Data-Driven Parenting: Robust Research and Policy Needed to Ensure that Parental Digital Monitoring Promotes a Good Digital Society

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Abstract

Digital monitoring technologies are providing parents with unprecedented abilities to oversee and limit their children's online and offline behaviours. Where previously caregivers primarily relied on direct verbal communication with children to gather information, they now commonly shift towards using digital monitoring technologies to achieve the same aims (namely, information gathering and safeguarding) – often without their children's awareness or consent – bringing significant implications for the family system, children's well-being, and children's rights. Their widespread use has significant implications on the overall well-being of our digital society. While these technologies are aimed at increasing children's safety and helping parents to feel secure, the supporting evidence for their efficacy is limited. At the same time, the risks associated with these technologies, such as their potential to undermine trust within families and disrupt children's developing self-regulation, are pronounced. With parents increasingly relying on digital monitoring as part of caring for their children, it is imperative to understand the implications of such technologies and to develop best practice recommendations for parents. In this paper, we provide a synthesis of critical future research directions in this space and propose policy recommendations, to facilitate the development and agenda-setting of digital parenting solutions that prioritise children's privacy while promoting the digital well-being of our society.

***Keywords*:** digital monitoring technologies; childcare; data-driven parenting; children's autonomy; children's well-being; datafied childhood

Introduction

Digital monitoring technologies are significantly increasing parents'[1] capacity to oversee and limit their children's online and offline behaviours. These technologies span multiple caregiving functions: They involve 1) restriction (i.e., limitation) settings for children's digital technology use and access to online content; 2) monitoring of children's online activities, such as the content they are accessing online and their online interactions; and 3) offline location tracking and reporting using digital technologies. Their use, through such popular apps as Life 360, Google Family Link, Apple Maps, Qustodio, and Apple screen time, is widespread. In the UK, 70% of parents with children aged 3-17 use technology to control their child's access to online content.[2] In the US, 86% of parents with children aged 5-11 years report restricting when and for how long kids can use screens, 75% mention they check the websites and apps their children use, and 72% say they use parental controls to restrict how much their child uses screens.[3] Studies estimate that around 40-50% of parents in the UK and the US use location tracking to monitor their children's whereabouts.[4]

Two trends have increased parents' reliance on monitoring technologies. First, as childcare intensifies[5], digital monitoring technologies are being presented as a solution to the pressures of modern parenting. Second, as children's behaviours and life experiences, such as playdates and socialising, increasingly move online, parents' support and intervention follow into this space.[6] These practices will only become more widespread as, aided by the increasing capabilities offered by AI, parents have access to evermore specific and complex data describing their children's activities online and offline.[7]

The widespread use of digital monitoring technology within families has significant implications for the overall well-being of our digital society. While these technologies are aimed at increasing children's safety and helping parents feel secure, the supporting evidence for their efficacy in these areas and their overall ability to promote young people's and their families' well-being is limited. At the same time, the risks associated with these technologies, such as their potential to undermine trust within families and hinder the self-regulation development of children, are pronounced. With more parents increasingly relying on externalised and automated methods to gather information about their children, it is imperative to understand the implications of such technologies and to develop best practice recommendations for parents. New policy frameworks are urgently needed to provide better guidance for parents and facilitate the development of solutions that prioritise children's privacy while promoting the digital well-being of our society.

1 In this paper we use the term 'parents', but these issues speak to caregivers and caregiving more broadly.

2 Ofcom (2023) Children and parents: Media Use and attitudes.

3 Auxier, B., et al. (2020). "Parenting Children in the Age of Screens", Pew Research Center.

4 UK: Lewis (2022) "Honey, let's track the kids: the rise of parental surveillance." The Guardian.
US: Burnell, K., Andrade, F. C., Kwiatek, S. M., & Hoyle, R. H. (2023). "Digital location tracking: A Preliminary Investigation of Parents' Use of Digital Technology To Monitor Their Adolescent's Location". Journal of Family Psychology 37(4): 561–567.

5 Intensification of childcare refers to the rise in the time and effort parents are expected to spend on childcare. See for example: Ishizuka, P. (2018). "Social Class, Gender, and Contemporary Parenting Standards in the United States: Evidence from a National Survey Experiment." Social Forces 98(1): 31-58 and Kornrich, S. and F. Furstenberg (2012). "Investing in Children: Changes in Parental Spending on Children, 1972–2007." Demography 50(1): 1-23.

6 Livingstone, S., & Bober, M. (2004). "UK children go online: Surveying the experiences of children and their parents". London: LSE Research Online.

7 E.g.: Family Time Blog (2023) AI and Parenting: The Ultimate Guide for raising kids. Family Time.

Benefits and risks of monitoring technology to digital society

Effective child care relies on parents having knowledge about children's experiences and behaviours. This knowledge enables parents to make informed decisions about how to support and intervene strategically to reduce harm to their children and to promote children's well-being.[8] Used effectively, monitoring technologies are an important tool for childcare that assists parents in safeguarding and guiding children in their online and offline behaviours. Good monitoring technologies could ultimately contribute to a digital society that protects children's safety, encourages better choices both offline and online, and supports development of healthy habits that will benefit children throughout their lives.

Technologies designed to restrict children's use by turning off device capabilities at times designated by parents can help children get better sleep[9] and focus at school, while blocking dangerous or inappropriate content can protect children from being exposed to such content online.[10] Offline location tracking, on the other hand, relies on digital technology to keep kids safe in the real world by monitoring where they are, so parents can intervene for their safety, as needed. Monitoring technology can therefore improve the well-being of children[11] and their parents, who derive a sense of peace and security when these technologies offer instrumental information about the safety of children.[12]

Though digital monitoring technologies, used correctly, can deliver benefits to children and their families, these need to be considered against the possible risks. Previous research has extensively discussed the risks to children's privacy.[13] We add to this discussion with a consideration of two broad categories of risk to children's and families' well-being: (a) negative consequences for parent-child relationship, and (b) undermining children's ability for self-regulation.

The first risk is that digital monitoring technology can have unintended consequences on the parent-child relationship. Screen-based activities are contentious in many families[14] and parental reliance on technology for information gathering and control may result in lowering the quality of family communication, a diminished sense of trust felt by children towards their parents, and an increase in perceived parental control.[15] Over time, children who have these experiences may be more prone to engage in secretive or rebellious behaviours.[16] Children may resist perceived privacy violations by circumventing parents' attempts to gain information, engaging in risky online and offline behaviours, and avoiding direct disclosures to parents. Children who experience monitoring as disruptive or unwarranted may seek out digital experiences through friends' or public devices and may find technological ways to override restrictions on their own devices. These behaviours are known as backfire effects of ineffective behaviour regulation[17]; the outcome is that poorly monitored children may be at greater risk than if they were not monitored at all. Evidence suggests that parents overestimate their knowledge of their children engaging in risky behaviours.[18] If this actual underestimation of a young person's exposure to risks is coupled with a parents' *belief* that they have more detailed insights into their children's digital and offline lives than ever before, this gap between parents' perceived and actual knowledge may put children at risk.

A second risk is that parents who heavily rely on restrictive digital monitoring, which closes off children's opportunities to make choices about their own practices, may undermine their children's ability to self-regulate technology use (i.e. to make and act on thoughtful and goal-directed decisions related to technology use that lead to their own best outcomes). Babies and young children may benefit from monitoring and restrictions that keep them safe until they can build their own self-regulatory skills. However, as children increasingly explore digital spaces, they must make frequent decisions about their time use, the content they pursue, and

8 Pathak, S. (2012). "Parental Monitoring and Self-disclosure of Adolescents." Journal of Humanities and Social Science 5(2): 01-05.

9 Restrictions can vary in impact. When these restrictions came in the form of state-wide bans on online gaming late at night for youths in South Korea, the documented sleep gains for boys were 1.5 minutes for boys and 2.7 minutes for girls. See Lee, C., et al. (2017). "Ex-post evaluation of illegalizing juvenile online game after midnight: A case of shutdown policy in South Korea." Telematics and Informatics 34(8): 1597-1606.

10 Ghosh, A. K., Badillo-Urquiola, K., Rosson, M. B., Xu, H., Carroll, J. M., & Wisniewski, P. J. (2018). "A Matter of Control or Safety? Examining Parental Use of Technical Monitoring Apps on Teens' Mobile Devices." In Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems (pp. 1-14).

11 Yunike, Y., Rehana, R., Misinem, M., & Kusumawaty, I. (2023). "The Implications of Utilizing Artificial Intelligence-Based Parenting Technology on Children's Mental Health: A Literature Review". Poltekita: Jurnal Ilmu Kesehatan 17(3): 1083-1099.

12 Leaver, T. (2017). "Intimate surveillance: Normalizing parental monitoring and mediation of infants online." Social Media + Society 3(2)
Simpson, B. (2014). "Tracking Children, Constructing Fear: GPS and the Manufacture of Family Safety." Information & Communications Technology Law 23(3): 273-285.

13 Feal, Á., et al. (2024). "Angel or Devil? A Privacy Study of Mobile Parental Control Apps." Proceedings in privacy enhancing technologies symposium 2020 (2): 314–335.

14 Anderson, M., et al. (2024). "How Teens and Parents Approach Screen Time", Pew Research Center.

15 Ghosh AK, Badillo-Urquiola K, Guha S, LaViola Jr JJ, Wisniewski PJ (2018, Apr 19). "Safety vs. Surveillance: What Children Have To Say About Mobile Apps For Parental Control". In Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems (pp. 1-14).
Vansteenkiste, M., Soenens, B., Van Petegem, S., & Duriez, B. (2014). "Longitudinal Associations Between Adolescent Perceived Degree and Style of Parental Prohibition and Internalization and Defiance". Developmental Psychology 50(1): 229.

16 Weinstein, N., & Przybylski, A. K. (2019). "The Impacts of Motivational Framing of Technology Restrictions on Adolescent Concealment: Evidence From a Preregistered Experimental Study". Computers in Human Behavior 90: 170-180.
Rudi, J. H. and J. Dworkin (2018). "Parents' and Youths' Solicitation and Disclosure of Information in Today's Digital Age." Journal of Youth Development 13(4).

17 Flamant, N., Haerens, L., Mabbe, E., Vansteenkiste, M., & Soenens, B. (2020). "How Do Adolescents Deal With Intrusive Parenting? The Role of Coping With Psychologically Controlling Parenting in Internalizing And Externalizing Problems. Journal of Adolescence 84: 200-212.
Van Petegem, S., Soenens, B., Vansteenkiste, M., & Beyers, W. (2015). "Rebels With a Cause? Adolescent Defiance From The Perspective of Reactance Theory and Sel-Determination Theory." Child Development 86(3): 903-918.

18 e.g. Geržičáková, M., et al. (2023). "What Do Parents Know about Children's Risky Online Experiences? The Role of Parental Mediation Strategies." Computers in Human Behavior 141: 107626.

point of disengagement to address their social, academic, and personal needs.[19] As children make decisions and, inevitably, mistakes, they may learn skills for making thoughtful online decisions later in life.[20] Moreover, self-regulation is a transferable skill; the more practice children have making thoughtful decisions concerning their own digital behaviours, for example, the better prepared they are to make independent decisions around digital technologies that will benefit them in later life.[21]

Both these risks can be mitigated through the strategic human-centred design of monitoring technologies, how technologies are marketed to families, and how they are eventually adopted into family practices. Existing policy-making, such as the Online Safety Bill[22], tends to focus on preventing harms, but ignores the possible benefits that may go hand-in-hand with the risks and potentially involve difficult trade-offs.[23] In building policies regarding digital monitoring technologies, policy makers should account for both the risks and opportunities that digital monitoring technologies offer to families and that will empower parents to support children's development.

Considerations for future research and policy-making

Future research is needed to examine the processes, principles, and practices that underpin effective digital parenting approaches and empower a positive caregiver-child relationship in different social contexts. Below we outline three important directions and considerations for enabling better digital parenting for our society. Together, these points lead us to the conclusion that future research must be able to synthesise across societal, family, individual, and technological levels, offering conceptual approaches to the issue and creating a principled yet practical roadmap for technology development and deployment. Based on this synthesis of critical future research directions, we propose corresponding policy recommendations, which are urgently needed to provide better guidance for parents and facilitate the development of solutions that prioritise children's privacy while promoting the digital well-being of our society.

Consideration 1: *Researchers must think critically about the outcomes under study*. At present, much of the evidence in support of the benefits of monitoring technologies focuses on short term *avoidance-focused* outcomes.[24] For example, research has focused on occasions when parents use monitoring technologies to protect a child from unwanted online content or parent-deemed excessive online use. Such research prioritises children's safety, often in a narrow sense, overlooking other possible goals of parenting, such as connecting with and empowering children.[25] In addition, research to date fails to consider the long-term consequences, such as how the choices made around digital monitoring technologies in families today may influence children's ability to make good decisions in the future—including, ultimately, those around their safety.

What short-term *and* long-term benefits do digital monitoring technologies have for family members' well-being and functioning? We have little data to answer this question, and most of the studies looking at digital monitoring technologies to date fail to engage with the fact that children are social agents, parent-child relationships are not static, and children will eventually grow up to become independent young adults that parents can no longer control through a parental control app. Children's developmental stages must be taken into consideration for understanding the implementation of technologies and deciding on the most relevant outcomes to be measured. Research sensitive to the shifting nature of children as they mature would enrich our understanding and ability to intervene to improve long-term outcomes for children and their parents. In infancy, for example, technology can be used broadly for safety and there is less concern for children's empowerment. During adolescence, children's natural negotiations for independence play a dominant role in how technologies are used by parents and received by children.[26]

While we encourage future research that looks at how to support children to develop good self-regulation, we must underscore the importance of building an understanding of how long-term resilience is developed as children grow by devising dedicated test indicators. For example,

19 Grolnick, W. S., & Raftery-Helmer, J. N. (2013). "Facilitating autonomy in the family: Supporting intrinsic motivation and self-regulation." Self-Regulation and Autonomy: Social and Developmental Dimensions of Human Conduct 141-164.

20 At least one longitudinal study linked parental controls used by parents with "compulsive internet use" by children one year later, which would be consistent with children having difficulties with self-regulation: Miltuze, A., et al. (2021). "Consistent and Appropriate Parental Restrictions Mitigating Against Children's Compulsive Internet Use: A One-Year Longitudinal Study." Technology, Knowledge and Learning 26(4): 883-895.

21 Lengetti, E., Kronk, R., & Cantrell, M. A. (2020). "A Theory Analysis of Mastery Learning and Self-Regulation." Nurse Education in Practice 49: 102911. Pressley, M. (1995). "More About The Development of Self-Regulation: Complex, Long-Term, and Thoroughly Social." Educational Psychologist 30(4): 207-212.

22 See Online Safety Act (2023) House of Commons Bill no. 3137. London. Available at: https://bills.parliament.uk/bills/3137

23 Nash, V. and Felton, L. (2023) "Expert Comment: Online Safety Bill - a missed opportunity?" University of Oxford.

24 Stoilova, M., et al. (2024). "Do parental control tools fulfil family expectations for child protection? A rapid evidence review of the contexts and outcomes of use." Journal of Children and Media 18(1): 29-49.

25 Deci, E. L., & Ryan, R. M. (2013). "The Importance of Autonomy for Development and Well-Being." Self-Regulation and Autonomy: Social and Developmental Dimensions of Human Conduct, 19-46.

26 Ryan, R. M., Lynch, J. H. (1989). Emotional Autonomy Versus Detachment: Revisiting the Vicissitudes of Adolescence and Young Adulthood. Child Development 1:340-356.

qualitative studies with children of different ages directly asking questions of resilience and empowerment[27], research following children across key stages of adolescent development as they seek more independence[28], and studies synthesising data across parents' and children's reports[29], can help speak to children's digital resilience through their own experiences and behaviours collected across longer spans of time.

Recommendation 1: *To gain a comprehensive understanding of the long-term impacts of technology on children and their development, it is imperative to support and invest in research initiatives that address how technology use can drive child and family well-being within a digital society*. By prioritising longitudinal studies and interdisciplinary collaborations, we can transform the current research paradigm that often focuses on one aspect of this critical social-technical challenge and uncover the complex interplay between monitoring technology adoption and its influence on children's digital resilience and well-being. Governmental bodies and regulators, such as the Information Commissioner's Office (ICO) and the Department for Science, Innovation and Technology, should consider carefully the evidence base for their recommendations to parents, prioritise regulations for the safeguarding of children, and establish broader engagement with diverse experts and stakeholders to discuss the implications of research that addresses long-term and positive outcomes for children.

At present, funding and support for research in this area remains limited. Initiatives such as the UKRI Cross Research Council Pilot Scheme and the Responsible AI UK programme represent initial efforts to bridge the gap between research disciplines and encourage interdisciplinary collaboration. However, despite these initiatives, discussions regarding the crucial impact of digital parenting and childhood are notably absent from national forums such as the recent UK AI summit. Consequently, UK researchers continue to face challenges in securing resources and support that allows them to investigate this critical topic by developing long-term observations and evaluations and drawing on cross-disciplinary expertise to investigate the nuances of the challenges.

Consideration 2: *Researchers should consider family members' individual characteristics as well as the nuanced family and societal contexts in which parents monitor their children*. These span psychological and sociological principles and involve: children's personal characteristics, such as age, gender, maturity; characteristics of family relationships that affect digital monitoring technology use; qualities of the family structure that influence parents' use of data and children's responses to both their parents and the monitoring technology being used[30]; as well as the social, cultural and normative structures within which families find themselves.

First, how digital monitoring technology will affect young people depends on the qualities of the family system in which it is used. We know, for example, that authoritarian parenting is associated with greater reliance on digital monitoring technologies[31], but we do not know if outsourcing supervisory childcare to technology as part of different parenting approaches matters for children's perspectives and eventual child outcomes. Additionally, studies should also recognise the bi-directional nature of parent-child relationships.[32] Children's behaviours, including their risky, externalising (e.g., aggressive), and internalising (e.g., depressive symptoms) behaviours, academic performance, and social interactions may affect parents' decisions concerning the use of digital monitoring technology and influence parental behaviours more broadly, impacting the context in which technology is implemented.

We must also acknowledge how variations in family structure and available resources may affect the technology usage. To give a few examples: (a) In transnational families, parents living away from their children turn to digital technologies as a practical solution for times they are not able to be physically with their children.[33] (b) Parental socioeconomic status and education may affect the amount of time parents can spend on childcare, extent of parental oversight more generally[34], and the rationale behind digital monitoring. Affluent and highly educated parents turn to digital monitoring to ensure their own "omnipresence."[35] Lower-income families may be driven to supervising their children remotely while engaging in paid work because digital monitoring is cheaper than human care.[36] (c) The local welfare system may play a role. In societies with extensive policies supporting work-family balance, parents will experience less conflict between their work and family responsibilities and may have more time to spend with children and thus less need to monitor children through technologies. How these complex factors may relate to the adoption and implications of the monitoring technologies is not yet fully understood.

27 Liebenberg, L., & Theron, L. C. (2015). "Innovative Qualitative Explorations of Culture and Resilience." Youth Resilience and Culture: Commonalities and Complexities 203-215.

28 Sawyer, S. M., Azzopardi, P. S., Wickremarathne, D., & Patton, G. C. (2018). "The Age of Adolescence." The Lancet Child & Adolescent Health 2(3): 223-228.

29 Kenny, D. A., Kashy, D. A., & Cook, W. L. (2020). "Dyadic Data Analysis." Guilford Publications. New York: Guildford.

30 Livingstone, S., & Blum-Ross, A. (2020). "Parenting For a Digital Future: How Hopes and Fears About Technology Shape Children's Lives". Oxford University Press, USA.

31 Ghosh, A. K., et al. (2018). A Matter of Control or Safety? Examining Parental Use of Technical Monitoring Apps on Teens' Mobile Devices. Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems. Montreal QC, Canada, Association for Computing Machinery: Paper 194.
Martínez, G., Casado, M. Á., & Garitaonandia, C. (2020). Online parental mediation strategies in family contexts of Spain. Comunicar, 28(65), 65–73.

32 Yan, N. and A. Ansari (2016). "Child Adjustment and Parent Functioning: Considering the Role of Child-driven Effects." Journal of Family Psychology 30(3): 297-308.

33 Liu, N. (2024). "CCTV cameras at home: Temporality experience of surveillance technology in family life." New Media & Society: 14614448241229175.

34 Mascheroni, G. and Ólafsson, K. (2014). Net Children Go Mobile: risks and opportunities. Second Edition. Milano: Educatt.

35 Lim, S. S. (2020). Transcendent parenting: raising children in the digital age. New York, NY, Oxford University Press.

36 Murphy, R. and W. G. Hui (2024). How and Why do Some Migrant Mothers Digitally Monitor Their Children in China? Gender in an Age of Global Care Crisis Conference. Oxford.

Finally, social norms and cultural context can directly influence parents' and children's behaviours, and shape different user *perceptions* of the same behaviours. For example, cultures differ in the extent of the negative associations between authoritarian parenting and children's outcomes, suggesting that parenting behaviours may be experienced differently by children growing up in different cultural contexts.[37] State and corporate digital surveillance are perceived differently in different countries[38], suggesting that attitudes to family surveillance may also vary. Societies and cultures may also differ in the extent of autonomy they allow their children, in perceptions of parental control, and how acceptable it is for parents to exercise high levels of control over their children via digital technology. All of these factors could influence parental desire for digital supervision of their children and the ways children experience this supervision. To advance understanding, future research should explore the intricate interplay between cultural influences, related perceptions of parental practices, and children's experiences of digital monitoring.

Recommendation 2: *Address the variation in the use of digital parenting technologies in the UK homes, considering specific factors such as the different family context, social norms and beliefs shared by children and parents, and access to socioeconomic resources.* When considering digital restrictions policy makers tend to imagine or even adopt a one-size-fits-all approach to digital technology. See, for example, the state-wide bans on online gaming at night for all youths in South Korea.[39] A report based on a large and well-designed survey could document the varied patterns of digital monitoring technology use and outcomes associated with the different family structures, resources, and contexts within which parents are raising their children. The focused attention on how monitoring technologies are used coupled with a nuanced consideration of additional factors would document real-world adoption practices, and could both inform best practice recommendations for families and children with different needs and research roadmaps, and help enhance public awareness. While the government may not be the most suitable entity to advise how parental monitoring technologies are employed at home, a systematic reporting of adoptions of such technologies in the UK households, akin to the annual Ofcom Children and Parents Media Use and Attitudes Report, could provide a more comprehensive understanding of the impact these technologies are already having in different contexts.

Consideration 3: So far, we have focused on qualities of the families and social environments for shaping the impacts of digital monitoring technologies. However, these *topics should be considered alongside the very technologies used by families, and design decisions within those technologies.* While the HCI community has a long history of designing for and with children, there is little consensus about how to design systems in ways that foster children's well-being and self-regulation abilities.[40] Historically, the field has positioned parents as the primary safeguards for children, and existing approaches tend to engage with new interventions and technological capabilities without considering careful considerations of how design choices reflect children's agency and autonomy. But growing evidence points to the need for child-focused designs that provide children with an active, participatory role[41], and as a result, new designs are created for children to manage their own screen time[42] or navigate cyberbullying.[43] While certain technologies provide children with some choice about how their data are collected by parents and used to create restrictions on their movement or online behaviours, designers can focus more heavily on building technologies to support parenting that go beyond surveillance[44], and which also foster their children's digital resilience, self-regulation and agency.[45] Literature such as we describe above from education sciences and developmental psychology tells us that the social context plays a crucial role in shaping children's digital agency development.

Consistent with sociological approaches discussed in Consideration 2 above, research focusing on designing for preschool children has shown that their agency in digital situations can be influenced by the social structures they are embedded in and their familiarity with specific situations.[46] Studies on interventions promoting digital agency also indicate that children's experiences in different socio-technical contexts, both online and offline, could affect their perception of data ownership and their rights to control their data.[47] Purely technical approaches that do not consider the critical socio-technical context in which these technologies will be used risk rendering interventions less effective or even impeding children's development of digital resilience and agency.

Recommendation 3. *Industry can facilitate efforts of parents to engage and support their children, and regulators can encourage companies to adopt design practices that*

37 Pinquart, M., & Kauser, R. (2018). Do the associations of parenting styles with behavior problems and academic achievement vary by culture? Results from a meta-analysis. Cultural Diversity and Ethnic Minority Psychology, 24(1),

38 Kalmus, V., et al. "Who is afraid of dataveillance? Attitudes toward online surveillance in a cross-cultural and generational perspective." New Media & Society 0(0)

39 Lee, C., et al. "Ex-post evaluation of illegalizing juvenile online game after midnight: A case of shutdown policy in South Korea."

40 Wang, G., Zhao, J., Van Kleek, M., & Shadbolt, N. (2023B). "12 Ways to Empower: Designing for Children's Digital Autonomy". In Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems (pp. 1-27).

41 Wang, G., Zhao, J., Van Kleek, M., & Shadbolt, N. (2021). "Protection or Punishment? Relating the Design Space of Parental Control Apps and Perceptions About Them to Support Digital Parenting." Proceedings of the ACM on Human-Computer Interaction 5(CSCW '21): 1-26.

42 Hiniker, A., Heung, S. S., Hong, S., & Kientz, J. A. (2018). "Coco's Videos: An Empirical Investigation of Video-Player Design Features and Children's Media Use." In Proceedings of the 2018 Chi Conference on Human Factors in Computing Systems (pp. 1-13).

43 Ghosh, A. K., Hughes, C. E., & Wisniewski, P. J. (2020, April). "Circle of Trust: A New Approach to Mobile Online Safety For Families." In Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems (pp. 1-14).

44 Zhao, J., Duron, B., & Wang, G. (2022, June). "KOALA Hero: Inform Children of Privacy Risks of Mobile Apps." In Interaction Design and Children (pp. 523-528).

45 Dinsmore, B., & Pugh, A. J. (2021, June). "The Paradox of Constrained Well-being: Childhood Autonomy, Surveillance and Inequality." In Sociological Forum 36(2): 448-470.

46 Petersen, P. (2015). "«– That's how much I can do!» - Children's Agency in Digital Tablet activities in a Swedish Preschool Environment." Nordic Journal of Digital Literacy 10(3): 145-169.

47 Wang et al (2024). "CHAMPION Kids: A Proof-of-Concept System Supporting Children's Sense of Data Autonomy on Social Media." In Proceedings of CHI 2024.

will promote a digital good society. Several UK policy recommendations relevant for digital monitoring technologies focus on mitigating associated risks but are rather limited in their reach. The UK Information Commissioner's Office (ICO) recommends that digital monitoring technologies should include clear indicators for children wherever monitoring is taking place.[48] The Data Minimisation principle of the ICO Age Appropriate Design Code suggests that online services should not collect more data than what is needed to "provide the elements of your service in which a child is actively and knowingly engaged. Give children separate choices over which elements they wish to activate."[49] However, neither of these recommendations prohibit the services from collecting excessive amounts of data in order to deliver surveillance functions that are often core in digital monitoring used by parents.

We recommend that data regulators like the ICO *strengthen their existing guidelines* aimed at mitigating risks associated with technologies digitally monitoring children. This will include: 1) Strengthening data protection regulations, by explicitly prohibiting the excessive collection of children's data by parental control technologies to help safeguard children's privacy and ensure that their data are not unnecessarily harvested for surveillance purposes; 2) Implementing mechanisms for stricter oversight and enforcement of existing data protection regulations, particularly concerning the collection of children's data, including allocating resources for monitoring compliance and imposing penalties for violations; and 3) Encouraging online services to be transparent about their data collection practices in relation to parental control technologies. Technology regulation that prioritises clear and easily accessible information for parents and children about what data is being collected, how it is being used, and who has access to it, can empower families at the user interface level.

Conclusions

As parents increasingly rely on digital technologies to collect information about their children's behaviours in order to keep them safe online, and AI tools are incorporated into these technologies, the amount of information available to the parents is expected to increase exponentially. The implications for children's self-regulation, well-being, and safety are substantial, as are implications for parental well-being and the functioning of the family unit.

In this paper we advocate for policy makers in organisations such as the UK Information Commissioner's Office, Department for Science, Innovation and Technology, and Ofcom, to go beyond their focus on the risks and *consider the opportunities* digital monitoring technologies offer to support and empower children and their families. Policy makers can facilitate parents' sense of safety without disempowering children by prioritising efforts that lead to: 1) Improved understanding of how parents' use of digital monitoring technologies affects children's safety, well-being, and digital resilience both in the short and in the long-term; 2) Greater focus on the ways that individual characteristics, family and social contexts influence these outcomes; 3) Greater transparency for both children and parents as to what these technologies actually do when they are being utilised; and 4) Design of digital monitoring technologies that not only promote children's safety and top-down controls for parents, but also which consider children's rights and support their self-regulation.

We suggest that two practices need to be at the basis of policy-related activities in this space. First, we need to include children in research and policy-focused conversations. Children are the focus of digital monitoring technologies, but so far their voices are largely absent from the research and policy debate surrounding them. Experts have been calling for the establishment of children's councils to support policy makers in regulating technologies that primarily affect them.[50] It is important to include children from diverse backgrounds and that children participate not just as figureheads, but that their voices on any such councils carry weight with policy makers. Such a participatory approach ensures we design for children's rights.[51] Second, to ensure that policy is informed and underpinned by the best research, we need to attend to the *robustness of the research itself,* and the care and accuracy with which it is communicated to policy makers and the public. All research benefits from open research practices, which are increasingly common in the fields of psychology, sociology, computer science, and others.[52] These methods provide more accurate and reproducible findings to inform policy and practice.

Despite the growing ubiquity of digital monitoring technologies, UK parents still largely feel unsupported in their use[53] and children often remain unheard. New policies designed to inform parental use of tools to monitor their children digitally must balance children's safety with their autonomy and self-regulation. Ultimately, they must be able to address the key tension in this space: How do parents promote not just the short-term safety of their children, but also their children's autonomy and expression, long-term self-regulation, and well-being?

48 Information Commissioners Office (2022) "Parental Controls" in Age Appropriate Design: A Code of Practice for Online Services.

49 Information Commissioners Office. Age Appropriate Design: A Code of Practice for Online Services. (p. 7)

50 INash, V. and Felton, L. "Expert Comment: Online Safety Bill - a missed opportunity?"

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