

a Therapist

City or Zip



Victor Men

Find a Therapist

Topics

Get Help

Magazine

Tests

Ex

# Gray Matters: Too Much Screen Time Damages the Brain

Neuroimaging research shows excessive screen time damages the brain.

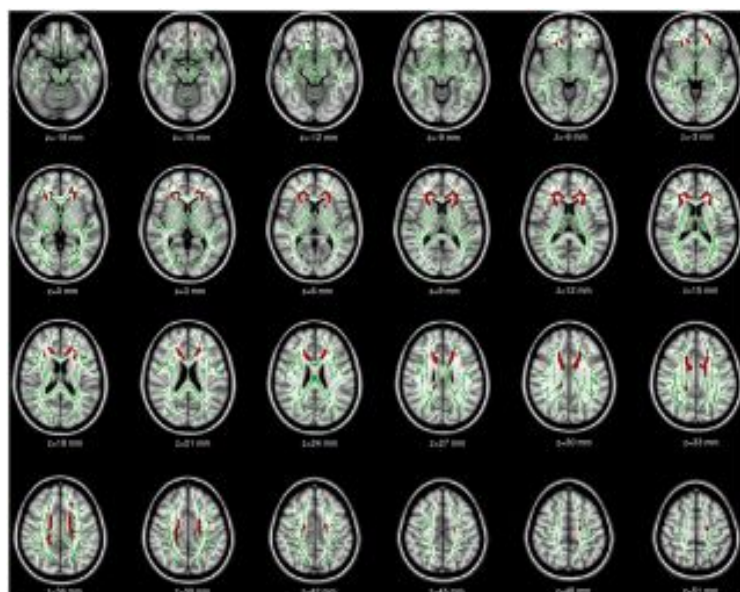
Posted Feb 27, 2014

[SHARE](#)

[TWEET](#)

[EMAIL](#)

[MORE](#)



Source: Lin, Zhou,Lei, et al., used with permission. Red areas designate abnormal white matter in internet addicted teens

***“Taken together, [studies show] internet addiction***

***(<https://www.psychologytoday.com/basics/addiction>) is associated with structural and functional changes in brain regions involving emotional processing, executive attention, decision making***

***(<https://www.psychologytoday.com/basics/decision-making>), and cognitive***

***(<https://www.psychologytoday.com/basics/cognition>) control.” --research authors summarizing neuro-imaging findings in internet and gaming addiction (Lin & Zhou et al, 2012)***

But what about kids who aren't "addicted" per se?

Addiction aside, a much broader concern that begs awareness is the risk that screen time is creating subtle damage even in children with “regular” exposure, considering that the average child clocks in more than seven hours a day ([Rideout 2010 \(http://kff.org/other/poll-finding/report-generation-m2-media-in-the-lives/\)](http://kff.org/other/poll-finding/report-generation-m2-media-in-the-lives/)). As a practitioner, I observe that many of the children I see suffer from sensory overload, lack of restorative sleep (<https://www.psychologytoday.com/basics/sleep>), and a hyperaroused nervous system, regardless of

~~an~~ ~~ion—much like the description in the quote above describing damage seen in scans.~~

Although many parents (<https://www.psychologytoday.com/basics/parenting>) have a nagging sense that they should do more to limit screen-time, they often question whether there's enough evidence to justify yanking coveted devices, rationalize that it's "part of our kids' culture," or worry that others—such as a spouse—will undermine their efforts. Digest the information below, even though it might feel uncomfortable, and arm yourself with the truth about the potential damage screen time is capable of imparting—particularly in a young, still-developing brain.

### Brain scan research findings in screen addiction:

**Gray matter atrophy:** Multiple studies have shown atrophy (shrinkage or loss of tissue volume) in gray matter areas (where "processing" occurs) in internet/gaming addiction ([Zhou 2011](#) (<http://www.ejradiology.com/article/S0720-048X%2809%2900589-0/abstract>), [Yuan 2011](#) (<http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0020708>), [Weng 2013](#) (<http://www.ejradiology.com/article/S0720-048X%2813%2900073-9/abstract>), and [Weng 2012](#) (<http://www.ncbi.nlm.nih.gov/pubmed/23328472>)). Areas affected included the important frontal lobe, which governs executive functions, such as planning, prioritizing, organizing, and [impulse control](#) (<https://www.psychologytoday.com/basics/self-control>) ("getting stuff done"). Volume loss was also seen in the striatum, which is involved in reward pathways and the suppression of socially unacceptable impulses. A finding of particular concern was damage to an area known as the *insula*, which is involved in our capacity to develop [empathy](#) (<https://www.psychologytoday.com/basics/empathy>) and compassion for others and our ability to integrate physical signals with emotion. Aside from the obvious link to violent behavior, these skills dictate the depth and quality of personal relationships.

**Compromised white matter integrity:** Research has also demonstrated loss of integrity to the brain's white matter ([Lin 2012](#) (<http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0030253>), [Yuan 2011](#) (<http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0020708>), [Hong 2013](#) (<http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0057831>) and [Weng 2013](#) (<http://www.ejradiology.com/article/S0720-048X%2813%2900073-9/abstract>)). "Spotty" white matter translates into loss of communication within the brain, including connections to and from various lobes of the same hemisphere, links between the right and left hemispheres, and paths between higher (cognitive) and lower (emotional and survival) brain centers. White matter also connects networks from the brain to the body and vice versa. Interrupted connections may slow down signals, "short-circuit" them, or cause them to be erratic ("misfire").

addicted teen boys (<http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0053055>), and Yuan et al found reduced cortical thickness in the frontal lobe of online gaming addicts (late adolescent males and females) correlated with impairment of a cognitive task (Yuan 2013 (<http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0053055>)).

**Impaired cognitive functioning:** Imaging studies have found less efficient information processing and reduced impulse inhibition (Dong & Devito 2013 (<http://www.psyn-journal.com/article/S0925-4927%2812%2900029-7/abstract>)), increased sensitivity to rewards and insensitivity to loss (Dong & Devito 2013 (<http://www.sciencedirect.com/science/article/pii/S0278584613001486>)), and abnormal spontaneous brain activity associated with poor task performance (Yuan 2011 (<https://www.landesbioscience.com/journals/cib/article/17871/>)).

**Cravings and impaired dopamine function:** Research on video games have shown dopamine (implicated in reward processing and addiction) is released during gaming (Koepp 1998 (<http://www.nature.com/nature/journal/v393/n6682/full/393266a0.html>) and Kuhn 2011 (<http://www.nature.com/tp/journal/v1/n11/full/tp201153a.html>)) and that craving or urges for gaming produces brain changes that are similar to drug cravings (Ko 2009 (<http://www.journalofpsychiatricresearch.com/article/S0022-3956%2808%2900229-X/abstract>), Han 2011 (<http://linkinghub.elsevier.com/retrieve/pii/S0010440X10000374>)). Other findings in internet addiction include reduced numbers of dopamine receptors and transporters (Kim 2011 (<http://www.ncbi.nlm.nih.gov/pubmed/21499141>) and Hou 2012 (<http://www.hindawi.com/journals/bmri/2012/854524/>)).

In short, excessive screen-time appears to impair brain structure and function. Much of the damage occurs in the brain's frontal lobe, which undergoes massive changes from puberty until the mid-twenties. Frontal lobe development, in turn, largely determines success in every area of life—from sense of well-being to academic or career (<https://www.psychologytoday.com/basics/career>) success to relationship skills. Use this research to strengthen your own parental position on screen [management](https://www.psychologytoday.com/basics/leadership) (<https://www.psychologytoday.com/basics/leadership>), and to convince others to do the same.

For more help on managing screen-time, visit [www.drdunckley.com/videogames/](http://www.drdunckley.com/videogames/) (<http://www.drdunckley.com/videogames/>) For more information on how the physiological effects of electronics translate into symptoms and dysfunction--as well as how to reverse such changes--see my new book, **Reset Your Child's Brain.** (<http://amzn.to/1FEBEOM>)

## References:

(S) ~~A Functional Magnetic Resonance Imaging Study.~~ *Psychiatry Research* 203, no. 2–3: 153–158. doi:10.1016/j.psychresns.2012.02.001.

Dong, Guangheng, Yanbo Hu, and Xiao Lin. “Reward/Punishment (<https://www.psychologytoday.com/basics/punishment>) Sensitivities Among Internet Addicts: Implications for Their Addictive Behaviors.” *Progress in Neuro-Psychopharmacology* (<https://www.psychologytoday.com/basics/psychopharmacology>) & *Biological Psychiatry* 46 (October 2013): 139–145. doi:10.1016/j.pnpbp.2013.07.007.

Han, Doug Hyun, Nicolas Bolo, Melissa A. Daniels, Lynn Arenella, In Kyoony Lyoo, and Perry F. Renshaw. “Brain Activity and Desire for Internet Video Game Play.” *Comprehensive Psychiatry* 52, no. 1 (January 2011): 88–95. doi:10.1016/j.comppsy.2010.04.004.

Hong, Soon-Beom, Jae-Won Kim, Eun-Jung Choi, Ho-Hyun Kim, Jeong-Eun Suh, Chang-Dai Kim, Paul Klauser, et al. “Reduced Orbitofrontal Cortical Thickness in Male Adolescents with Internet Addiction.” *Behavioral and Brain Functions* 9, no. 1 (2013): 11. doi:10.1186/1744-9081-9-11.

Hong, Soon-Beom, Andrew Zalesky, Luca Cocchi, Alex Fornito, Eun-Jung Choi, Ho-Hyun Kim, Jeong-Eun Suh, Chang-Dai Kim, Jae-Won Kim, and Soon-Hyung Yi. “Decreased Functional Brain Connectivity in Adolescents with Internet Addiction.” Edited by Xi-Nian Zuo. *PLoS ONE* 8, no. 2 (February 25, 2013): e57831. doi:10.1371/journal.pone.0057831.

Hou, Haifeng, Shaowe Jia, Shu Hu, Rong Fan, Wen Sun, Taotao Sun, and Hong Zhang. “Reduced Striatal Dopamine Transporters in People with Internet Addiction Disorder.” *Journal of Biomedicine & Biotechnology* 2012 (2012): 854524. doi:10.1155/2012/854524.

Kim, Sang Hee, Sang-Hyun Baik, Chang Soo Park, Su Jin Kim, Sung Won Choi, and Sang Eun Kim. “Reduced Striatal Dopamine D2 Receptors in People with Internet Addiction.” *Neuroreport* 22, no. 8 (June 11, 2011): 407–411. doi:10.1097/WNR.0b013e328346e16e.

Ko, Chih-Hung, Gin-Chung Liu, Sigmund Hsiao, Ju-Yu Yen, Ming-Jen Yang, Wei-Chen Lin, Cheng-Fang Yen, and Cheng-Sheng Chen. “Brain Activities Associated with Gaming Urge of Online Gaming Addiction.” *Journal of Psychiatric* (<https://www.psychologytoday.com/basics/psychiatry>) *Research* 43, no. 7 (April 2009): 739–747. doi:10.1016/j.jpsychires.2008.09.012.

Kühn, S, A Romanowski, C Schilling, R Lorenz, C Mörsen, N Seiferth, T Banaschewski, et al. “The Neural (<https://www.psychologytoday.com/basics/neuroscience>) Basis of Video Gaming.” *Translational Psychiatry* 1 (2011): e53. doi:10.1038/tp.2011.53.

adolescents with Internet Addiction Disorder: A Tract-Based Spatial Statistics Study. *PLoS ONE* 8, no. 1 (January 9, 2013): e530253. doi:10.1371/journal.pone.0030253.

Rideout, Victoria J., Ulla G. Foehr, and Donald F. Roberts. "Generation M2: Media in the Lives of 8- to 18-Year Olds." *Kaiser Family Foundation Study* (2010). <http://kff.org/other/poll-finding/report-generation-m2-media-in-the-lives/> (<http://kff.org/other/poll-finding/report-generation-m2-media-in-the-lives/>).

Weng, Chuan-Bo, Ruo-Bing Qian, Xian-Ming Fu, Bin Lin, Xiao-Peng Han, Chao-Shi Niu, and Ye-Han Wang. "Gray Matter and White Matter Abnormalities in Online Game Addiction." *European Journal of Radiology* 82, no. 8 (August 2013): 1308–1312. doi:10.1016/j.ejrad.2013.01.031.

Yuan, Kai, Ping Cheng, Tao Dong, Yanzhi Bi, Lihong Xing, Dahua Yu, Limei Zhao, et al. "Cortical Thickness Abnormalities in Late Adolescence (<https://www.psychologytoday.com/basics/adolescence>) with Online Gaming Addiction." Edited by Bogdan Draganski. *PLoS ONE* 8, no. 1 (January 9, 2013): e53055. doi:10.1371/journal.pone.0053055.

Yuan, Kai, Chenwang Jin, Ping Cheng, Xuejuan Yang, Tao Dong, Yanzhi Bi, Lihong Xing, et al. "Amplitude of Low Frequency Fluctuation Abnormalities in Adolescents with Online Gaming Addiction." Edited by Krish Sathian. *PLoS ONE* 8, no. 11 (November 4, 2013): e78708. doi:10.1371/journal.pone.0078708.

Yuan, Kai, Wei Qin, Guihong Wang, Fang Zeng, Liyan Zhao, Xuejuan Yang, Peng Liu, et al. "Microstructure Abnormalities in Adolescents with Internet Addiction Disorder." Edited by Shaolin Yang. *PLoS ONE* 6, no. 6 (June 3, 2011): e20708. doi:10.1371/journal.pone.0020708.

Zhou, Yan, Fu-Chun Lin, Ya-Song Du, Ling-di Qin, Zhi-Min Zhao, Jian-Rong Xu, and Hao Lei. "Gray Matter Abnormalities in Internet Addiction: A Voxel-Based Morphometry Study." *European Journal of Radiology* 79, no. 1 (July 2011): 92–95. doi:10.1016/j.ejrad.2009.10.025.

[SHARE](#)

[TWEET](#)

[EMAIL](#)

[MORE](#)

79 COMMENTS 

[app\\_id=22058004181138](#) [text=Gray%20Matters%3](#) [7?](#)  
[4&display=page&href=htt](#) [A%20Too%20Much%20](#) [destination=node/144987](#)  
[ps%3A/www.psychology](#) [Screen%20Time%20Da](#)  
[today.com/blog/mental](#) [of Reset Your Child's Brain and](#)  
[wealth/201402/gray-](#) [%20%20%7C%20Psych](#)

Victoria L. Dunckley, M.D. is an integrative child, adolescent and adult psychiatrist, the author of *Reset Your Child's Brain*, and an expert on the effects of screen-time on the developing nervous system.