

Understanding iPad Kids

By Sara Abbas
Art by Maya Meux

General Editor: Jam Stebbins | Graduate Scientific Reviewer: Sophia Holmqvist |
Lay Reviewer: Tamai Mulbah | Scientific Reviewer: Manav Dasondi



There is an emerging trend among young people today – in the corners of restaurants, the seats of airport gates, and the homes of families, a dim blue light shining on the faces of “iPad kids”. The term “iPad kids” has been used to describe a new generation of mobile device users, most of whom use tablets or iPads over other devices such as laptops. These children are often seen in public with their eyes glazed over and glued to the screen of their mobile devices. The internet, once an exciting break from reality confined to a personal computer in the family room, has slowly escaped and found its way into the hands of individuals. Prolonged internet usage has been associated with sleep disturbance, anxiety, depression, and attention deficit disorder in adults [1, 2]. However, since mobile device usage of this magnitude is unprecedented among children, the effects of extended screen time on neurodevelopment and behavior are not well known. The question then is: why and how do kids use these mobile devices, and what exactly are the implications of extended screen time on children and their cognitive and social development?

Screen time generally refers to the time spent using electronic devices, including televisions, smartphones, tablets, and computers. The American Academy of Child and Adolescent Psychiatry (AACAP) recommends that children under the age of two only have screen time when watching educational programming with a parent or guardian and that children ages two to five limit non-educational screen time to one hour on weekdays or three hours on weekends. However, for ages six and above, the AACAP provides no recommended screen time. Their only guidance is to limit device usage and encourage healthy habits [3]. Other guidelines, such as from OSF Healthcare, recommend no more than two hours per day for children five and up [4]. However, considering any of those guidelines, the data on how much actual screen time children engage in is alarming. Before the COVID-19 pandemic, the average amount of time on screens for ages 6 to 12 was 2.6 hours per day. During the pandemic, average screen time increased to a whopping 5.9 hours per day [5]. Heightened parental anxiety and stress during the pandemic were directly correlated with increased screen time for their children [5]. Parents who reported feeling stressed explicitly stated that they would give their children more screen time to compensate [5]. Results also showed that lower household income was associated with greater screen time in children [5]. Parental stress during the pandemic led to leniency in screen time usage for their children, but there is a dearth of data on how children use their mobile devices. In one study of preschool-aged children, results showed that across both IOS



and Android users, the most used applications, not including the internet browser or Siri, were YouTube, YouTube Kids, and video streaming applications [6].

Screen time amongst children has dramatically increased and parents are allowing this in order to alleviate stress, but how is this affecting children’s functioning? A behavior analysis study examined differences across sex of children ages seven to ten who played video and mobile games [7]. The results showed that children who spent more time playing video games, whether that be on computers, tablets, cell phones, or gaming consoles, exhibited attention issues as well as impulsive behavior [7]. Of the male participants, 43.75% experienced severe difficulty in following directions, maintaining focus, and staying still [7]. Interestingly, only 3.75% of female participants experienced the same level of attention/hyperactive behavior [7]. Another

“

By pushing for the use of educational and skill-based applications, as well as enforcing recommended screen times, the detrimental effects of children's technology use could be significantly reduced.

”

study reported that excessive mobile media use in children may interfere with executive functioning activities such as task completion, impulse control, emotional regulation, and cognitive flexibility [8]. Increased screen time may result in a variety of behavioral outcomes depending on the type of content consumed and when screen time is introduced to a child [8]. For example, decreased sleep quality due to increased screen time has been linked to depression and suicide [8]. ADHD-like behavior has been found to be related to sleep problems as well as screen time and fast-paced content [8]. On the other hand, a decrease in prosocial behavior has been linked to early and prolonged exposure to violent content [8]. MRI studies using diffusion tensor imaging (DTI), a technique that measures water molecule diffusion and directionality, saw that high screen time was correlated with low fractional anisotropy (FA) and high radial diffusivity (RD) in neuronal tracks that support language skills, literacy skills, semantic processing, emotional integration, and incorporation of visual imagery [9]. Within this study, FA was associated with white matter organization and RD was associated with degree of myelination. In regions of the brain associated with language, specifically the arcuate fasciculus, participants with elevated screen times showed low FA and high RD values [9]. This was also seen in regions associated with literacy, emotional integration, and visual imagery incorporation [9]. Although the study was not conclusive, these findings along with the cognitive assessments administered to the study participants suggest a link between increased screen time and lower proficiency in these cognitive processes [9].

Increased mobile device usage is associated with impaired executive functioning, attentional deficits, and psychiatric symptoms such as depression. The relationships between mobile device usage and cognitive deficits/psychopathology can be supported further by examining neural correlates of these deficits. A cross-sectional study of 47 pre-kindergarten children whose screen time was beyond the AAP guidelines revealed reduced neuron density and structure in brain regions supporting language and literacy skills when compared to children with screen time that did follow guidelines [9]. Here, structure specifically refers to the bundling and packing of neurons in certain areas. Myelination, an aspect of structure, refers to the lipid-protein layer that coats the axons of neurons and serves the purpose of accelerating neuronal signaling. In other words, the findings showed that children who had excessive screen time exhibited reduced nerve fiber size and lower cognitive assessment scores [8]. An electroencephalography (EEG) study of 437 children conducted over the course of nine years demonstrated that those who had higher screen time exhibited greater altered cortical activity before the age of two years old [10]. An EEG records the electrical activity of the brain, and this review looked at the theta and beta waves or rhythms. Theta waves are strongly believed to be related to behavior, and beta waves are associated with muscle movement and anxious thinking. Children with higher screen time showed a higher ratio of theta to beta waves, which indicates altered neuronal activity [11, 12, 13].



Excessive screen time is clearly associated with changes in behavior, microstructural changes in the brain, and altered cortical activity. However, these changes are not necessarily negative. There may be beneficial effects of appropriate mobile device use on the neural and social development of children. Using educational apps reinforces learning in early childhood, and may be a tool to teach complex social concepts such as racial and ethnic tolerance, empathy, and other interpersonal skills [8]. One study found that when children were given access to a tablet with drawing apps, they showed increased proficiency in the skill [14]. In 2011, a teacher named James Harmon analyzed the results of the Ohio Graduation Test, a standardized exam administered to 8th graders, and found that students with tablets had a 6% greater chance of passing the reading portion and an 8% greater chance of passing the writing portion of the exam compared to students with no tablets [15]. These findings suggest that there may be benefits to allowing children controlled access to tablets. However, these findings do not negate the negative consequences associated with excessive screen time.

It is abundantly clear that giving children unlimited access to screens via mobile devices has detrimental effects on both cognitive and social development. Cognitively, changes in the structural organization of the cortex, neuronal volume loss, and changes in electrical activity have been documented in children with excessive screen time, and possible social outcomes range from ADHD-like behavior to depression. The amount that children use screens needs to change, but this technology is not going away any time soon. By pushing for the use of educational and skill-based applications, as well as enforcing recommended screen times, the detrimental effects of children's technology use could be significantly reduced. 🧠

UNDERSTANDING IPAD KIDS

1. Pandya, A., & Lodha, P. (2021). Social connectedness, excessive screen time during COVID-19 and Mental Health: A review of Current evidence. *Frontiers in Human Dynamics*, 3. <https://doi.org/10.3389/fhumd.2021.684137>
2. Oberle, E., Ji, X. R., Kerai, S., Guhn, M., Schonert-Reichl, K. A., & Gadermann, A. M. (2020). Screen time and extracurricular activities as risk and protective factors for mental health in adolescence: A population-level study. *Preventive medicine*, 141, 106291. <https://doi.org/10.1016/j.ypmed.2020.106291>
3. Screen time and children. (n.d.). https://www.aacap.org/AACAP/Families_and_Youth/Facts_for_Families/FFF-Guide/Children-And-Watching-TV-054.aspx
4. Legner, L. (2021, December 6). Kids' screen time: How much is too much? OSF HealthCare Blog. <https://www.osfhealth-care.org/blog/kids-screen-time-how-much-is-too-much/>
5. Seguin, D., Kuenzel, E., Morton, J. B., & Duerden, E. G. (2021). School's out: Parenting stress and screen time use in school-age children during the COVID-19 pandemic. *Journal of affective disorders reports*, 6, 100217. <https://doi.org/10.1016/j.jadr.2021.100217>
6. Radesky, J., Weeks, H. M., Ball, R., Schaller, A., Yeo, S., Durnez, J., Tamayo-Rios, M., Epstein, M., Kirkorian, H. L., Coyne, S. M., & Barr, R. (2020). Young children's use of smartphones and tablets. *Pediatrics*, 146(1). <https://doi.org/10.1542/peds.2019-3518>
7. Singh, P., Mujawar, N., Moharkar, R., & Kaur, H. (2016). Effect of video and mobile games on children's behavior. *Indian Journal of Health and Wellbeing*, 7(5), 488- 492.
8. Kılıç, A.O., Sari, E., Yucel, H. et al. Exposure to and use of mobile devices in children aged 1–60 months. *Eur J Pediatr* 178, 221–227 (2019). <https://doi.org/10.1007/s00431-018-3284-x>
9. Hutton, J. S., Dudley, J., Horowitz-Kraus, T., DeWitt, T., & Holland, S. K. (2020). Associations Between Screen-Based Media Use and Brain White Matter Integrity in Preschool-Aged Children. *JAMA pediatrics*, 174(1), e193869. <https://doi.org/10.1001/jamapediatrics.2019.3869>
10. Law, E. C., Han, M. X., Lai, Z., Lim, S., Ong, Z. Y., Ng, V., Gabard-Durnam, L. J., Wilkinson, C. L., Levin, A. R., Rifkin-Graboi, A., Daniel, L. M., Gluckman, P. D., Chong, Y. S., Meaney, M. J., & Nelson, C. A. (2023). Associations Between Infant Screen Use, Electroencephalography Markers, and Cognitive Outcomes. *JAMA pediatrics*, 177(3), 311–318. <https://doi.org/10.1001/jamapediatrics.2022.5674>
11. Orekhova, E. V., Stroganova, T. A., Posikera, I. N., & Elam, M.

(2006). EEG theta rhythm in infants and preschool children. *Clinical neurophysiology : official journal of the International Federation of Clinical Neurophysiology*, 117(5), 1047–1062. <https://doi.org/10.1016/j.clinph.2005.12.027>

12. Baker S. N. (2007). Oscillatory interactions between sensorimotor cortex and the periphery. *Current opinion in neurobiology*, 17(6), 649–655. <https://doi.org/10.1016/j.conb.2008.01.007>
13. Baumeister, J., Barthel, T., Geiss, K. R., & Weiss, M. (2008). Influence of phosphatidylserine on cognitive performance and cortical activity after induced stress. *Nutritional Neuroscience*, 11(3), 103–110. <https://doi.org/10.1179/147683008X301478>
14. Yadav, S., & Chakraborty, P. (2017). Children aged two to four are able to scribble and draw using a smartphone app. *Acta paediatrica (Oslo, Norway : 1992)*, 106(6), 991–994. <https://doi.org/10.1111/apa.13818>
15. Pierce, M. (2011). iPads Make Better Readers, Writers. *The Journal: Technological Horizons in Education*. <https://the-journal.com/articles/2011/09/06/ipads-make-better-readers-writers.aspx>

YOUR BRAIN AFTER A “BOO!”: THE NEUROSCIENCE BEHIND HORROR FILMS

1. Movieclips (Director). (2011, May 27). The Shower—Psycho (5/12) Movie CLIP (1960) HD. <https://www.youtube.com/watch?v=0WtDmbr9xyY>
2. Hasson, U., Landesman, O., Knappmeyer, B., Vallines, I., Rubin, N., & Heeger, D. J. (2008). Neurocinematics: The neuroscience of film. *Projections*, 2(1), 1–26. <https://doi.org/10.3167/proj.2008.020102>
3. Gore, J. C. (2003). Principles and practice of functional MRI of the human brain. *Journal of Clinical Investigation*, 112(1), 4–9. <https://doi.org/10.1172/JCI200319010>
4. Zaki, J., & Ochsner, K. (2009). The need for a cognitive neuroscience of naturalistic social cognition. *Annals of the New York Academy of Sciences*, 1167(1), 16–30. <https://doi.org/10.1111/j.1749-6632.2009.04601.x>
5. Naser Moghadasi, A. (2015). Neurocinema: A brief overview. *Iranian Journal of Neurology*, 14(3), 180–184.
6. AbuHasan, Q., Reddy, V., & Siddiqui, W. (2024). Neuroanatomy, Amygdala. In *StatPearls*. StatPearls Publishing. <http://www.ncbi.nlm.nih.gov/books/NBK537102/>
7. Nummenmaa, L. (2021). Psychology and neurobiology of horror movies. OSF. <https://doi.org/10.31234/osf.io/b8tgs>