

DIGITAL COGNITION AND
DEMOCRACY INITIATIVE

DIGITAL TOOLS, COGNITION, AND DEMOCRACY

A REVIEW OF THE LITERATURE

THE DIGITAL COGNITION AND
DEMOCRACY INITIATIVE

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About the Digital Cognition and Democracy Initiative

Digital technology has become a fixture in everyday life. The digital technology landscape has dramatically shifted, catering to individualized neurochemical reinforcement. Information mediation is now fast-paced, high-volume, low-friction, and extra-sensorial, garnering increasing concern about the impacts digital ubiquity is having on democracy.

Documented risks to the individual include impacts on mental health, particularly among young people; the proliferation of false information; and an overreliance on outsourced information. Impacts at the individual level cumulatively manifest in societal level concerns, such as affective polarization—defined as the tendency to distrust people from the opposite end of the political spectrum—and risks to public health as a consequence of disinformation campaigns. While digital technologies are not the sole cause of these concerns, the role they play is significant. A sound ability to update one's beliefs and to engage in constructive discourse are key elements of civic engagement and therefore healthy democracy. These skills rely on a concert of cognitive processes that are now influenced by rapid and extensive technology proliferation. The urgency of exploring this problem has grown as the risks to individual and societal well-being have become more evident.

This literature review supports a series examining the effects digital technologies have on the following cognitive processes: ["Memory,"](#) ["Attention,"](#) and ["Reasoning."](#) The broader report series includes three additional papers looking at some of the society-level cognitive and democratic impacts of technology, titled: ["Modulating Trust,"](#) ["Shortcutting Critical Thinking,"](#) and ["Exploiting Emotions."](#) We have also compiled a capstone report, ["Rewired: How Digital Technologies Shape Cognition."](#)

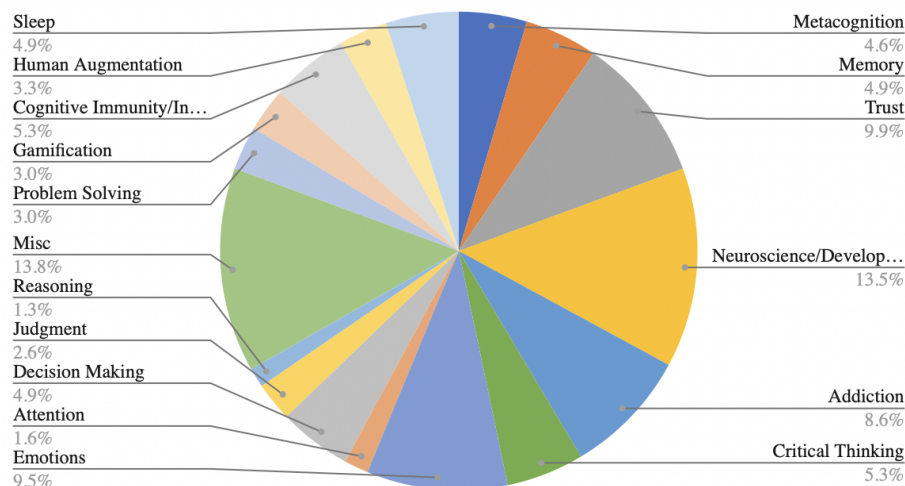
A note on methods

The DCDI team built out this literature review to help clarify our goals for and approach to this project. This review is not an exhaustive summary of the entire catalog of cognitive science; rather, it is a selection of the research most relevant to the DCDI effort. It includes peer reviewed articles published in academic and scientific journals, conference papers, reports, press releases, expert commentaries, and books. Although this literature review focuses primarily on work published over the past 15 years, it also includes older materials where necessary to build a foundational understanding of the subject matter. Our earliest source was published in 1977, while the most recent is from 2022. This report also only covers research published in English.

The Literature on Digital Tools, Cognition, and Democracy

For the purpose of the project, the DCDI team divided existing research into the following fourteen buckets: Neuroscience/Development, Attention, Memory, Problem Solving, Decision Making, Emotions, Trust, Critical Thinking, Metacognition, Addiction, Gamifying of Serious Subjects, Cognitive Immunity/Inoculation, Human Augmentation, and Sleep. There is an additional “Miscellaneous” section for research that does not fall into a specific category. The chart below depicts the share of each of these categories. The largest segments include neuroscience and neurological development; digital technologies and trust; addiction and problematic technology use; and the interplay between emotions and digital technologies.

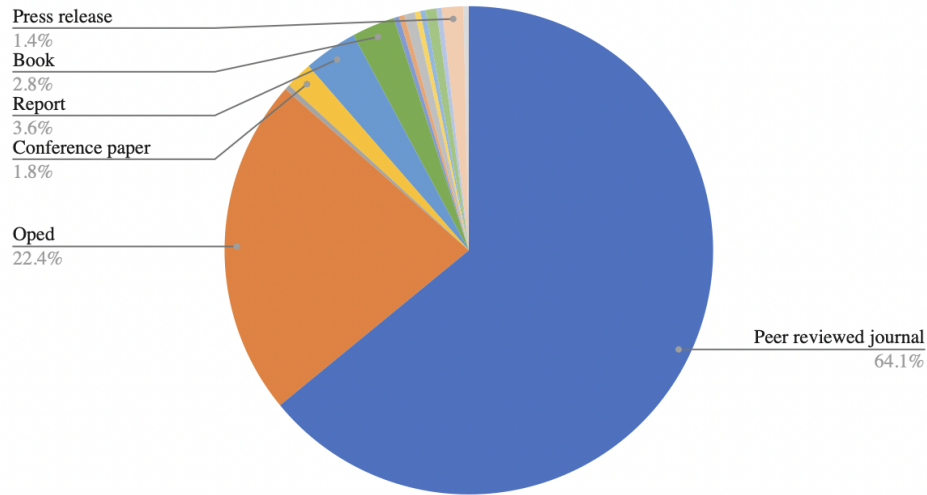
Research Theme



Publication Types

Of the literature reviewed, 64.1% originates from peer-reviewed sources, while the remaining 35.9% came from expert commentaries (22.4%), reports (3.6%), books (2.8%), conference papers (1.8%), and press releases (1.4%).

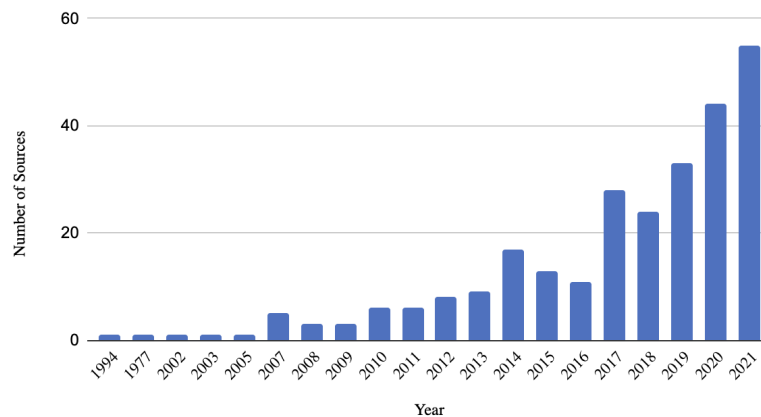
Publication Type



Publication Trends

This chart, displaying the amount of literature we analyzed, demonstrates an upward trend, with a dramatic increase in 2007, and again in 2017. Since 2017, the number of publications per year has more than doubled, with 2021 showing the greatest number of publications to date at 37.

Publications by Year

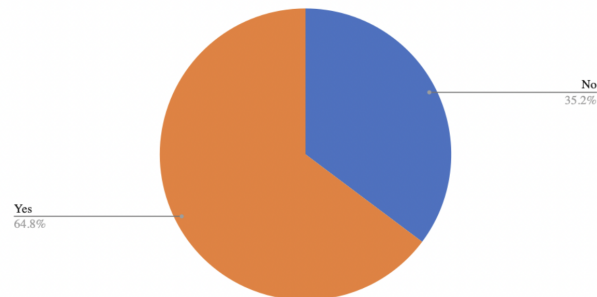


Establishing a Relationship

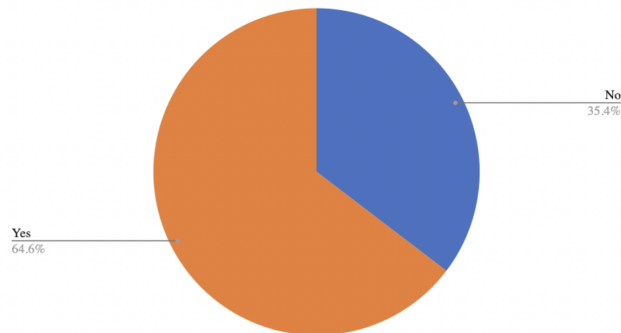
With this data, it is possible to point to trends in the research. To appropriately highlight the percentage of sources that indicated a degree of causation between technology and impacts on human cognition, we first identified the percentage of our literature that specifically discussed

this interaction, followed by the literature that specifically indicates that there is in fact a relationship. 62.6% of the sources explicitly discussed the relationship between technology and human cognition. Of the sources that specifically discussed the relationship between technology and human cognition, nearly all indicated that technology is affecting cognition in some way. The remaining 37.4% served a number of other purposes, including providing context for, and information on, human cognitive processes, specific technologies, and democracy at large.

Does the source discuss the relationship between technology and cognition?



Does the source say that technology is affecting cognition?

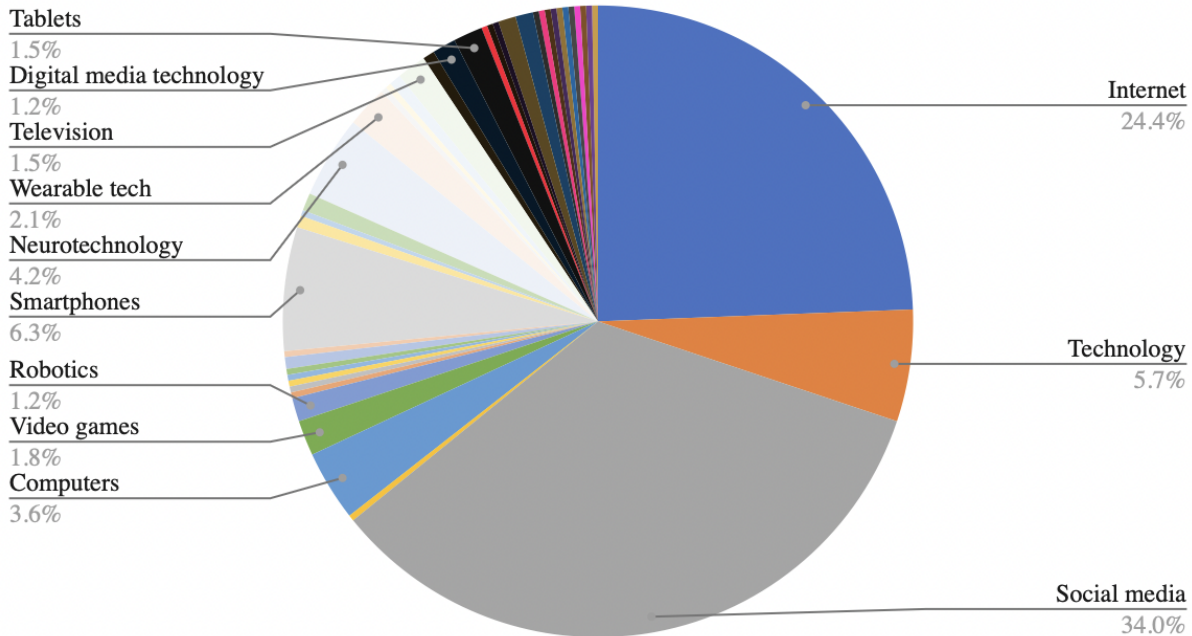


Technology

It is common that conversations around technology and cognition focus largely on social media. However, the literature reviewed here explores the impacts of a range of technologies on human cognition. Forty-one different types of technology were mentioned at least once in the literature review, alongside technology generally. While social media remains a focal point, it makes up

just over a third of the discussion, with the Internet as a close second.

Count of Technologies Discussed

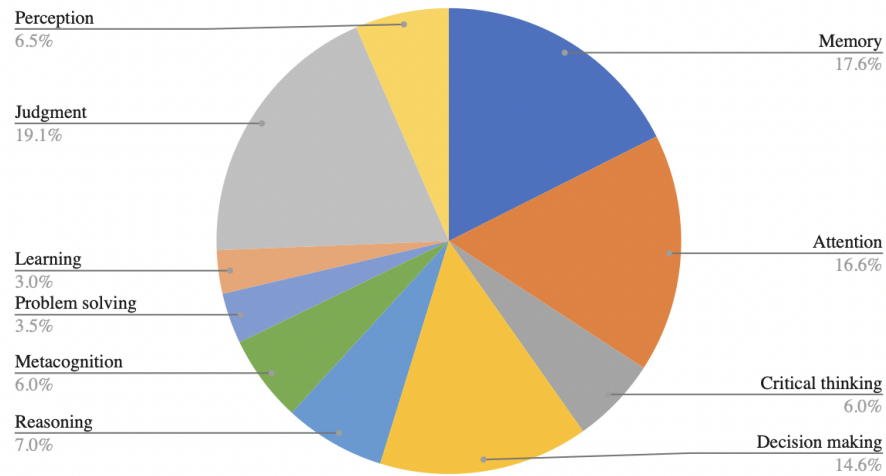


The above chart depicts the 12 most commonly mentioned technologies in the literature reviewed. Additional mentions of the following technologies occurred at least once in our research: artificial intelligence; algorithms; apps; assistive technology; automation; brain-to-cloud interfaces; brain-to-brain interfaces; communication technologies; digital devices; digital spaces; digital systems; digital technologies; digital tools; e-commerce; e-services; interactive technologies; Internet technologies; mobile computing; mobile devices; magnetic resonance imaging (MRI); nanotechnology; new media technologies; new technology; organizational pervasive technologies; spirit tech; supercomputers; telecommunications networks; Web2.0; Web3.0; and Web-based technology.

Cognitive Processes and Effects

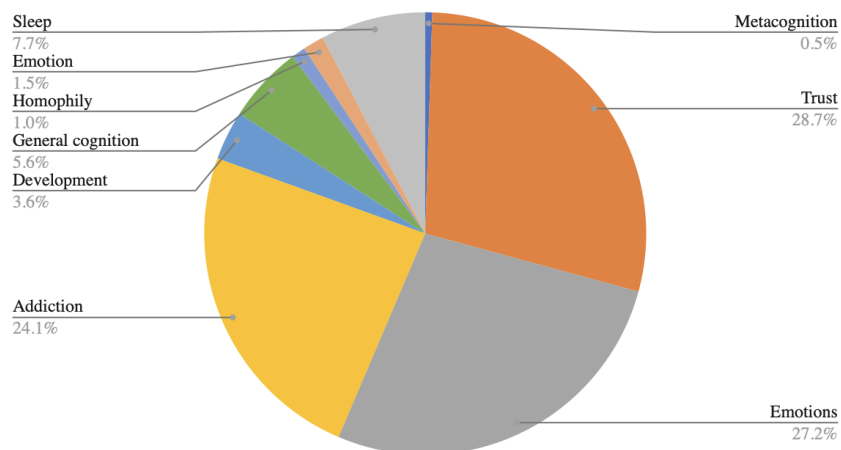
Finally, we established trends around cognitive processes and secondary effects found in the literature. While not every source we analyzed mentioned a specific cognitive process, the literature indicates that technology affects a wide range of cognitive processes, especially attention, judgment, memory, and decision making.

Publications by Cognitive Process



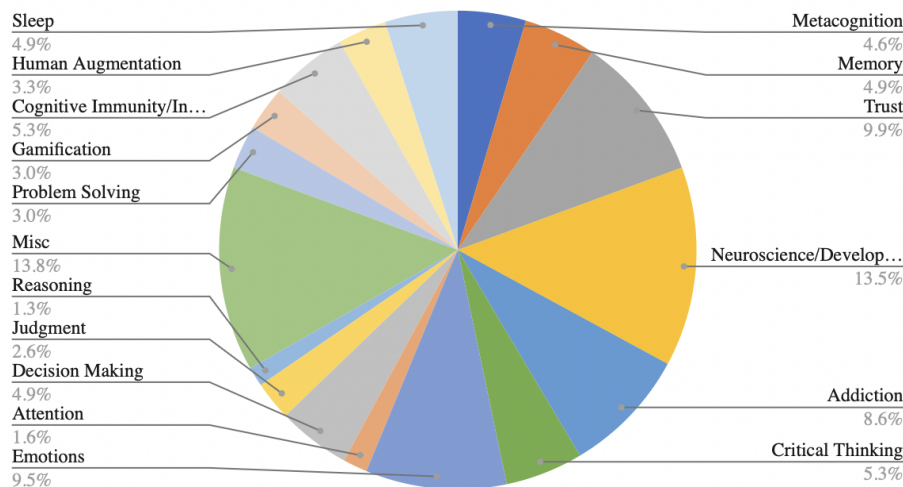
The literature also highlighted a number of cognitive effects (separate from the cognitive processes) that are influenced by technology. Of primary concern in the literature are technology's effects on trust, emotions, and the potential for addiction.

Publication by Cognitive Effect



The Themes in Review

Research Theme



Neuroscience and Cognitive Development

Research on technologies' effects on cognitive development reaches a number of disparate conclusions. Some studies indicate that interactive media like video games can require skills associated with attention and processing gains.¹ Other studies suggest that "addictive use of the Internet is linked to functional brain changes involving parts of the prefrontal cortex, accompanied by changes in other cortical (e.g., temporal) and subcortical (e.g., ventral striatum) regions."² Not all the studies indicated a negative relationship. In "Media Use and Brain Development During Adolescence," the authors point to evidence that "the density of grey matter volume in the amygdala, a structure associated with emotional processing" can be attributed to both online and offline large social networks.³ Further, there is mixed evidence about the effects of screen time on children.⁴ Overall, the sources indicated a need to be cautious about avoiding bias and instantly branding technology as a negative for brain development, though the literature indicated that there was sufficient evidence of concern, and that further research is critically

¹ Daniel R. Anderson and Kaveri Subrahmanyam, "Digital Screen Media and Cognitive Development," *Pediatrics* 140, no. Supplement_2 (2017): S57-S61, <https://doi.org/10.1542/peds.2016-1758C>.

² Mattias Brand et al., "Prefrontal Control and Internet Addiction: A Theoretical Model and Review of Neuropsychological and Neuroimaging Findings," *Frontiers in Human Neuroscience* (2014): 375, <https://doi.org/10.3389/fnhum.2014.00375>

³ Eveline A. Crone and Elly A. Konijn, "Media Use and Brain Development During Adolescence," *Nat Commun* 9, no. 588 (2018), <https://doi.org/10.1038/s41467-018-03126-x>.

⁴ Daniel R. Anderson and Kaveri Subrahmanyam, "Digital Screen Media and Cognitive Development," *Pediatrics* 140, no. Supplement_2 (2017): S57-S61, <https://doi.org/10.1542/peds.2016-1758C>

necessary.⁵ Francesca Gottschalk clearly states the challenges of researching the connection between digital systems and cognition:

"Some of the main challenges in the available research... include: Lack of quality research and coherence across research – reanalysis of the same datasets has produced very different results, or results are contested. Reliability of brain science for understanding behavioral issues – challenges in identifying functional relevance of morphological differences/activation patterns; limitations in imaging such as fMRI. Study design issues – reliance on self-report data, small sample sizes and results infer correlation not causation. Chicken and egg dilemma – e.g. do behavioural tendencies/problems predict more screen time, or does screen time predict behavioural tendencies/problems?"⁶

– Francesca Gottschalk, "Impacts of Technology Use on Children: Exploring Literature on the Brain, Cognition, and Well-Being."

It is also worth noting that there is a growing body of work on such systems, with some literature proposing them as ways to augment human cognition to better keep up with technology and to better experience emerging technologies.⁷

Addiction/Problematic Use

Significant research has been done on the issue of problematic technology use, especially regarding the intersection of youth cognitive development and technology addiction. Some studies which analyze the effects of technology on adolescent brains have found that "too much screen time damages the brain."⁸ This research found adverse impacts of technology on the brain, which affect core cognitive processes such as emotional processing, problem solving and decision making, and judgment.⁹

⁵ Francesca Gottschalk, "Impacts of Technology Use on Children: Exploring Literature on the Brain, Cognition and Well-Being," *OECD Education Working Papers* (2019), <https://doi.org/10.1787/19939019>

⁶ Ibid.

⁷ Nuno RB Martins et al., "Human Brain/Cloud Interface," In *Advances in Clinical Immunology, Medical Microbiology, COVID-19, and Big Data* (Singapore: Jenny Stanford Publishing, 2021): 485-538.

⁸ Victoria L. Dunckley, "Gray Matters: Too Much Screen Time Damages the Brain," *Psychology Today*, February 27, 2014, <https://www.psychologytoday.com/us/blog/mental-wealth/201402/gray-matters-too-much-screen-time-damages-the-brain>.

⁹ Muhammed Hakan Aksu et al., "The Relationship between Social Problem Solving, Cognitive Factors and Social Media Addiction in Young Adults: A Pilot Study," *Journal of Cognitive Behavioral Psychotherapy and Research* 8, no. 3 (2019): 164-169, https://www.researchgate.net/publication/336205417_The_relationship_between_Social_Problem_Solving_Cognitive_Factors_and_Social_Media_Addiction_in_Young_Adults_A_Pilot_Study;

While most research focuses on adolescents and young adults, some studies have also challenged the popular notion that technology addiction is only affecting young people. One study conducted in 2018 found that American adults spent half their day (approximately 11 hours) consuming content of some kind, and that radio and television remain prominent in adult media consumption.¹⁰ According to the market-research firm Nielsen, as of 2019, Americans aged 65 and older spend more time looking at screens than millennials or Gen Z; and their data confirms that television is the key reason for the difference in screen time between elderly and young Americans.¹¹

There is also a growing body of literature which focuses on treatments for Internet addiction. Some research identifies evidence that Internet addiction has physical manifestations in the brain similar to drug addiction. As a result, interventions for Internet addiction, or problematic media use, have thus far focused primarily on 'detox'-focused treatment centers and talk therapy.¹² Research as far back as 2007 found that Internet addiction can be treated with cognitive behavioral therapy (CBT); treatment centers are opening around the world to deal solely with Internet addiction.¹³ Additionally, preliminary investigations suggest that Internet addiction may respond to pharmacological treatment.¹⁴ Aneta Przepiorka et al. found in 2014 that Internet addiction may respond to drugs, and that psychological and pharmacological treatments working in tandem may be the most effective approach.¹⁵ However, more research is needed to examine the long-term effects of such treatments.

¹⁰ "Time Flies: US Adults Now Spent Nearly Half a Day Interacting with Media," *Nielsen*, July 2018, <https://www.nielsen.com/us/en/insights/article/2018/time-flies-us-adults-now-spend-nearly-half-a-day-interacting-with-media/>.

¹¹ Hillary Hoffower, "Millennials and Gen Z Love Their Technology — But American Seniors Are Actually Spending the Most Time on Their Screens," *Business Insider*, August 15, 2019, <https://www.businessinsider.com/american-seniors-technologically-addiction-versus-millennials-gen-z-2019-8>.

¹² M. Brand et al., "Prefrontal Control and Internet Addiction: A Theoretical Model and Review of Neuropsychological and Neuroimaging Findings," *Frontiers in Human Neuroscience* (2014): 375, <https://doi.org/10.3389/fnhum.2014.00375>; Jong-Un Kim, "The Effect of a R/T Group Counseling Program on the Internet Addiction Level and Self-Esteem of Internet Addiction University Students," *International Journal of Reality Therapy* 27, no. 2 (2008); Chloe Sang-Hun, "South Korea Expands Aid for Internet Addiction," *The New York Times*, May 28, 2010, <https://www.nytimes.com/2010/05/29/world/asia/29game.html>; "South Korean Internet Addiction Camp: What Is Life Like There?" *BBC Newsround*, July 8, 2019, <https://www.bbc.co.uk/newsround/48855182>.

¹³ Kimberly S. Young, "Cognitive Behavior Therapy with Internet Addicts: Treatment Outcomes and Implications," *Cyberpsychology & Behavior* 10, no. 5 (2007): 671-679, <https://doi.org/10.1089/cpb.2007.9971>; Michael Sullivan, "Hooked on The Internet, South Korean Teens Go Into Digital Detox," *NPR*, August 13, 2019, <https://www.npr.org/2019/08/13/748299817/hooked-on-the-internet-south-korean-teens-go-into-digital-detox>.

¹⁴ J. Michael Bostwick and Jeffrey A. Bucci, "Internet Sex Addiction Treated with Naltrexone," in *Mayo Clinic Proceedings*, vol. 83, no. 2 (Cambridge: Elsevier Academic Press, 2008): pp. 226-230; Doug Hyun Han et al., "Bupropion Sustained Release Treatment Decreases Craving for Video Games and Cue-Induced Brain Activity in Patients with Internet Video Game Addiction," *Psychology of Popular Media* 1 (2011): 108, <https://psycnet.apa.org/doi/10.1037/2160-4134.1.S.108>.

¹⁵ Aneta Małgorzata Przepiorka et al., "Clinical Approaches to Treatment of Internet Addiction," *Pharmacological Reports* 66, no. 2 (2014): 187-191, <https://doi.org/10.1016/j.pharep.2013.10.001>.

Gamification

The literature on gamification falls mainly into two categories: how digital gamification affects cognition, and how gamification can be used to mitigate the negative externalities of digital systems on cognition. The former includes literature on how digitally gamified play differs from traditional play for children because it closes the design loop, introducing external validation, and reducing self realization.¹⁶ There is also some literature about how the gamification of online conspiracy theories, like QAnon, add to their addictive nature, with quests, lores, and “characters” played online.¹⁷ Lastly, there is an increasing body of literature on the gamification of investing apps like Robinhood, which use gamified interfaces to encourage users to trade.¹⁸

“At least part of Robinhood’s success appears to have been built on a Silicon Valley playbook of behavioral nudges and push notifications, which has drawn inexperienced investors into the riskiest trading.”¹⁹

— Nathaniel Popper, *“Robinhood Has Lured Young Traders, Sometimes with Devastating Results.”*

Most of the literature on gamification focuses on the idea of cognitive inoculation. This idea, illustrated in the well-known Roozenbeek and Van der Linden studies around games to fortify resilience against disinformation, suggests that gamifying fake news detection, particularly gamifying how fake news is made, helps users better insulate themselves against fake news online.^{20 21} However, this is an emerging field of research, with more replication needed to confirm the trends initially identified.²²

¹⁶ Beata Mostafavi, “Gamified Childhood: Are Digital Devices Replacing Traditional Playtime?” *University of Michigan Health Lab*, October 24, 2019,

<https://labblog.uofmhealth.org/health-tech/gamified-childhood-are-digital-devices-replacing-traditional-playtime>.

¹⁷ Chris O’Brien, “How Social Media and Gamification Fueled QAnon’s ‘Crowdsourced Cult,’” *Venture Beat*, October 9, 2020, <https://venturebeat.com/2020/10/09/how-social-media-and-gamification-fueled-qanons-crowdsourced-cult/>.

¹⁸ Nathaniel Popper, “Robinhood Has Lured Young Traders, Sometimes with Devastating Results,” *The New York Times*, July 8, 2020, <https://www.nytimes.com/2020/07/08/technology/robinhood-risky-trading.html?referringSource=articleShare>.

¹⁹ Ibid.

²⁰ Melisa Basol et al., “Good News about Bad News: Gamified Inoculation Boosts Confidence and Cognitive Immunity against Fake News,” *Journal of Cognition* 3, no. 1 (2020),

<https://journals.sagepub.com/doi/full/10.1177/20539517211013868>.

²¹ Jon Roozenbeek and Sander Van der Linden, “Fake News Game Confers Psychological Resistance against Online Misinformation,” *Palgrave Communications* 5, no. 1 (2019): 1-10, <https://www.nature.com/articles/s41599-019-0279-9>.

²² Christoph Pimmer et al., “Fake News Resilience through Online Games? Tentative Findings from a Randomized Controlled Trial in Higher Education,” in *Proceedings of the 17th International Conference on Cognition and Exploratory Learning in the Digital Age (CELDA 2020)* (Lisbon: IADIS Press, 2020) https://www.researchgate.net/publication/343976604_Fake_news_resilience_through_online_games_Tentative_findings_from_a_randomized_controlled_trial_in_higher_education.

Emotions

The literature highlights that digital technologies heighten and exploit our emotions. Our research indicates that the virality of fake news, for example, is a direct result of the inflammatory language used. The emotionally arousing nature of sensational or outright fake content—whether it appeals to negative emotions such as fear or anger, or positive emotions such as joy or the feeling of being understood—overrides other cognitive processes such as critical thinking, and can result in our trusting illogical or sensationalized information.²³ The literature also addresses the issue of echo chambers and in-group/out-group mentality. Some research concludes that the moral-emotional expressions which are so popular on social media platforms intensify existing social and political identities. As Bakir and McStay put it:

*"The fake news situation is socially and democratically problematic on three fronts: (1) its production of wrongly informed citizens, that (2) are likely to stay wrongly informed in echo chambers and (3) be emotionally antagonized or outraged given the affective and provocative nature of much fake news."*²⁴

- Vian Bakir and Andrew McStay, "Fake News and the Economy of Emotions: Problems, Causes, Solutions."

There is also a growing body of literature on the importance of emotional appeals with regard to online recruitment and radicalization. One study analyzed Occupy Wall Street's recruitment via Facebook, and found that the most successful recruiting tactics were those that used highly emotional messages appealing to both positive and negative emotions.²⁵ Another study on the social influence factors that aid terrorists in recruitment shows that appeals to in-group/out-group biases and the emotions that correlate with animosity towards the out-group are extremely effective in online recruiting.²⁶

Some of the literature also discusses the "economy of emotions," which refers to the ways "emotions are leveraged to generate attention and viewing time, which converts to advertising revenue."²⁷ Social media platforms and other companies are thus incentivized to promote increasingly emotional and sensational content, in order to bring in more views, clicks and

²³ Ullrich K.H. Ecker et al., "The Psychological Drivers of Misinformation Belief and Its Resistance to Correction," *Nature Reviews Psychology* 1, no. 1 (2022): 13-29, <https://www.nature.com/articles/s44159-021-00006-y.pdf>.

²⁴ Vian Bakir and Andrew McStay, "Fake News and the Economy of Emotions: Problems, Causes, Solutions," *Digital Journalism* 6, no. 2 (2018): 154-175, <https://doi.org/10.1080/21670811.2017.1345645>.

²⁵ Sarah Gaby and Neal Caren, "Occupy Online: How Cute Old Men and Malcolm X Recruited 400,000 US Users to OWS on Facebook," *Social Movement Studies* 11, no. 3-4 (2012): 367-374, <https://doi.org/10.1080/14742837.2012.708858>.

²⁶ Rosanna E. Guadagno et al., "Social Influence in the Online Recruitment of Terrorists and Terrorist Sympathizers: Implications for Social Psychology Research," *Revue Internationale de Psychologie Sociale* 23, no. 1 (2010): 25-56.

²⁷ Vian Bakir and Andrew McStay, "Fake News and the Economy of Emotions: Problems, Causes, Solutions," *Digital Journalism* 6, no. 2 (2018): 154-175, <https://doi.org/10.1080/21670811.2017.1345645>.

traffic, thereby increasing revenue.²⁸ Algorithms developed by these platforms are thus geared towards reinforcing content which is personally and emotionally targeted at users, resulting in the increase and spread of mis- and dis-information.²⁹

For additional information on how emotions are affected and manipulated by digital technologies, a forthcoming IST paper will further delve into the issue and will be linked here upon publication.

Critical Thinking

Much of the research examining digital technologies and critical thinking focuses on media literacy or critical consumption of digital media.^{30, 31} Much of the literature emphasizes the problems of mis- and dis-information in what some call the “Post Truth Era.”³² Other cited trends that limit critical thinking include echo chambers, ambiguous information, biased reasoning, and that in “the post-truth age, facts and objective evidence are less powerful in shaping public opinion than personal beliefs, anecdotes, and popular views.”³³

“[Critical information literacy] would facilitate the average Internet user’s ability to seek, find, and use appropriate information, which in turn would facilitate more thoughtful dialogues and learning. Such literacy skills would facilitate a shift from the rote sharing and acceptance of information on the Internet to substantive evaluation and purposeful usage of information.”³⁴

– Kelly Y.L. Ku et al., “What Predicts Adolescents’ Critical Thinking about Real-Life News? The Roles of Social Media News Consumption and News Media Literacy.”

²⁸ Jonathan Haidt and Tobias Rose-Stockwell, “The Dark Psychology of Social Networks: Why it Feels like Everything is Going Haywire,” *The Atlantic*, December 2019, <https://www.theatlantic.com/magazine/archive/2019/12/social-media-democracy/600763/>.

²⁹ Vian Bakir and Andrew McStay, “Fake News and the Economy of Emotions: Problems, Causes, Solutions,” *Digital Journalism* 6, no. 2 (2018): 154-175, <https://doi.org/10.1080/21670811.2017.1345645>.

³⁰ Andrew Arnold, “How to Maintain Critical Thinking In The Modern World of New Media,” *Forbes*, February 27, 2018, <https://www.forbes.com/sites/andrewarnold/2018/02/27/how-to-maintain-critical-thinking-in-the-modern-world-of-new-media/?sh=6f9eabc550e5>.

³¹ Art Silverblatt, “Media Literacy and Critical Thinking,” *International Journal of Media and Information Literacy* 3, no. 2 (2018): 66-71, <https://cyberleninka.ru/article/n/media-literacy-and-critical-thinking/viewer>.

³² Nicole A. Cooke, “Posttruth, Truthiness, and Alternative Facts: Information Behavior and Critical Information Consumption for a New Age,” *The Library Quarterly* 87, no. 3 (2017): 211-221.

³³ Kelly Y.L. Ku et al., “What Predicts Adolescents’ Critical Thinking about Real-Life News? The Roles of Social Media News Consumption and News Media Literacy,” *Thinking Skills and Creativity* 33 (2019): 100570, <https://www.sciencedirect.com/science/article/abs/pii/S1871187119300100>.

³⁴ Nicole A. Cooke, “Posttruth, Truthiness, and Alternative Facts: Information Behavior and Critical Information Consumption for a New Age,” *The Library Quarterly* 87, no. 3 (2017): 211-221.

Recommendations for improving critical thinking with regards to digital media include verifying the source, challenging bias, and using fact checkers.³⁵

Metacognition

The literature on metacognition largely examines the phenomenon of overconfidence as a result of our unconscious offloading of cognition to digital technologies. As Fisher and Oppenheimer explain in, "Harder Than You Think: How Outside Assistance Leads to Overconfidence," people often do not recognize just how much they are relying on outside information, especially online search engines, which in turn leads to an overconfidence in their own knowledge.³⁶ By off-loading cognition, people become more forgetful and demonstrate reduced effort and altered memory strategies, all of which are offset by the external aid they receive.³⁷ This phenomenon is further explored in another article by the authors, which examines how technology makes us believe we are more capable than we truly are.³⁸ This psychological effect is called the illusion of explanatory depth (IOED).³⁹ The literature also explores the implications of this phenomenon on civil society, namely voters. One survey revealed that there is a robust IOED with voters during election seasons: Because Americans are inundated with vague, superficial candidate ads, they believe that they have a more concrete understanding of candidates' policy positions than they truly do.⁴⁰

In addition, the literature examines the role of metacognition in Internet addiction.⁴¹ One study found a significant, positive relationship between the two. It found that the Internet and other digital technologies cause unwanted effects, but argued that metacognitive processes can have a "positive and mediating role on this relationship."⁴² Another study found that positive

³⁵ Andrew Arnold, "How to Maintain Critical Thinking In The Modern World of New Media," *Forbes*, February 27, 2018, <https://www.forbes.com/sites/andrewarnold/2018/02/27/how-to-maintain-critical-thinking-in-the-modern-world-of-new-media/?sh=6f9eabc550e5>.

³⁶ Matthew Fisher and Daniel M. Oppenheimer, "Harder Than You Think: How Outside Assistance Leads to Overconfidence," *Psychological Science* 32, no. 4 (2021): 598-610, <https://cpb-us-w2.wpmucdn.com/campuspress.yale.edu/dist/c/259/files/2021/04/Fisher-Harder-Than-You-Think.pdf>.

³⁷ Ibid.

³⁸ Matthew Fisher and Daniel M. Oppenheimer, "Who Knows What? Knowledge Misattribution in the Division of Cognitive Labor," *Journal of Experimental Psychology: Applied* (2021), <https://cpb-us-w2.wpmucdn.com/campuspress.yale.edu/dist/c/259/files/2021/07/FisherOppenheimer21-Who-Knows-What.pdf>.

³⁹ Adam L. Alter et al., "Missing the Trees for the Forest: A Construal Level Account of the Illusion of Explanatory Depth," *Journal of Personality and Social Psychology* 99, no. 3 (2010): 436; Nathaniel Rabb et al., "Individual Representation in a Community of Knowledge," *Trends in Cognitive Sciences* 23, no. 10 (2019): 891-902, <https://pubmed.ncbi.nlm.nih.gov/31477385/>; Adrian F. Ward, "People Mistake the Internet's Knowledge for Their Own," *Proceedings of the National Academy of Sciences* 118, no. 43 (2021), <https://www.pnas.org/doi/10.1073/pnas.2105061118>.

⁴⁰ Adam L. Alter et al., "Missing the Trees for the Forest: A Construal Level Account of the Illusion of Explanatory Depth," *Journal of Personality and Social Psychology* 99, no. 3 (2010): 436.

⁴¹ Fatemeh Bidi et al., "The Mediating Role of Metacognition in the Relationship Between Internet Addiction and General Health," *Addiction & Health* 4, no. 1-2 (2012): 49.

⁴² Ibid.

metacognitions mediate the association between the fear of missing out (FOMO) and problematic Internet use, which is cited as one of the most significant reasons for Internet addiction.⁴³ These findings suggest that metacognitive processes can potentially mediate the negative effects of digital technologies on our cognition.

Memory

The cognitive science literature concludes that memory is flexible and shifts over time, and that as a result, it can be exploited by digital influence.⁴⁴ As more time passes between an event and its recall, the memory is mixed with prior knowledge and becomes fuzzier and less precise.⁴⁵ Some studies examine the ways in which false or biased information can influence memory, even after credible corrections, because our pre-existing beliefs and values become attached to certain memories.⁴⁶

The literature also addresses the ways in which the omnipresence of technology in our lives impacts our memory and recall. One study examines how media usage impairs our memory of an experience if we use media to capture said experiences.⁴⁷ As Sparrow, Liu, and Wegner show:

"The results of four studies suggest that when faced with difficult questions, people are primed to think about computers and that when people expect to have future access to information, they have lower rates of recall of the information itself and enhanced recall instead for where to access it. The Internet has become a primary form of external or transactive memory, where information is stored collectively outside ourselves."⁴⁸

- Betsy Sparrow et al., "Google Effects on Memory: Cognitive Consequences of Having Information at Our Fingertips."

This sentiment is echoed in Adrian Ward's "People Mistake the Internet's Knowledge for Their Own," in which he conducts eight experiments to examine the possibility that when people use Google to search for information, they cannot accurately distinguish between internal and

⁴³ Silvia Casale, "Exploring the Role of Positive Metacognitions in Explaining the Association Between the Fear of Missing Out and Social Media Addiction," *Addictive Behaviors* 85 (2018): 83-87, <https://pubmed.ncbi.nlm.nih.gov/29864680/>.

⁴⁴ Eryn J. Newman and Elizabeth F. Loftus, "Updating Ebbinghaus on the Science of Memory," *Europe's Journal of Psychology* 8, no. 2 (2012): 209-216.

⁴⁵ Ibid.

⁴⁶ Briony Swire et al., "Processing Political Misinformation: Comprehending the Trump Phenomenon," *Royal Society Open Science* 4, no. 3 (2017): 160802, <https://doi.org/10.1098/rsos.160802>.

⁴⁷ Diana I. Tamir et al., "Media Usage Diminishes Memory for Experiences," *Journal of Experimental Social Psychology* 76 (2018): 161-168, <https://doi.org/10.1016/j.jesp.2018.01.006>.

⁴⁸ Betsy Sparrow et al., "Google Effects on Memory: Cognitive Consequences of Having Information at Our Fingertips," *Science* 333, no. 6043 (2011): 776-778, <https://www.science.org/doi/10.1126/science.1207745>.

external knowledge.⁴⁹ While more research is needed in this area, preliminary findings demonstrate a worrisome trend towards a dependence on a “digital transactive memory partner,” which weakens our internal memory in favor of an overreliance on what we assume will always be accessible and correct.⁵⁰

Trust

Much of the research examining the spread of fake news digs into the question of why people believe and share mis- and disinformation.⁵¹ Many articles touch on in-group/out-group biases and other cognitive biases, which cause us to believe information which aligns with our previously held values and beliefs.⁵² It is extraordinarily easy for us to judge information based on whether it “feels” right or wrong, instead of examining concrete evidence, and as the literature notes, we tend to fall victim to our biases more often than not.⁵³ Some articles address the rise in conspiracy theories in American politics, as well as “the damage done to trust by the normalization of untruth.”⁵⁴ Social media platforms have become “hotspots for unsubstantiated information,” making it incredibly difficult to remedy these issues.⁵⁵

It should also be noted that while people are increasingly dependent on technology, especially in light of the COVID-19 pandemic, there is also a rising distrust in technology worldwide.⁵⁶ The Edelman Trust Barometer found in a survey of 31,000 people in 27 countries that trust in technology fell by six points in 2020, to 70 on a scale of 100.⁵⁷ A further large-scale analysis of

⁴⁹ Adrian F. Ward, “People Mistake the Internet’s Knowledge for Their Own,” *Proceedings of the National Academy of Sciences* 118, no. 43 (2021), <https://doi.org/10.1073/pnas.2105061118>.

⁵⁰ Adrian F. Ward, “Supernormal: How the Internet is Changing Our Memories and Our Minds,” *Psychological Inquiry* 24, no. 4 (2013): 341-348.

⁵¹ Rainer Greifeneder et al., *The Psychology of Fake News: Accepting, Sharing, and Correcting Misinformation* (London: Routledge, 2021).

⁵² Andrew Hutchinson, “New Report Shows Universal Distrust in Social Media as a News Source,” *Social Media Today*, February 1, 2020, <https://www.socialmediatoday.com/news/new-report-shows-universal-distrust-in-social-media-as-a-news-source/571512/>.

⁵³ David Robson, “Why Are People So Incredibly Gullible?” *BCC Future*, March 24, 2016, <https://www.bbc.com/future/article/20160323-why-are-people-so-incredibly-gullible>; Norbert Schwarz and E. J. Newman, “How Does the Gut Know Truth,” *Psychological Science Agenda* 31, no. 8 (2017), https://www.researchgate.net/profile/Norbert-Schwarz-3/publication/319451271_How_does_the_gut_know_truth/data/59ab20eaaca272f8a154eacb/17-APA-Schwarz-Newman-How-does-the-gut-know-truth-Science-Brief.pdf.

⁵⁴ Paul Musgrave, “Democracy Requires Trust. But Trump Is Making Us All Into Conspiracy Theorists,” *The Washington Post*, March 7, 2017, <https://www.washingtonpost.com/posteverything/wp/2017/03/07/democracy-requires-trust-but-trump-is-making-us-all-into-conspiracy-theorists/>.

⁵⁵ Yannis Theocharis et al., “Does the Platform Matter? Social Media and COVID-19 Conspiracy Theory Beliefs in 17 Countries,” *New Media & Society* (2021): 14614448211045666, <https://doi.org/10.1177/14614448211045666>.

⁵⁶ Bhaskar Chakravorti, “Trust in Digital Technology Will Be the Internet’s Next Frontier, for 2018 and beyond,” *The Conversation*, January 3, 2018, <https://theconversation.com/trust-in-digital-technology-will-be-the-Internets-next-frontier-for-2018-and-beyond-87566>.

⁵⁷ Mike Allen and Ina Fried, “Exclusive: Trust in Tech Craters,” *Axios*, March 31, 2021, <https://www.axios.com/edelman-trust-barometer-tech-5787acea-8ef5-4d0b-9694-6e4f8eb006c4.html>.

trust in technology around the world found that digital trust is not monolithic; it is extremely fragile, and varies geographically, with local contexts being essential to (re)building trust.⁵⁸ A 2020 survey of 12,000+ US adults found that people distrust political information on social media platforms far more than traditional news sources.⁵⁹

"In recent years, almost no action was taken to actively reduce digital mistrust. Instead, a series of scandals and poorly managed incidents have eroded the Digital Trust that existed at the start of digital transformation. Governments face push-back when rolling out digital services and technology companies face unhappy employees, critical customers, and pushy regulators. Hence, the question of how to reduce digital mistrust will not go away but only gain in importance in the future."⁶⁰

— Swiss Digital Initiative, "Digital Trust Whitepaper."

More research is needed to reconcile rising distrust in technology with the effects of mis/disinformation spread on social media platforms.

⁵⁸ Bhaskar Chakravortia et al., "How Digital Trust Varies Around the World," *Harvard Business Review*, February 25, 2021, <https://hbr.org/2021/02/how-digital-trust-varies-around-the-world>.

⁵⁹ Andrew Hutchinson, "New Report Shows Universal Distrust in Social Media as a News Source," *Social Media Today*, February 1, 2020, <https://www.socialmediatoday.com/news/new-report-shows-universal-distrust-in-social-media-as-a-news-source/571512/>.

⁶⁰ "Digital Trust Whitepaper," *Swiss Digital Initiative*, November 2021, <https://a.storyblok.com/f/72700/x/b481b921eb/digital-trust-final-forpublication.pdf>.

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