Edited by

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THE WILEY HANDBOOK OF *Psychology, Technology and Society*

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Preface

In the beginning (*c.*1969) there was the ARPANET, which provided an interconnected network for Defense Advanced Research Project Agency (DARPA) to connect universities that had defense department contracts and other professionals doing government work. Initially, only a couple of universities were online but more came quickly. Before long ARPANET split into MILNET for military work and NSFNET and several other government-based networks and in a matter of less than 20 years, the Internet was born. What followed was quite literally an explosion from connecting over a 300-baud-rate modem where you placed your phone in a rubber coupler, listened to the beeps and buzzes, and then watched as character after character emerged slowly on a dot matrix printer. To someone who was there it was magic.

People who had the Internet in the early 1980s were able to access ARCHIE, GOPHER, MELVYN, and USENET and find information and people far and wide. The communication was slow, but it was thrilling. Principal investigators working on grants were able to connect online in an ongoing discussion. Wading through many lines of old messages was required in order to get to the new ones, but it was amazing to be able to leave a message for another PI and find a response a day or so later. It has been an interesting ride from the early 1980s to current day and those nearly three decades have seen the slow buildup of the text-based Internet through the 1980s until the development of the World Wide Web and Mosaic in the 1990s, which allowed us to use a graphical environment to go far beyond the simple line-based system that we had just grown accustomed to in the past decade. Mosaic turned

into Netscape Navigator – which also included a simple tool to build your own website – and Navigator begat a string of browsers, each with their own quirks and possibilities. Browsers needed a means of finding information and so search engines were born. Search engines such as Alta Vista and Lycos and other metasearch engines such as WebCrawler and Dogpile provided a means to search the Internet by searching the search engines. Eventually, in the late 1990s Google was introduced and all the other search engines that followed provided intense competition for our eyeballs and questions.

All of what people could do online needed to be done on a rather large, by today's standards, desktop computer, which began with the IBM PC and Apple series until the desire to have a computer that was portable led to laptops such as the IBM-PC Convertible, Apple PowerBook, and entries into the portable computing field by Compaq, Toshiba, Commodore, and others. As demand for portability increased, smaller and smaller "laptops" emerged including Netbooks and eventually Chromebooks. When even smaller devices were desired, personal data assistants (PDAs) emerged on the scene, including the early versions of the Palm Pilot and the BlackBerry, which allowed Internet access and other functions typically done on a computer system.

But that was not enough for us and when in 1999 the Japanese company NTT DoCoMo released a "smartphone" that incorporated the qualities found in a cell phone or mobile phone – which had been in existence for several years but did not allow Internet access – the world changed dramatically. While the Japanese embraced their smartphone, it was not until Research in Motion released the BlackBerry that smartphones took off in America in the early 2000s. And took off they did! Within a scant 10 years we have gone from a society that embraced the Internet on

machines that either resided semi-permanently on a desk or sat somewhat uncomfortably on a lap to a small device that nearly every person in America carries in their pocket or purse. While cell phones – those without all the advanced features of smartphone – were the standard until the early 2000s, the smartphone has become increasingly more popular. According to Statista,[1] a company that compiles statistics from around the globe, 11% of the 2008 U.S. population owned a smartphone and that has increased to 81% in 2015. eMarketer,[2] a digital marketing, media, and commerce company, estimates that there are nearly 2 billion smartphone users in the world and that two-fifths of all mobile phone users own a smartphone. eMarketer predicts that by 2017, 50% of mobile phone users worldwide will be using a smartphone.

The smartphone has certainly been a game changer in our world and because so many of us now carry a powerful Internet computer – complete with dozens of applications that do anything from shop to play music to provide video to literally anything you can imagine – all day long and, for many, all night long, too. The purpose of this handbook is to provide a snapshot of how this ubiquitous online access to information, communication, entertainment, products, and so much more has affected us on a variety of levels. The literature on the psychology of technology is too broad to cover in one publication, even one with 30 chapters. Nonetheless, the chapters that follow examine the impact on all aspects of our lives and provide, in many cases, an outlook for the future and, in others, a prescription for maintaining mental and physical health. We have ventured around the world to provide readers with the most up-to-date research and scholarship from Australia, Canada, the Czech Republic, Germany, the United Kingdom, and the United States.

Our authors are most prestigious and have won numerous awards and accolades, including the following:

- Dr. L. Mark Carrier, Dr. Larry D. Rosen, and Dr. Kaveri Subrahmanyam won Outstanding Professor Awards on their campuses.
- Dr. Adam Gazzaley: Pfizer/AFAR Innovations in Aging Award, the Ellison Foundation New Scholar Award in Aging, and the Harold Brenner Pepinsky Early Career Award in Neurobehavioral Science.
- Dr. Douglas Gentile: Distinguished Scientific Contributions to Media Psychology Award from the American Psychological Association (Division 46).
- Dr. Robin Kowalski: Clemson University's Award of Distinction, Clemson University's College of Business and Behavioral Science Award for Excellence in Undergraduate Teaching, the Phil Prince Award for Excellence and Innovation in the Classroom, Clemson University's College of Business and Behavioral Science Senior Research Award, Clemson University's Bradbury Award for contributions to the honors college, and the Clemson Board of Trustees Award for Faculty Excellence.
- Dr. Clare Wood: British Psychological Society's award for Excellence in the Teaching of Psychology.
- Dr. Eileen Wood: University Teaching Excellence Award, the Hoffman-Little Award for Teaching Excellence, and the OCUFA Teaching Excellence Award.
- Dr. David Ziegler: UCSF School of Medicine Technology Transformation Grant, a Human Brain Mapping Trainee Travel Award, the Angus MacDonald Award for Excellence in Undergraduate Teaching at MIT, the Denison University President's Medal, and was a two-

time recipient of the Harvard/MIT/MGH Advanced Multimodal Neuroimaging Training Program Fellowship.

Our authors have also been active in research and other scholarly activities, publishing literally hundreds, if not thousands, of journal articles, edited journals, and have written seminal books in this field:

- Dr. Deborah Boehm-Davis is co-author of the textbook *An Introduction to Humans in Engineered Systems* and co-editor of the forthcoming *Handbook of Human-Systems Integration*. Served as an associate editor for *Human Factors* and the *International Journal of Human–Computer Studies* and on the editorial boards of several journals.
- Dr. Mark Brosnan published a book entitled *Technophobia: The Psychological Impact of Information Technology*.
- Dr. W. Keith Campbell is the author of more than 100 scientific journal articles and book chapters, and the books *When You Love a Man Who Loves Himself: How to Deal with a One-way Relationship*; *The Narcissism Epidemic: Living in the Age of Entitlement* (with Jean Twenge); and *The Handbook of Narcissism and Narcissistic Personality Disorder: Theoretical Approaches, Empirical Findings, and Treatments* (with Josh Miller). He and Jean Twenge also have a personality textbook, *Personality Psychology: Understanding Yourself and Others*, to be published in 2015.
- Dr. L. Mark Carrier co-authored *Rewired: Understanding the iGeneration and the Way They Learn* and *iDisorder: Understanding Our Obsession with Technology and Overcoming Its Hold on Us*.

- Dr. Nancy A. Cheever co-authored *Rewired: Understanding the iGeneration and the Way They Learn* and *iDisorder: Understanding Our Obsession with Technology and Overcoming Its Hold on Us*.
- Dr. Douglas Gentile is editor of *Media Violence and Children: A Complete Guide for Parents and Professionals*, and co-author of the book *Violent Video Game Effects on Children and Adolescents: Theory, Research, and Public Policy*.
- Dr. Reynol Junco is the author of *Engaging Students Through Social Media: Evidence-Based Practices for Use in Student Affairs.*
- Dr. Robin Kowalski is the author or co-author of several books, including *Complaining, Teasing, and Other Annoying Behaviors*, *Social Anxiety*, *Aversive Interpersonal Behaviors*, *Behaving Badly*, *The Social Psychology of Emotional and Behavioral Problems*, *Cyberbullying: Bullying in the Digital Age*.
- Dr. Laura Levine co-authored *Child Development: An Active Learning Approach* and *Child Development from Infancy to Adolescence: An Active Learning Approach*.
- Dr. Larry D. Rosen is the author of *Me, MySpace and I: Parenting the Net Generation* and co-authored *TechnoStress: Coping With Technology @Work, @Home, @Play*, *The Mental Health Technology Bible*, *Rewired: Understanding the iGeneration and the Way They Learn* and *iDisorder: Understanding Our Obsession With Technology and Overcoming its Hold on Us.*
- Dr. David Šmahel is editor of *Cyberpsychology: Journal of Psychosocial Research on Cyberspace* and co-authored the book *Digital Youth: The Role of Media in Development*.

- Dr. Nancy Signorielli authored or co-authored *Violence and Terror in the Mass Media: An Annotated Bibliography* and *Violence in the Media: A Reference Handbook*.
- Dr. Kaveri Subrahmanyam co-authored *Digital Youth: The Role of Media in Development*.
- Dr. Jean Twenge authored *Generation Me: Why Today's Young Americans Are More Confident, Assertive, Entitled – and More Miserable Than Ever Before* and co-authored *The Narcissism Epidemic*: *Living in the Age of Entitlement* and *Psychology of Personality*.

Although our authors are clearly exceptional, some have been honored as being top in their respective fields:

- Dr. Douglas Gentile was named one of the top 300 professors in the United States by Princeton Review.
- Dr. Megan Moreno is an executive committee member on the American Academy of Pediatrics Committee on Communications and Media.
- Dr. Nancy Signorielli testified in May 1993 at the U.S. House of Representatives Energy and Commerce committee's subcommittee on telecommunications and finance oversight hearing on television violence and its impact on children.
- Dr. Deborah Boehm-Davis served as a Senior Policy Advisor for Human Factors at the Food and Drug Administration's Center for Devices and Radiological Health. She has also served as President and Secretary-Treasurer of the Human Factors and Ergonomics Society (HFES) and as President of Division 21 (Applied Experimental and Engineering Psychology) of the American Psychological Association (APA). She has testified before Congress, and served on numerous

panels for the National Research Council, National Research Foundation, Transportation Research Board, and NASA. She was a member and chair of the Federal Aviation Administration's Research, Engineering, and Development Advisory Committee, as well as their Human Factors Subcommittee. She was a member of the Air Force Scientific Advisory Board and the Transportation Security Administration's Scientific Advisory Board.

Finally, many of our authors have appeared on and/or in numerous national and international programs and publications including *The Today Show*, CNN, MSNBC, PBS, NPR, *The Wall Street Journal*, BBC World News, *The New York Times*, *Scientific American*, *Dateline NBC*, *U.S. News & World Report*, *The Washington Post*, and *The Daily Show with Jon Stewart*.

This handbook is divided into sections that cover this title's major areas of study. While certainly not exhaustive, the handbook provides an excellent overview of the field.

Part I: The Psychology of Technology

The first section includes chapters that encompass broad areas of research such as the impact of technology on the brain, generational similarities and differences in technology use and values, Internet credibility and information literacy, ethical concerns in online research, and issues of age and gender. In “The Acute and Chronic Impact of Technology on our Brain,” David A. Ziegler, Jyoti Mishra, and Adam Gazzaley present a review of the existing literature on how technology affects the human brain. They write that it is “unquestionable that innovations in technology and media will continue at a lightning pace, resulting in new methods for interacting with our worlds and bringing with them new sources of distractions, as well as potential avenues for enhancing our lives.” How these technologies affect our brains is complicated and often controversial. The literature points to both positive and negative effects of using technology on the brain, including some “profoundly promising aspects of how new technologies might be harnessed to enhance cognition in at-risk populations, leading to better lives.”

In the next chapter, “Similarities and Differences in Workplace, Personal, and Technology-Related Values, Beliefs, and Attitudes Across Five Generations of Americans,” handbook co-editor Larry D. Rosen and José M. Lara-Ruiz present a research study that examines values, beliefs, and attitudes among members of five generations of Americans. Beginning with an introduction to how researchers have conceptualized generations in the past, Rosen and Lara-Ruiz provide data on more than 2,500 people who provided an assessment of their personal, work, and technology-related values, beliefs, and attitudes as well as their use of technology. Drawing on generational comparisons and trend analyses, this chapter argues that

technology has altered our understanding of generations and that due to the rapid pace of technological change, we must consider that generations no longer span 20 years but instead form mini-generations of half that length.

Handbook co-editor Nancy A. Cheever and Jeffrey Rokkum examine the literature and significance of Internet source credibility and information literacy in the chapter “Internet Credibility and Digital Media Literacy.” They write that as technology continues to expand people’s access to information, the variability of accuracy and believability (or credibility) of that information increases, and policies to verify Internet content are practically nonexistent. They conclude that while people do understand differences in credibility exist among Internet sources, they tend to judge websites based on the way they look rather than their content. Digital media literacy is a process and a skill that is developed over time. Research into programs to increase awareness of credibility issues and enhance digital media literacy points to a need for greater content assessment and teaching the process of evaluating sources rather than simply teaching people how to search for information.

Next, in “Gender Digital Divide: Does it Exist and What are the Explanations?” Richard Joiner, Caroline Stewart, and Chelsey Beaney from the University of Bath present three studies that track the differences in uses of the Internet by men and women through studies performed at a variety of UK universities over a 10-year period. The authors present an excellent and interesting case for the continuing existence of a secondary digital divide that still exists to this day and conclude that much of this rests on the differential uses of the Internet by men and women, where women use it primarily for communication and men for entertainment.

John T. E. Richardson and Anne Jelfs review the basis of data and opinion about differences between digital natives and digital immigrants in “Access and Attitudes to Digital Technologies Across the Adult Lifespan: Evidence from Distance Education.” The authors chose to use a large sample of distance education students who are less likely to be typical college students but also more likely to need to use technology to complete their studies. The authors describe their study of a large sample of students of different ages and make comparisons by age of response rates, use of and access to different technologies, attitudes toward technology use, and approaches to studying. Results are described in tables and in the text and conclusions are drawn about how there may not need to be a distinction between digital natives and digital immigrants in this environment.

Finally, in “Navigating Psychological Ethics in Shared Multi-User Online Environments,” Jeff Gavin and Karen Rodham explore the challenges of privacy and confidentiality in online research. They write that the Internet has become an invaluable resource for researchers interested in contemporary social and psychological practices. The expansion of psychological research into the online milieu brings with it new ethical challenges, particularly in terms of consent, privacy, and confidentiality. As a consequence, a number of authors have written about practical and ethical considerations with regard to online research. Current guidelines do not address the ethical and methodological challenges posed by the changing trends in Internet use, which now include multi-author and multimedia sites such as Facebook, Twitter, MySpace, and YouTube. The authors draw from their experience as researchers of online identities, support, and coping to explore how decisions about public and private spaces, informed consent, and anonymity are

addressed in online environments containing several layers of text, image, and audio-visual input from multiple sources across multiple, linked sites.

Part II: Children, Teens, and Technology

The second section of the handbook examines the impact of technology on youth and young adults. In “Executive Function in Risky Online Behaviors by Adolescents and Young Adults,” a research team from the George Marsh Applied Cognition Laboratory at California State University, Dominguez Hills presents an empirical research study examining the link between executive function and risky online behaviors. Based on their research, the authors conclude that executive function is a relevant factor when considering the causes of risky online behaviors by teens and young adults. They suggest that “more research is needed in order to examine the possibility that the act of going online itself leads to changes in executive function,” and that “more information is required to understand the details of how individual differences in executive function affect risky online behaviors.” They write that “acknowledging developmental differences in executive function can also help to improve prevention work in adolescents and young adults by building on their existing executive function” skills. The authors suggest that “software and website designers should put safeguards into programs and online environments where possible and allow for parental controls.”

In the review chapter “Cyberbullying: Prevalence, Causes, and Consequences,” Robin M. Kowalski and Elizabeth Whittaker cover the definition of cyberbullying, compare and contrast cyberbullying with traditional bullying, relate the characteristics of victims and perpetrators, and list the consequences of cyberbullying for victims and perpetrators. Cyberbullying encompasses a range of aggressive behaviors that involve the use of electronic communication technologies. Although cyberbullying and

traditional bullying share three primary features of aggression, power imbalance, and repeated behaviors, cyberbullying differs from traditional bullying in the anonymity that surrounds the behaviors and in the increased accessibility of the victim. Several person and situational variables are related to victim and perpetrator involvement in cyberbullying, including social intelligence, hyperactivity, and risky online behavior for victims and empathy, narcissism, depression, and anxiety for perpetrators. Victims of cyberbullying experience several negative physical and psychological problems, while being a perpetrator is associated with a range of negative factors. Kowalski and Whittaker presse for more research on defining and measuring cyberbullying and more longitudinal research on cyberbullying.

Next, in “A Step Toward Understanding Cross-National and Cross-Cultural Variances in Cyberbullying,” Fatih Bayraktar is interested in understanding variations in cyberbullying and cybervictimization rates across nations and cultures. He proposes that part of the explanation for the variations is found in two key psychological constructs whose values depend upon one’s nation or culture. The two key constructs are femininity/masculinity and independent/interdependent self-construal. Using data collected from a sample of university students, Bayraktar tested two different models of the relationship between the constructs and cyberbullying/cybervictimization. The author suggests that masculinity and independent self-construal are strongly associated with respect to cyberbullying and that independent self-construal is a protective factor against cybervictimization in those with strong femininity.

In “Sexual Communication in the Digital Age,” Michelle Drouin reviews the known research on the topic of “sexting,” defined as the transmission of sexually explicit

material via cell phone and the Internet. The chapter begins with a description of the various electronic avenues that people use for sexting, discusses the prevalence rates of sexting, reviews research on the content of “sext” messages, considers the motivations, risk factors, and consequences of sexting, and ends with brief summaries of new directions in sexting research. The new directions include sexting compliance and coercion, and couples using sexting for computer-mediated sexual communication.

Drouin and her colleagues Daren Kaiser and Daniel A. Miller tackle “Mobile Phone Dependency: What’s All the Buzz About?” In this chapter, the authors discuss the phenomenon of problematic mobile phone use (a.k.a. mobile phone dependency), defined as “mobile phone use that causes problems in a user’s life.” The authors summarize the literature on problematic mobile phone use, noting that the differences in the existing findings partly might be attributable to differences in socio-cultural, historical, or methodological factors. The possible effects of prolonged text messaging use are described, including decreased face-to-face socializing, increased anxiety and dependence, and phantom vibrations. New directions for research are presented, two of which are the recognition and treatment of problematic mobile phone use and using mobile phones as mechanisms for behavior change.

The next few chapters look at text messaging. In “Assessing the Written Language of Text Messages,” Abbie Grace and Nenagh Kemp explain that the twentieth anniversary of the first text message was celebrated in December 2012. In 2012, 8.5 trillion messages were sent. The development of a text messaging “language” during this rapid growth has prompted researchers to observe a rapidly forming and changing style of communication and to investigate the factors that influence its development. The authors explain that “the ability of texters to participate in textism-rich

conversations and to further develop text messaging language style can be seen as an addition to, not a deletion from, their overall set of literacy skills." The authors discovered that textisms have little or no negative effect on conventional literacy skills, and in fact the use of textisms seems to have communicative value unique to the informal social and technological environment in which it is situated.

In "Texting Behavior and Language Skills in Children and Adults," the research team of Sam Waldron, Nenagh Kemp, Beverly Plester, and Clare Wood provide a literature review of the connection between texting behavior and language skills. The authors summarize the results of studies that look at reading ability, spelling ability, phonology, grammatical ability, and general writing. Additionally, the writers note several methodological problems in running texting studies, including problems with self-report measures and issues related to how textisms are measured. The review concludes that the relationship between texting and language skills depends on the age bracket considered, with some evidence suggesting that texting might be beneficial for children. For adolescents and adults, there is not a clear relationship between the behavior and language skills.

Finally, in "Are 'Friends' Electric? Why Those with an Autism Spectrum Disorder (ASD) Thrive in Online Cultures but Suffer in Offline Cultures," Mark Brosnan and Jeff Gavin discuss the ways in which participation in online communities by people with autism spectrum disorder can enhance their interpersonal relationship where they may otherwise struggle in offline communities. The authors present research projects involving persons who use Facebook and self-identify as having ASD. The first study established that persons with ASD have a preference for online communication over offline communication. The

second study established that emotion is expressed online by those with ASD. The third study showed that persons with ASD can engage in empathic interactions online. In summary, the authors found that persons with ASD engaged in “normal” communication and interaction in an online context.

Part III: Social Media

Part III examines the phenomenon of social networking platforms from a variety of perspectives. In the review chapter “Social Networking and Depression,” Brian A. Feinstein, Vickie Bhatia, Jessica A. Latack, and Joanne Davila present an examination of the association between social networking site (SNS) use and depression. The authors present a thorough review of the existing literature on SNS use and depression, and explain its prevalence and associated risk factors. The authors conclude that negative experiences and social comparisons on SNSs as well as using the Internet to the point of experiencing negative consequences in one’s offline life are both associated with depressive symptoms, while *only* the amount of time using SNSs is not related to depression. It is the quality, not the quantity, of social networking that better predicts depression.

In “Sex, Alcohol, and Depression: Adolescent Health Displays on Social Media,” Megan A. Moreno and Megan Pumper review the issue of adolescent health risk behavior on social media from an explanatory perspective using previous empirical research. The authors present an overview of health risk displays such as alcohol use, sexual activity, and depression, and the consequences relating to such behavior. “Exploring Disclosure and Privacy in a Digital Age: Risks and Benefits” explores issues of privacy and disclosure in social networking, offering an overview of the area from face-to-face communication to contemporary digital settings. Karin Archer, Emily Christofides, Amanda Nosko, and Eileen Wood focus on risks and benefits, with practical advice for discouraging over-disclosure and maximizing privacy. In the next chapter, “The Emergence of Mobile Social Network Platforms on the Mobile Internet,” Andrew Richard Schrock examines mobile social

networking from a variety of perspectives, first summarizing the developments leading to mobile social network platforms and then explaining how these platforms represent a shift from traditional desktop to mobile social network paradigms. The author then examines three specific mobile social network platform characteristics: constant contact, the importance of place, and locational privacy.

The next chapter in this section looks at impression management issues. In “Technology and Self-Presentation: Impression Management Online,” Miriam Bartsch and Kaveri Subrahmanyam present a comprehensive overview of impression management from a historical perspective as well as embedding it into issues of privacy. The need for privacy and the need for self-presentation are viewed as two sides of the same issue. The authors find that while users engage in online impression management that is part-and-parcel with self-presentation, they also are concerned about privacy. Finally, “Narcissism, Emerging Media, and Society” provides a literature review of the connection between emerging media and narcissism exploring the range of studies done that attempt to connect the two. W. Keith Campbell and Jean M. Twenge provide a comprehensive chapter that covers a vast array of literature that will assist the professional reader in gaining a handle on this interesting topic.

Part IV: Multitasking

Extensive use of technological devices leads to media multitasking as well as frequent interruptions in task flow. These issues are explored by the chapters in Part IV. In “Searching for Generation M: Does Multitasking Practice Improve Multitasking Skill?” L. Mark Carrier, Mike Kersten, and Larry D. Rosen present an empirical research project that examines whether more multitasking among young people leads to improved multitasking skill. The authors present a literature review examining multitasking behaviors, ultimately showing that while Generation Mers believe they can multitask efficiently, little evidence shows this to be true. The authors present two general hypotheses: that extreme Generation M multitaskers will report having the same difficulty combining tasks as moderate and low multitaskers and those in other generations; and that extensive practice on a task will not make that task easier to combine with other tasks than others. The authors conclude that more multitasking does not lead to improved multitasking skill.

In “Multitasking and Attention: Implications for College Students” Laura L. Bowman, Bradley M. Waite, and Laura E. Levine review the evidence related to media multitasking in college students and/or young adults. The evidence shows that people are media multitasking frequently, with impacts upon academic performance and attentional skills. Additionally, the writers discuss the effects of media multitasking while engaging in driver and pedestrian behaviors. The experimental literature on divided attention is summarized, indicating clear limits in people’s ability to do more than one task at a time. The authors end the chapter with several lists of recommendations regarding how individuals and agents involved in media multitasking environments can make

improvements to minimize the negative impacts of media multitasking.

Next, Eileen Wood and Lucia Zivcakova set out to review what is known about how multitasking affects students during the learning process in “Understanding Multimedia Multitasking in Educational Settings.” In the beginning part of the chapter, scientific research and theory that delineate how multitasking works are presented. It is shown that multitasking generally involves performing only one task at a time, but can be true multitasking (i.e., parallel processing) under certain conditions that are unlikely to take place during real-world learning tasks. The writers then go over the existing empirical research on multitasking that is “on task” and multitasking that is “off task” (i.e., related or unrelated to the learning goals). The authors conclude that multitasking, when well integrated into the learning context, can have positive outcomes, but, when it involves off-task use of technologies, can lead to learning decrements.

In “Multitasking, Note Taking, and Learning in Technology-Immersive Learning Environments” Lin Lin and Chris Bigenho describe the intense multitasking environment that exists in today’s classrooms due to the presence of computer-based technologies. The chapter investigates how multitasking in this environment might impact long-term learning. In order to understand the answer, the authors divide classroom multitasking into two kinds: multitasking with compatible tasks and multitasking with non-compatible tasks. Compatible tasks are those that have goals that are similar to the primary learning goal. Non-compatible tasks have goals that distract the student from learning. In reviewing the research on these situations, the authors explain a variety of models from cognitive psychology and from educational psychology that can be applied to the multimedia learning environment.

Finally, in the review chapter “Multitasking and Interrupted Task Performance: From Theory to Application,” Nicole E. Werner, David M. Cades, and Deborah A. Boehm-Davis present a thorough examination of the theory and research related to task interruptions. The authors offer a definition of interruptions and explain the differences between interruptions, multitasking, task switching, and distractions. The chapter covers work interruptions, task performance, errors, interruption and resumption lag, and so on and describes the current findings and future goals of related research.

Part V: The Media’s Impact on Audiences

The final section examines how media and technology use and content affect people in a variety of ways. Nancy Signorielli offers the latest research on cultivation research in “Cultivation in the Twenty-First Century.” In this chapter Signorielli examines the historical significance and new research surrounding cultivation theory, which posits that long exposure to televised images and narratives can cultivate attitudes about the real world that match the common themes that television presents. Signorielli, part of the original “cultural indicators” team headed by the late George Gerbner, presents a thorough examination of cultivation theory and research from its inception in the 1970s to the present. Though not a new technology, television continues to garner more advertising dollars and viewers’ time than any other medium, making it perhaps the most pervasive and influential mass medium that can be seen from a variety of platforms, including newer technological devices such as smartphones and tablets. As a socializing agent, television presents shared cultural stories that influence people’s thoughts and opinions. The chapter presents a detailed description of how cultivation is conceptualized and measured, examining the various constructs that researchers have tackled.

In the next chapter, “Internet Addiction,” Petra Vondráčková and David Šmahel explore Internet addiction from historical and contemporary perspectives. The authors provide the classification and definition of Internet addiction, its primary measurement tools, the major related scholarship, prevalence rates and correlates, and the associated problems and treatments. The authors explain how Internet addiction fits with the DSM criteria, and the various schools of thought surrounding its inclusion or

exclusion as a stand-alone disorder. The authors conclude that much more research is needed in this area, and that more accurate definitions and diagnostic criteria, including longitudinal studies, are needed to fully understand this phenomenon.

In “Smashing the Screen: Violent Video Game Effects,” Ann Lewis, Sara Prot, Christopher L. Groves, and Douglas A. Gentile present an examination of violent video game effects from both the theoretical and empirical perspectives. The authors review the existing literature on the topic through a number of sections including their related theoretical frameworks, cognitive and behavioral outcomes, helping, empathy and desensitization issues, sexual socialization, racial and ethnic stereotyping, school performance, and issues of attention, addiction, and cognitive control. The authors conclude that the wide body of research in this area generally points to violent video game play associated with negative effects, though a multitude of variables both exacerbate and mitigate the salience of these effects. The authors also note that video games themselves are generally not problematic, and that some video game play has prosocial and other positive outcomes.

More information about video games is offered in “What is Known About Video Game and Internet Addiction After DSM-5.” A research team from Iowa State University presents a literature review of a subject that has been extensively studied and is now finally in the Appendix of the new DSM-5. This makes this chapter a very powerful addition to the handbook as it sets the stage for what research needs to be done to further move Internet gaming addiction to the future DSM-6. Finally, in the last chapter, “The Future of Technology in Education,” Candrianna Clem and Reynol Junco explore the existing research on technology use in education, and specifically examine

online modalities, flipped classrooms, social media, and use of tablets in the classroom. The authors conclude that the most effective methods of using technology in education match course objectives with the specific modalities and that educators who are highly motivated and trained to use these technologies will produce better outcomes.

Notes

1 See www.statista.com for the latest statistics within the U.S. and around the world.

2 “Smartphone Users Worldwide Will Total 1.75 Billion in 2014,” at http://www.emarketer.com/Article/Smartphone-Users-Worldwide-Will-Total-175-Billion-2014/1010536 (accessed November 21, 2014).

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Larry D. Rosen, Nancy A. Cheever, and L. Mark Carrier

Part I
The Psychology of Technology

1
The Acute and Chronic Impact of Technology on our Brain

David A. Ziegler,[1] Jyoti Mishra[1] and Adam Gazzaley[2]
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Our modern-day environments are technologically richer than ever before. There is no better example of the pervasiveness of technology and media in our daily lives than a brief survey of the annual International Consumer Electronics Show. The 2014 event was dominated by innovations such as smartwatches, earbuds that measure heart rate (and vary your workout soundtrack accordingly), and even a navigation jacket that integrates wirelessly with mobile GPS devices. Such wearable electronics are the perfect examples of how media and technology have become ubiquitous in our daily lives. While there has been much discussion and debate over the potential positive and negative societal implications of technology (Ling, 2004; Rosen, Carrier, & Cheever, 2013), an equally important but relatively unexamined question is what effect these new technologies have on our brains.

With each new wave of technological advancement, we are faced with new streams of sensory inputs from myriad modalities that challenge our brains and require us to adapt to an ever-changing information landscape. This burgeoning set of new information brings with it novel forms of irrelevant distractions and interference, which can disrupt performance on goal-directed activities. Further, this information overload imposes greater cognitive demands on our neural systems to selectively attend to

sensory inputs that are relevant to our immediate goals, while ignoring the interfering sources. Over the past decade, research in our laboratory has focused on unraveling the neural mechanisms underlying our capacity to selectively attend to goals in the face of interference (Clapp, Rubens, Sabharwal, & Gazzaley, 2011; Gazzaley et al., 2008; Gazzaley, Cooney, Rissman, & D'Esposito, 2005; Zanto, Rubens, Bollinger, & Gazzaley, 2010). In this chapter, we will review what is known about how our brains cope with technologies such as television, Internet, email, digital and social media, video games, and mobile devices, how multitasking with multiple technological devices affects neural processing, and will consider the possibilities for harnessing new technologies for personal cognitive benefit.

Usage and Attitudes Toward Technology Across the Lifespan

While an ever-increasing pool of new technologies and digital media appears to be an inevitable phenomenon, there is no clear consensus as to whether the impact of this on our brains is positive or negative. Proponents of technological innovation cite increases in productivity, flexibility, and control over how we accomplish our goals (Hill, Hawkins, Ferris, & Weitzman, 2001; Valcour & Hunter, 2005), but the majority of the existing research literature tends to focus on negative aspects of technological media innovation in our daily lives. Email and text messaging provide an instructive case in point. While they both enable flexible, immediate communication from any place, and at any time, there is increasing evidence that such forms of communication are a primary source of chronic stress in our lives (Barley, Meyerson, & Grodal, 2010), ultimately leading to increased workload and a