This study is the first to support the occurrences in public situations such as at the park and other naturalistic settings (Hiniker et al., 2015), of high mobile use by parents predicting small but present increases in externalising child behavioural difficulties, of children under the age of 10. Further to this, Poulain, Ludwig, Hiemisch, Hilbert and Kiess (2019) confirm the findings of McDaniel and Radesky (2018) in which externalising problem behaviours such as conduct problems, symptoms of hyperactivity and inattention as well as internalising problem beahviours such as withdrawal, were both reported by parents in relation to increased parental mobile phone use.

Poulain et al. (2019) studied the strength and difficulties of 2-9 year old children in relation to parental media use, child media use and parent-child interactions. It was suggested that parental mobile use may frustrate children particularly if the reason for mobile use is not clear, therefore their reactions are expressed through either externalising or internalising behaviours. Furthermore, reduced parent-child interactions due to parental mobile phone use were strongly associated with the probability of children presenting with conduct problems and emotional problems. The problems that children presented as an effect of parental mobile phone use were due to a lack of respect and helpfulness from their parents when using their mobile phones, as well as receiving a lack of socially acceptable examples guided by parental

behaviour. In addition, internalising problem behaviour was linked to a lack of social competence in children, which lead to peer problems and social withdrawal. All of the above associated with a tendency for children forming a disinterest in most interactions and an inability to proficiently engage in shared activities.

To date there is only one account by Myruski, Gulyayeva, Birk, Perez-Edgar, Buss and Dennis-Tiwary (2018) focusing on children's emotion regulation development in regard to parental mobile phone use. It was found that children presented with more negative affect and less positive affect during the caregiver mobile phone condition. It has been evidenced that positive development of children's emotion regulation has been linked with academic success (Graziano, Reavis, Keane & Calkins, 2007) and positive peer relationships (Petrides, Sangareau, Furnham & Frederickson, 2006). These positive outcomes which are linked to positive child emotional regulation development are primarily shaped by parental monitoring of children's emotions and feelings and adapting appropriately to each situation. Positively shaping children's emotion regulation is one of the most important roles of a parent (Saarni, Campos, Camras & Witherington, 2007). Therefore, it is of great interest that we examine the relationship between emotion regulation development and parental phone use further, in addition to the effect of parental mobile phone use on child behavioural development. Further information about parental mobile phone use and the effect it has on child behaviour and emotion regulation will be able to increase public health knowledge of this topic area and update any advice currently provided.

The aim of this current study is to investigate the relationship between parental use of mobile phones in the presence of children and the effect this has on children's social and emotional behaviour. Of particular interest is the effect that parental mobile phone use has on 3 and 4 year old children's social and emotional development, as they are at the fundamental age in which their social and emotional development is shaped by those around them (Landry,

2008), which at this young age is primarily their parents. The principle aspect under investigation is whether an increase in parental mobile phone use in the first instance, bears any relation to child social development in respect to externalising behaviour exhibited by children, and in the second instance, if an increase in parental mobile phone use bears any relation to child emotion regulation.

If parental phone usage is as distracting as reported (Reed, Hirsh-Pasek & Golinkoff, 2017), then it may well be that the distraction of parents when using their mobile phones is having a profound effect on children's social and emotional behaviour.

It is hypothesised that there will be increased externalising behavioural difficulties seen in children whose parents show a greater amount of mobile phone usage. In addition, it is hypothesised that children's emotion regulation ability will be reduced in those whose parents show a greater amount of mobile phone usage.

Parent reported data was gathered using an online survey in which participants provided information about their children's beahviour and emotion regulation ability, as well as their own mobile device use.

Method

Participants

Thirty mothers and 2 fathers (M_{age} = 36 years) of 3 and 4 year old children (M_{age} = 45 months). Multiple recruitment methods were used. Thirty-one out of the 32 participants were white British with one participant reporting as mixed race. Sixty three percent of participants were married, 22% were co-habiting, 6% were single and 9% were either in a civil partnership, divorced or separated. Due to the Covide-19 pandemic 36% of parents reported having one child at home, 39% reported having two children at home and 14% reported having three or more children at home. Additionally, 17% of parents reported that their

child's behaviour was better than before Covide-19 lockdown was implemented, 53% reported their children's behaviour was the same and 19% reported that their children's behaviour was worse. Lockdown regulations allowed for one session of outdoor activity per day of which 81% of parents reported that their children were going out for this exercise session. Finally, 72% of parents reported using their mobiles more often since lockdown had been implemented. Recruitment took place through social media, snowball sampling, the University of Bath Participation Pool, contact with different nurseries and relevant organisations (e.g., play groups) around the UK and personal contacts with links to primary schools. Electronic recruitment flyers were created and distributed around relevant organisations and were also posted on social media (Appendix A). Consent to participate was obtained in order to commence with the survey. Participants were required to select the appropriate response in order to provide consent and continue with the survey. Due to the inclusion of the Strength and Difficulties Questionnaire and Emotion Regulation Questionnaire, parents of children who were reported as having developmental problems were excluded from the study. This factor was screened for as part of the consent form in which parents had to report if their child had developmental problems, and if this was the case then they were not able to continue with the survey.

Materials

Participants completed a survey that was created using the University of Bath REDcap programme. The survey consisted of both bespoke questions relating to mobile and screen use of caregivers, as well as standardised questionnaires which were placed within the survey to assess parent reported child behaviour and emotion regulation. The bespoke questionnaires completed by participants gathered information concerning general descriptive information about the caregiver and their child (Appendix B), caregiver's use of phones (Appendix C) and caregiver's weekly screen time on their principle mobile

device (Appendix D). Additionally, questions concerning the Covid-19 pandemic of 2020 were included to gather descriptive information concerning any changes in parental technology use and child behaviour due to the lockdown imposed by the government (Appendix E).

Design and Procedure

A cross-sectional design was used. The study received full ethical approval form the University of Bath Psychology Ethics Committee (ethics code 20-071) .

Descriptive Information

Participants answered questions relating to general descriptive information about themselves and their child such as age, gender, employment, ethnicity and so on. The data gathered was categorical information.

The descriptive information gathered relating to the Covid-19 pandemic required participants to report their home situation during the pandemic. A 3-point Likert scale of 0 (*better*) to 2 (*worse*) was used to gather information about children's behaviour during lockdown compared to before. A '*yes*' / '*no*' choice was used to gather information about whether caregivers were going to work or not and a '*yes*' / '*no*' choice was used to assess if caregivers were using their mobiles more during lockdown.

Parent Reported Daily Phone Use

Caregiver's use of phones required participants to report their estimated average daily phone usage on any given day using a 5-point Likert scale from 1 (*less than an hour a day*) to 5 (*more than 6 hours a day*). The frequency of selected items for each rating scale was then added up.

Screen Time Statistics

Caregiver's weekly screen time for their principle mobile device required participants to access screen time statistics through the settings function on their phone and were then asked

to report the averages of their top three app times in hours and minutes from the previous week. The top three app times were added up to create one value in minutes for each participant which was used to represent weekly screen time across all mobile device models reported.

Externalising Behaviour

The Strength and Difficulties Questionnaire (SDQ; Appendix F) consisted of 25 items covering the four subscales of emotional problems, conduct problems, hyperactivity problems and peer problems, which were rated on a scale from 0 (*not true*) to 2 (*certainly true*). Flowing the scoring procedure for the SDQ, it was scored by adding up the number of times '*certainly true*' was selected to produce one value, with 40 being the highest possible score attainable if '*certainly true'* was selected for all items. All participants selected '*certainly true'* at least once. The face validity of the scales within the SDQ as reported by Gustafsson, Gustafsson and Proczkowska-Björklund (2016) ranged between $\alpha = .76$ and $\alpha = .84$.

Emotion Regulation

The shortened version of the Emotion Regulation Questionnaire (ERQ; Appendix G) consisted of 16 items covering the four subscales of anger, fear, positive emotionality-exuberance and sadness, which were rated on a scale from 1 (*doesn't apply at all*) to 5 (*applies very well to my child*).The first three items of each subscale were added up with the 4th item of each subscale scored in reverse, this then produced one score for each participant out of a maximum score of 64. With regards to external reliability, the correlation coefficients for the scales within the ERQ as reported by Rydell, Berlin and Bohlin (2003) ranged between $r = .62$ and $r = .79$.

After completion of the survey, parents were shown a debriefing information sheet to inform them of the data we were most interested in. Thus, it was fully explained to the

participants why we are interested in the possible links between parental phone use and children's social and emotional development.

Participants could complete the survey in their own time and on their screen of choice. Data collection occurred over a period of two weeks within the month of May 2020. Participants could complete the survey in whichever location the participant happened to be at the time (most likely at home due to the governmental lockdown enforcement). The survey took approximately 25 minutes to complete and there were no time restrictions.

Results

For the measures of behaviour and emotion regulation children were scored on respective scales in which the higher their score the worse their behaviour or emotion regulation ability. The average scores from all children is presented in Table 1. Children's average reported score for child behaviour (*M* = 15.33) was 25 points below the highest possible score of 40. In terms of the ERQ, children's average score for emotion regulation ability (*M* = 35.42) was 29 points below the highest possible score of 64.

Table 1. Mean and Standard Deviation of child behaviour and emotion regulation

Measures	M	SD
SDQ	15.33	1.67
ERQ	35.42	6.82

SDQ = Strength and Difficulties Questionnaire
ERQ = Emotion Regulation Questionnaire

The relationship between screen time statistics (*M* = 631.23 minutes, *SD* = 553.47 minutes) and children's behaviour (SDQ) and emotion regulation ability (ERQ), was investigated using a Pearson correlation coefficient. Preliminary analyses were performed to ensure no violation

of the assumptions of normality, linearity and homoscedasticity. Only 13 participants could or were willing to provide their average weekly statistical information. No statistically significant correlation was found between screen time statistics and child behaviour (r = -.35, n = 12, p = .258), however it did indicate a negative relationship which would suggest that an increase in screen time influenced better behaviour exhibited by children. Non-significance was also found for screen time statistics and child emotion regulation ability (r = -.24, n = 12, p = .453), however a positive relationship was indicated which would suggest that an increase in screen time influenced worse emotion regulation in children.

Table 2. Descriptive statistics of the categories of Reported Screen Time

Predictor	Frequency (*N*)
Reported Screen Time	
Less than 1 hour	1
1-2 hours	10
2-4 hours	17
4-6 hours	3
More than 6 hours	1

Note. N = 32

As shown in Table 2, most participants reported using their phone for between 2-4 hours a day.

Table 3. The relationship between parent reported screen time and children's behaviour and emotion regulation ability.

Measures	Pearson's Correlation Coefficient (*r*)	Significnce (*p*)
SDQ	-0.327	0.072
ERQ	-0.019	0.942

Note, *N* = 31 for SDQ and *N* = 28 for ERQ. Participants were on average 36.28 years old (*SD* = 5). Children of participants were on average 45.31 months old (*SD* = 6.26). The predictor of both SDQ and ERQ was Reported Screen Time.

As presented in Table 3. the relationship between child behaviour (as measured by the SDQ) and reported screen time of parents was investigated using Pearson's correlation coefficient. Preliminary analyses were performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There was no significant relationship found between the two variables of child behaviour and reported screen time, however a negative relationship was found. Additionally, the relationship between child emotion regulation (as measured by the ERQ) and reported screen time of parents was investigated using a Pearson's correlation coefficient. There was no significant relationship found between the two variables of child emotion regulation ability and reported screen time, however a negative relationship was indicated suggesting that an increase in reported phone use may influence an increase in child emotion regulation.

Discussion

The current study explored the relationship between parental mobile phone use in the form of reported screen time and screen time statistics, and the relation this has on 3 and 4 year old children's behaviour and emotion regulation ability. Firstly, with respect to children's behaviour, the present data show that reported screen time use does not show any significant relationship to child behaviour. Secondly, with respect to children's emotion regulation ability, the present data show that parental mobile phone use does not show any significant relationship to child emotion regulation. Additionally, no relationship was found between

parent screen time statistics and child behavioural development or emotion regulation ability. Two measures of parental mobile use were collected, however only the reported measures were used for the main analysis due to the larger sample size. In the present sample, the majority of the 32 participants reported spending around 2 to 4 hours a day on their mobile devices. From the 13 participants that provided mobile screen static information the average daily phone usage was 1.5 hours. Here, there appears to be a misjudgment of phone use by parents such that they believe they are using their mobile device more than they are in practice. However, the comparison between reported phone usage and screen time statistics may not be an accurate account of the difference seen in the two phone use measures due to the differing sample sizes. This could possibly be due to each variable not producing the same outcome measure, such that screen time statistics represents the top 3 app times over a given time frame whereas reported screen use represents all phone and app use over the same time frame.

The link between child behavioural problems and parental mobile use in the current study is unable to demonstrate the findings of Poulain et al. (2019) who found that mothers' media use was associated with an increase in child behavioural difficulties and a decrease in prosocial behaviour. These results differ with the current study in so far as reported mobile use has not been linked to an increase in parent reported child behavioural problems. One possible explanation for child behavioural problems found by Poulain et al. (2019) could be that overtime children may receive inconsistent and reduced parental scaffolding in terms of discipline and rules to guide their behaviour. Hiniker et al. (2015) suggest that this could lead to an increase in child behavioural problems due to children's actions not being enforced through discipline or praise. However, the lack of relationship found in the current study between child beahviour and parent reported mobile use could be explained through an

increase of parental phone use in terms of shared activities involving child relevant apps and games.

Furthermore, the outcome of the current study is also contrary to other studies in this area. For example, McDaniel and Radesky (2018) found that perceived technoference in mother-child interactions was associated with externalising and internalising behaviour exhibited by children. However, in the current study, child problem behaviours (both internalising and externalising) appeared to be uninfluenced by parental phone use. Additionally, in a naturalistic observation study by Radeky et al. (2014) it was described that young children would act in a silly manner, raise their voices, and show more impulsive behaviours whilst their caregivers were using a mobile device during mealtimes. Another possible explanation for increased child behavioural problems as suggested by Odour et al. (2016) might be that children often become frustrated by a sudden withdrawal of parental attention when using their mobile devices, particularly if the reason for device use is not clear. Yet, the current study lacks the evidence of a relationship between an increase in parental phone use leading to child problem behaviours. This could possibly be due to the reports off phone use from parents not representing their true use for various reasons, such that they may be falsely reporting due to embarrassment of their true use or misjudgments of use and so on.

The pattern of results in terms of children's emotion regulation ability and parental mobile use in the current study also yield interpretations contrary to current literature. In particular, Myruski et al. (2018) found that infants displayed increased negative affect during periods of time in which mothers were reenacting the Still Face Paradigm (SFP) whilst using their mobile phones. however, within the current study, children displayed no emotion regulation or dysregulation during periods of time in which their parents were using their mobile phone for entertainment purposes. What could partially explain the occurrence found by Myruski et al. (2018) is that parents need to understand the child's mental state and motivations for

behaviour in order to intervene effectively to help the child regulate their emotions. Yet, parents who often use mobile devices in the presence of their children show a reduced understanding of their child's mental state and intentions (Rosenblunm et al., 2006).

One limitation of the current study could be that the impact that Covid-19 had on everyone's lives may underlie some of the relationships seen as a result. Whilst Covid-19 data was collected from participants this was simply for descriptive information and was not accounted for in any of the tests run on data gathered. Therefore, it may be that some confounding variables such as child behaviour and parental phone use differ greatly due to the presence of Covid-19 compared to before the pandemic. It is thus with precaution that we compare the results from the current study to any previous literature due to the presence of the unprecedented global pandemic. Behaviours may well have been exaggerated or extenuated; an increase seen in parent reported screen use or a decrease in parent reported child behaviour, considering homeschooling and restrictions on leaving the home. Firstly, during the pandemic children's behaviour was reported to be the same for 53% of respondents and surprisingly, better for 17% of respondents. This change in typical behaviour exhibited by children could have some effect on the behaviour scores seen as a result. Secondly, the majority of parents reported that their phone use increased during lockdown, which additionally may have extenuated or increased some of the results gathered. Therefore, it may be difficult to generalise the findings to the target population in times when Covid-19 was not of concern.

A second and more serious limitation of the current study is that it was not specified that parents should report their phone use when in the presence of their child, rather they were to report their phone use in general. Screen time statistics would provide slightly more precise information of phone use as it includes the time spent on each activity, However, it is up to participants to volunteer this information and so only thirteen responses of this type were

gathered in the current study. Yet, this information was not specific to phone use around the child, again simply phone use in general. In addition, it should be noted that screen time statistics was calculated using the top 3 app times over the past week added up to create one value per participant. This was due to the different phone devices that were reported, and the screen statistic information recorded by different devices that could be compared to create one scree statistic value. Although, this screen time statistic information could be a potential underestimation of phone use. Therefore, screen time statistics does not represent complete phone usage over the past week, simply the most 3 used apps. Furthermore, the reported screen time of parents may not realistically match the screen time statistics provided by their phone's recorded information. Therefore, it is hard to know how realistic the reported screen use is. Moreover, during the Covid-19 pandemic 72% of parents reported to use their mobile phones more than usual and so there may be an effect on the relationship seen between parental phone use and child behaviour or emotion regulation due to the increase in parental mobile usage during the pandemic.

The survey itself was completed for the most part in the home situation and distractions were likely to be present. This suggests that there may be some biases in concentration and commitment to completing the survey in the most comprehensive manner. This further indicates that results should be interpreted with precaution.

A third limitation is that the sample size in the current study was very small and this may have been due to various reasons. For example, the data was collected during the main 'lockdown' phase of the Covid-19 pandemic in the UK. The virus caused disruptions and changes to everyone's lives and therefore people may have had little time to complete additional tasks such as the survey for this study. Therefore, the findings from this study should not be more than speculation. The small sample size suggests that the results formulated in the current study may not relate well to the target population, particularly due to

the fact that the majority of participants had achieved some form of higher education and so reflected a higher economic status population. Participants were mainly recruited through social media and so this excludes any parents who do not have social media accounts. Additionally, recruitment focused particularly on populations in the local vicinity of the South West of England and thus will not reflect a national sample population

In terms of recruitment, one additional limitation indicates that applying the findings of the current study to the population should be done with caution particularly due to some of the recruitment methods being directed at personal contacts of whom had links with schools and additionally word of mouth via these contacts.

In addition, another limitation is that there was only a two-week period to collect data due to last minute amendments that required ethical approval. Ethical approval took longer than usual to be processed due to most people working from home and the cut off point for the data collection period. Advertising the study virtually and gaining access to relevant Facebook groups and approval to advertise the study was challenging and not widely accepted, again due to the lockdown situation and people having other priorities. However, during the current study there were many hurdles to overcome and adapt to which saw a very difficult time for scientific research. Due to Covid-19, amendments had to be made to ethics, research methods had to be adapted from observational designs to online surveys as so forth. Furthermore, new variables were investigated within the current study which have not been looked at to date, such as screen time statistics which are available on all smartphones and an efficient way to gather accurate mobile, tablet and computer screen use data. Therefore, despite the limitations identified, there are positive elements that can be taken from the process and formulation of the current study.

The study set out to investigate the relationship between parental mobile use in the presence of 3 and 4 year old children and whether this has an effect on the children's

behaviour and emotion regulation. The findings do make a tentative contribution to a growing literature indicating associations between parental mobile use and child development. Further research could investigate the suggestion made by Odour et al. (2016) regarding the frustration children feel when parent's attention is suddenly withdrawn without clear reason due to mobile device use. This could incorporate further specificity of emotion regulation such as frustration in children in response to parental mobile use. Alternatively, Rosenblumn et al. (2006) suggested that parents who demonstrate increased use of mobile devices in the presence of children show reduced understanding of their children's mental states and motivations. Following this, research looking at how well parents know the motivations behind their children's behaviour in relation to the extent of parental phone use would be an interesting area to explore. Furthermore, Hiniker et al. (2015) point out the importance of parental scaffolding and how the presence of scaffolding alongside parental phone use is linked to a reduction in child behavioural problems. This thus points to the need for research which looks at the relationship between parental phone use and child behaviour in terms of parents who demonstrate increased parental scaffolding compared to those who demonstrate decreased parental scaffolding. It is important that researchers continue to broad scope of relationships between parental phone use and general child development such as language acquisition, behaviour, emotion regulation, social communication and so forth, as it could lead to great relevance in terms of informing public health guidance. The current study and supporting literature confirm the need for continued research concerning parental mobile phone use before the potential negative effects are prominent in our children.

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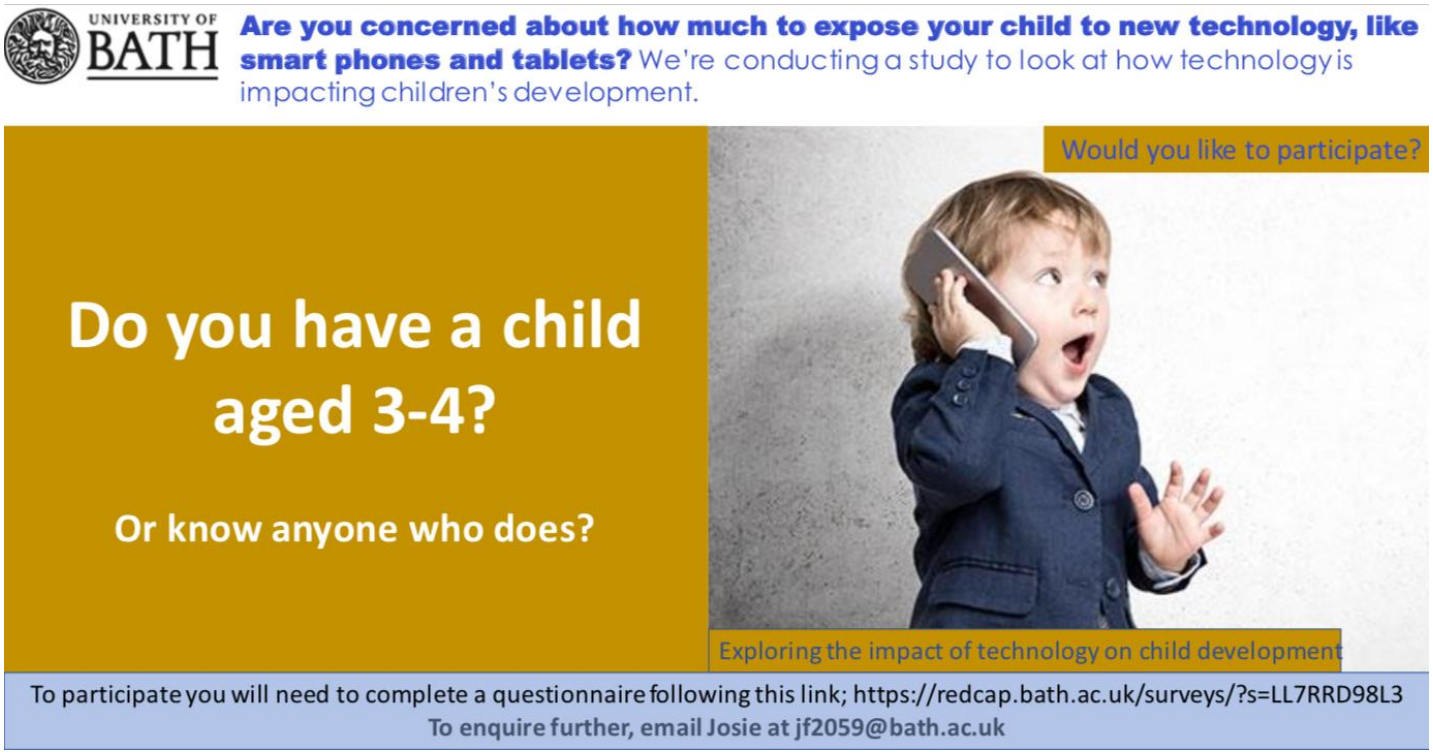
Appendices

Appendix A - Recruitment poster



Appendix B - Descriptive Information

Mobile Phone Online Survey	
What is your date of birth?	_____
Your age	_____
Please state your relationship to the child _____	
Your sex?	◯ Female ◯ Male ◯ Other ◯ Prefer not to say
Your ethnicity?	◯ White ◯ Black ◯ Asian ◯ Mixed ◯ Chinese ◯ Other
If other, please provide your ethnicity	_____
What is your highest educational qualification	◯ PhD ◯ Masters Degree ◯ Bachelor's Degree ◯ GNVQ/Vocational Qualification ◯ A levels ◯ GCSEs ◯ No Qualification ◯ Other
If other, what is your highest qualification?	_____
Are you...	◯ Married ◯ Civil Partnered ◯ Co-habiting with partner ◯ Single ◯ Divorced ◯ Separated ◯ Living Separate from Partner ◯ Other
If other, please explain your relationship status	_____
How many other children live in your household?	◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5 ◯ 6 ◯ 7+
What is your occupation?	_____
What is your child's date of birth?	_____
Your child's age (in months)	_____

We now want to ask you about your own use of smart phones or tablets.

How many smart phone/tablet devices you regularly use?

- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4 or more

What type of smart phone device do you use most frequently?

- ◯ Apple
- ◯ Android
- ◯ Windows phones
- ◯ Huawei

How many hours do you spend on mobile devices every day?

- ◯ less than an hour/day
- ◯ 1-2 hours/day
- ◯ 2-4 hours/day
- ◯ 4-6 hours/day
- ◯ more than 6 hours/day

Are you happy with the amount you usually use your phone?

- ◯ Extremely happy
- ◯ Moderately happy
- ◯ Slightly happy
- ◯ Neither happy nor unhappy
- ◯ Slightly unhappy
- ◯ Moderately unhappy
- ◯ Extremely unhappy

Do you wish you could reduce the amount of time you spend on your phone?

- ◯ Yes
- ◯ Sometimes
- ◯ No

Are you comfortable using your phone while looking after your child?

- ◯ Definitely yes
- ◯ Probably yes
- ◯ Probably not
- ◯ Definitely not

Do you feel you use your phone too much when taking care of your child?

- ◯ Yes
- ◯ Sometimes
- ◯ No

Do you wish you could cut down on your phone use when looking after your child?

- ◯ Definitely yes
- ◯ Probably yes
- ◯ Might or might not
- ◯ Probably not
- ◯ Definitely not

What activities do you usually use your smart phone device for? Choose as many as are appropriate

- ☐ Phone call
- ☐ Messaging/texting
- ☐ Email
- ☐ Social media (e.g. Facebook, Twitter, Instagram)
- ☐ Games
- ☐ Shopping
- ☐ Activity Tracking/ Life tracking
- ☐ Smart Device Monitoring (e.g., turning heating on and off, smart doorbells)
- ☐ Entertainment (YouTube, Streaming, Music, Podcasts)
- ☐ Reading (News, Kindle)
- ☐ Navigation (maps to navigate walking, SatNav)
- ☐ Work activities
- ☐ Other activities

Please indicate what else you use your smart phone for.

_____

Device Average Usage for Smart Phones

We would now appreciate if you could answer some questions relating to your device's screen time statistics for the past week. Are you willing to tell us about your past week's screen use?

◯ Yes
◯ No

Please access the screen time section of your Apple device - settings, screen time, see all activity - Please click on the last full week by scrolling down slightly until arrows appear to go back to the LAST FULL WEEK (7 days). Have you been able to find this information?

◯ Yes ◯ No

What is your last full week's average daily use? This is your average use over 7 days. Usually expressed in terms of hours and minutes. _____

Apples devices calculate the top three types of activities you use your phone for. Please indicate what the first type of activity is?

_____

what is the second type of activity?

_____

what is the third type of activity?

_____

Please tell us the amount of time on [three_types_type1].

_____

Please tell us the amount of time on [three_types_type2].

_____

Please tell us the amount of time on [three_types_type3].

_____

What is your total screen time during the last full week (7 days)? Usually expressed in hours and minutes _____

Looking at the apps you've used the most, are there any apps that you typical use with your child? If so, please indicate the amount of time on each of those apps below (no need to include the app name).

Please scroll down a bit further. Please tell us last week's average number of pick-ups.

_____

Please tell us the total number of pickups.

_____

Appendix E - COVID-19 related questions

Questions in relation to COVID-19 situation **During this period of government restrictions due to COVID-19:**	
How many children in your household are going to school or nursery?	○ 0 ○ 1 ○ 2 ○ 3+
How many children in your household are staying at home?	○ 0 ○ 1 ○ 2 ○ 3+
Are there any other members in your household at this time who would not usually be living with you?	☐ Parents ☐ Aunts/uncles ☐ Cousins ☐ Other relatives ☐ Friends ☐ Others
If 'others', please specify.	_____
Are you a key worker?	○ Yes ○ No
Are you going into work?	○ Yes ○ No
Are you going to work and are not a key worker?	○ Yes ○ No
Are you still working but from home?	○ Yes ○ No
Are you having to stay at home because your children are at home?	○ Yes ○ No
Are you socially isolating (not going out at all)?	○ Yes ○ No
Do you have someone / an organisation to help give you access to essentials such as food?	○ Yes ○ No
Are you going out once a day to get some exercise?	○ Yes ○ No
Are your children going out once a day to get some exercise?	○ Yes ○ No
Do you go with your children to get some exercise?	○ Yes ○ No
How would you describe your children's behaviour during this pandemic compared to before the pandemic?	○ Better ○ The same ○ Worse
Are you using technology such as mobile phones, iPads, laptops and TVs more than usual during this pandemic?	○ Yes ○ No
Are your children using technology such as mobile phones, iPads, laptops and TVs more than usual during this pandemic?	○ Yes ○ No

Thank you very much for your help!

Appendix F - Strength and Difficulties Questionnaire (2-4 years)

	Not True	Somewhat True	Certainly True
Considerate of other people's feelings	☐	☐	☐
Restless, overactive, cannot stay still for long	☐	☐	☐
Often complains of headaches, stomach-aches or sickness	☐	☐	☐
Shares readily with other children (treats, toys, pencils etc.)	☐	☐	☐
Often has temper tantrums or hot tempers	☐	☐	☐
Rather solitary, tends to play alone	☐	☐	☐
Generally obedient, usually does what adults request	☐	☐	☐
Many worries, often seems worried	☐	☐	☐
Helpful if someone is hurt, upset or feeling ill	☐	☐	☐
Constantly fidgeting or squirming	☐	☐	☐
Has at least one good friend	☐	☐	☐
Often fights with other children or bullies them	☐	☐	☐
Often unhappy, down-hearted or tearful	☐	☐	☐
Generally liked by other children	☐	☐	☐
Easily distracted, concentration wanders	☐	☐	☐
Nervous or clingy in new situations, easily loses confidence	☐	☐	☐
Kind to younger children	☐	☐	☐
Often argumentative with adults	☐	☐	☐
Picked on or bullied by other children	☐	☐	☐
Often volunteers to help others (parents, teachers, other children)	☐	☐	☐
Can stop and think things out before acting	☐	☐	☐
Can be spiteful to others	☐	☐	☐
Gets on better with adults than with other children	☐	☐	☐
Many fears, easily scared	☐	☐	☐
Sees tasks through to the end, good attention span	☐	☐	☐

	Not True	Somewhat True	Certainly True
Considerate of other people's feelings	☐	☐	☐
Restless, overactive, cannot stay still for long	☐	☐	☐
Often complains of headaches, stomach-aches or sickness	☐	☐	☐
Shares readily with other children (treats, toys, pencils etc.)	☐	☐	☐
Often has temper tantrums or hot tempers	☐	☐	☐
Rather solitary, tends to play alone	☐	☐	☐
Generally obedient, usually does what adults request	☐	☐	☐
Many worries, often seems worried	☐	☐	☐
Helpful if someone is hurt, upset or feeling ill	☐	☐	☐
Constantly fidgeting or squirming	☐	☐	☐
Has at least one good friend	☐	☐	☐
Often fights with other children or bullies them	☐	☐	☐
Often unhappy, down-hearted or tearful	☐	☐	☐
Generally liked by other children	☐	☐	☐
Easily distracted, concentration wanders	☐	☐	☐
Nervous or clingy in new situations, easily loses confidence	☐	☐	☐
Kind to younger children	☐	☐	☐
Often lies or cheats	☐	☐	☐
Picked on or bullied by other children	☐	☐	☐
Often volunteers to help others (parents, teachers, other children)	☐	☐	☐
Thinks things out before acting	☐	☐	☐
Steals from home, school or elsewhere	☐	☐	☐
Gets on better with adults than with other children	☐	☐	☐
Many fears, easily scared	☐	☐	☐
Sees tasks through to the end, good attention span	☐	☐	☐

Appendix G - Strength and Difficulties Questionnaire (4-17 years)

Appendix H - Emotion Regulation Questionnaire

	Doesn't apply at all to my child	Somewhat applies to my child	Neutral	Applies to my child	Applies very well to my child
My child often becomes angry and falls in a bad mood	○	○	○	○	○
When angry or in a bad mood, my child reacts strongly and intensely	○	○	○	○	○
It is easy for others, for instance a parent, to calm him/her down	○	○	○	○	○
He/she has difficulties calming down on his/her own	○	○	○	○	○
My child often gets frightened and worried	○	○	○	○	○
When frightened and worried, he/she reacts strongly and intensely	○	○	○	○	○
It is easy for others, for instance a parent, to make him/her calm down	○	○	○	○	○
He/she has difficulties making him/herself calm down	○	○	○	○	○
My child often gets happy, excited and in an exuberant mood	○	○	○	○	○
When in an exuberant mood, my child reacts strongly	○	○	○	○	○
It is easy for others, for instance a parent, to make him/her quiet down	○	○	○	○	○
He/she has difficulties quietening down his/herself	○	○	○	○	○
My child often becomes sad	○	○	○	○	○
When sad, my child reacts strongly and intensely (e.g. cries, screams)	○	○	○	○	○
It is easy for others, for instance a parent, to make him/her feel better (e.g. by comforting, distracting or talking things through)	○	○	○	○	○
He/she has difficulties finding something to make him/herself feel better	○	○	○	○	○