

Trends in U.S. Adolescents' Media Use, 1976–2016: The Rise of Digital Media, the Decline of TV, and the (Near) Demise of Print

Jean M. Twenge, Gabrielle N. Martin, and Brian H. Spitzberg
San Diego State University

Studies have produced conflicting results about whether digital media (the Internet, texting, social media, and gaming) displace or complement use of older legacy media (print media such as books, magazines, and newspapers; TV; and movies). Here, we examine generational/time period trends in media use in nationally representative samples of 8th, 10th, and 12th graders in the United States, 1976–2016 ($N = 1,021,209$; 51% female). Digital media use has increased considerably, with the average 12th grader in 2016 spending more than twice as much time online as in 2006, and with time online, texting, and on social media totaling to about 6 hr a day by 2016. Whereas only half of 12th graders visited social media sites almost every day in 2008, 82% did by 2016. At the same time, iGen adolescents in the 2010s spent significantly less time on print media, TV, or movies compared with adolescents in previous decades. The percentage of 12th graders who read a book or a magazine every day declined from 60% in the late 1970s to 16% by 2016, and 8th graders spent almost an hour less time watching TV in 2016 compared with the early 1990s. Trends were fairly uniform across gender, race/ethnicity, and socioeconomic status. The rapid adoption of digital media since the 2000s has displaced the consumption of legacy media.

Public Policy Relevance Statement

Compared with previous generations of teens, iGen teens in the 2010s spend more time online and less time with older media such as books, magazines, and TV. Time on digital media appears to have displaced time once spent reading and watching TV.

Keywords: digital media, print, TV, birth cohort, cultural change

In a society awash in information, media, and communication, attention has become a scarce resource. Individual patterns of working, sleeping, eating, commuting, playing, and interacting are surprisingly routine (Chen et al., 2011; González, Hidalgo, & Barabási, 2008; Miritello et al., 2013; Serfass & Sherman, 2015; Song, Qu, Blumm, & Barabási, 2010). Such routines represent relative tradeoffs and constraints in uses of time. Most of these routine activities are accomplished through communication (Emanuel et al., 2008; Perras & Weitzel, 1981), and, increasingly, through electronically mediated communication (Hanson, Drumheller, Mallard, McKee, & Schlegel, 2010; Perrin, 2015). With only so many hours in a day, and only so much cognitive capacity for information processing, an attention economy results in which each activity competes with other activities (Serrano-Puche, 2017). Time elasticity is limited.

This competition for attention has significant implications for all populations but particularly for how adolescents use their time. Adolescence is a crucial time for media use. Adolescents of age 11–17 years consume media at much higher rates than younger children (Rideout, Foehr, & Roberts, 2010) and at equivalent rates to adults (Common Sense Media, 2016). Because new digital media allow adolescents to communicate with their friends, often independently of adults, media meet and support basic adolescent developmental needs such as those for social connection (Gardner & Davis, 2013; Primack & Escobar-Viera, 2017), identity formation (Lloyd, 2002), and sexual exploration (Subrahmanyam, Smahel, & Greenfield, 2006). However, concerns have been raised about media effects on physical health (Council on Communications and Media, 2016; Iannotti, Kogan, Janssen, & Boyce, 2009; Reid Chassiakos, Radesky, Christakis, Moreno, & Cross) and mental health (Pea et al., 2012; Shakya & Christakis, 2017).

In recent years, adolescents have engaged more and more with technology, spending hours online, on social media, texting, and gaming on electronic devices including smartphones and tablets (Lauricella, Cingel, Blackwell, Wartella, & Conway, 2014; Perrin, 2015; Rideout et al., 2010), activities that we define as “digital media.” As generations become more digitally native, their comfort level with (Van Valkom, Stapley, & Malter, 2013) and use of (Taipale, 2016; van den Berg, Arentze, & Timmermans, 2012) digital media increase relative to that of previous generations.

This article was published Online First August 20, 2018.

Jean M. Twenge and Gabrielle N. Martin, Department of Psychology, San Diego State University; Brian H. Spitzberg, School of Communication, San Diego State University.

Correspondence concerning this article should be addressed to Jean M. Twenge, Department of Psychology, San Diego State University, 5500 Campanile Drive, San Diego, CA 92182-4611. E-mail: jtwenge@mail.sdsu.edu

Table 1
U.S. Adolescents' Media Use, 1976–2016

	<i>N</i>	76–79	80–84	85–89	90–94	95–99	00–04	05–09	2010
Digital media									
Internet (hr/day)									
8th	49,006	—	—	—	—	—	—	1.04 (1.34)	1.08 (1.58)
10th	51,447	—	—	—	—	—	—	1.12 (1.34)	1.18 (1.59)
12th	20,250	—	—	—	—	—	—	1.06 (1.32)	1.35 (1.66)
Texting (hr/day)									
8th	30,740	—	—	—	—	—	—	—	1.84 (2.39)
10th	31,649	—	—	—	—	—	—	—	2.21 (2.49)
12th	11,858	—	—	—	—	—	—	—	2.39 (2.51)
Social media (hr/day)									
8th	17,166	—	—	—	—	—	—	—	—
10th	17,532	—	—	—	—	—	—	—	—
12th	5,658	—	—	—	—	—	—	—	—
Social media (1–5 scale)									
8th	109,958	—	—	—	—	—	—	3.73 (1.58)	4.00 (1.45)
10th	100,395	—	—	—	—	—	—	4.04 (1.37)	4.24 (1.26)
12th	20,849	—	—	—	—	—	—	3.98 (1.37)	4.26 (1.22)
Social media almost every day (%)									
8th	109,958	—	—	—	—	—	—	51%	57%
10th	100,395	—	—	—	—	—	—	58%	64%
12th	20,849	—	—	—	—	—	—	52%	63%
Gaming (hr/day)									
8th	39,560	—	—	—	—	—	—	1.05 (1.42)	1.29 (1.84)
10th	41,437	—	—	—	—	—	—	.93 (1.35)	1.19 (1.75)
12th	15,827	—	—	—	—	—	—	.92 (1.35)	1.29 (1.85)
Legacy media									
Books									
12th # in last year	108,896	5.15 (4.24)	4.66 (4.13)	4.17 (4.04)	3.96 (3.92)	3.68 (3.85)	3.33 (3.68)	3.85 (3.91)	3.78 (3.85)
12th books/magazines (1–5 scale)	110,732	4.39 (0.91)	4.32 (0.94)	4.19 (0.99)	4.15 (1.00)	4.03 (1.04)	3.91 (1.08)	3.79 (1.15)	3.57 (1.20)
12th books/magazines every day	110,732	60%	56%	48%	46%	41%	35%	32%	26%
Magazines (1–5 scale)									
8th	438,666	—	—	—	3.59 (1.12)	3.59 (1.12)	3.39 (1.18)	3.04 (1.24)	2.70 (1.25)
10th	399,708	—	—	—	3.55 (1.03)	3.52 (1.03)	3.33 (1.09)	3.04 (1.15)	2.73 (1.16)
Newspapers (1–5 scale)									
8th	437,126	—	—	—	3.41 (1.32)	3.10 (1.33)	2.77 (1.33)	2.45 (1.31)	2.10 (1.21)
10th	398,777	—	—	—	3.74 (1.22)	3.48 (1.27)	3.16 (1.30)	2.80 (1.32)	2.36 (1.25)
Going to movies (1–5 scale)									
8th	440,279	—	—	—	2.87 (0.76)	2.89 (0.76)	2.90 (0.77)	2.86 (0.77)	2.75 (0.75)
10th	400,826	—	—	—	2.72 (0.70)	2.73 (0.70)	2.75 (0.70)	2.73 (0.70)	2.65 (0.68)
12th	180,104	2.72 (0.68)	2.75 (0.67)	2.78 (0.67)	2.70 (0.67)	2.70 (0.67)	2.72 (0.67)	2.68 (0.67)	2.62 (0.66)
TV (hr/day)									
8th	438,359	—	—	—	2.95 (1.61)	2.89 (1.65)	2.79 (1.65)	2.64 (1.65)	2.49 (1.66)
10th	399,337	—	—	—	2.53 (1.55)	2.42 (1.54)	2.42 (1.59)	2.34 (1.57)	2.19 (1.54)
12th (weekdays only)	109,055	2.45 (1.83)	2.42 (1.76)	2.36 (1.77)	2.34 (1.78)	2.25 (1.78)	2.20 (1.80)	2.13 (1.75)	2.12 (1.75)

However, data on the amount of time teens and young adults spend in these pursuits are thin, often based on small samples (Hanson et al., 2010; Janusik & Wolvin, 2009; Kayany & Yelsma, 2000; Lauricella et al., 2014), over relatively brief time-spans (Hall, Kearney, & Xing, 2018), collected primarily for market research (GfK, 2014; JWT, 2012; Newell, Genschel, & Zhang, 2014), on only one type of media (Lenhart et al., 2015; Twenge & Park, 2018), or not updated every year (Common Sense Media, 2015), leading to outdated information (Rideout et al., 2010). Moreover, few studies track media use over the years among the same age-group using the same questions. For example, the 2015 Common Sense Media survey specifically notes it cannot be compared with the earlier data from the Kaiser Family Foundation (Common Sense Media, 2015). The European time use survey covers different time periods in different countries at different times (Callejo, 2013). Thus, it is unclear how much time adolescents spend with digital media and how much that has changed over the years and over generations (also known as cohorts).

Moderators of trends in media use are also important to consider. Although a few studies have explored how digital media use

differs by gender (Muscanell & Guadagno, 2012), race/ethnicity (Campos-Castillo, 2015), and socioeconomic status (SES; Jackson et al., 2008), few studies have explored whether these variables moderate cohort/time period differences in digital or legacy media, especially after smartphones became a common source of Internet access. SES may be an especially important moderator, as broadband Internet access and smartphones are both often costly, which may impact digital media use (Anderson, 2017).

In addition, it is unclear whether time spent on digital media has replaced time spent on older, legacy media or merely supplemented it. Like all people, adolescents have a limited number of hours in their days, suggesting that as digital media use increases, the use of legacy media will decline. On the other hand, use of digital media may enhance rather than reduce other activities if they increase overall interest in and access to media. These possibilities have been advanced in the literature on digital media use, with some scholars contending that digital media take time away from legacy media (Bauerlein, 2007; De Waal & Schoenbach, 2010; Ha & Fang, 2012; Kayany & Yelsma, 2000; Lee & Lee, 2015; Lee & Leung, 2008), whereas others have concluded that the

	2011	2012	2013	2014	2015	2016	<i>d</i> (hr) earliest to 2016	<i>d</i> (hr) 2010 to 2016
Digital media								
Internet (hr/day)								
8th	1.12 (1.61)	1.15 (1.65)	1.42 (1.92)	1.50 (1.99)	1.66 (2.07)	1.66 (2.03)	0.36 (0.62)	.32 (.58)
10th	1.24 (1.68)	1.34 (1.73)	1.54 (1.89)	1.79 (2.05)	1.78 (2.04)	1.92 (2.07)	0.54 (0.80)	.40 (.74)
12th	1.44 (1.76)	1.57 (1.88)	1.74 (1.93)	1.95 (2.01)	2.03 (2.09)	2.18 (2.14)	0.75 (1.12)	.60 (.83)
Texting (hr/day)								
8th	1.88 (2.39)	1.66 (2.24)	1.64 (2.21)	1.51 (2.12)	1.46 (2.10)	1.27 (1.89)	-0.27 (-0.57)	-.27 (-.57)
10th	2.34 (2.52)	2.11 (2.40)	2.06 (2.36)	2.02 (2.34)	1.77 (2.19)	1.68 (2.10)	-0.23 (-0.53)	-.23 (-.53)
12th	2.48 (2.50)	2.31 (2.39)	2.30 (2.42)	2.25 (2.35)	2.08 (2.30)	1.99 (1.25)	-0.21 (-0.40)	-.21 (-.40)
Social media (hr/day)								
8th	—	—	1.25 (1.98)	1.49 (2.14)	1.41 (2.07)	1.36 (1.99)	0.06 (0.11)	.06 (.11)
10th	—	—	1.34 (1.95)	1.73 (2.20)	1.61 (2.10)	1.63 (2.06)	0.14 (0.29)	.14 (.29)
12th	—	—	1.43 (1.95)	1.78 (2.14)	1.70 (2.11)	1.75 (2.13)	0.16 (0.32)	.16 (.32)
Social media (1–5 scale)								
8th	4.07 (1.43)	4.09 (1.38)	4.15 (1.35)	4.34 (1.27)	4.41 (1.22)	4.40 (1.23)	0.48	.30
10th	4.36 (1.19)	4.43 (1.11)	4.43 (1.13)	4.53 (1.07)	4.57 (1.05)	4.63 (0.97)	0.50	.35
12th	4.41 (1.13)	4.48 (1.07)	4.48 (1.07)	4.59 (0.99)	4.65 (0.89)	4.64 (0.94)	0.59	.37
Social media almost every day (%)								
8th	61%	59%	62%	72%	75%	75%	0.57	.38
10th	69%	71%	72%	79%	81%	83%	0.60	.43
12th	70%	72%	74%	81%	82%	82%	0.67	.44
Gaming (hr/day)								
8th	1.37 (1.87)	1.34 (1.82)	1.57 (2.01)	1.60 (2.05)	1.61 (2.05)	1.57 (1.98)	0.32 (0.52)	.15 (.28)
10th	1.25 (1.84)	1.32 (1.87)	1.45 (1.96)	1.62 (2.09)	1.45 (1.96)	1.54 (1.99)	0.39 (0.61)	.19 (.35)
12th	1.31 (1.83)	1.38 (1.93)	1.41 (1.93)	1.44 (1.89)	1.46 (1.97)	1.50 (1.98)	0.37 (0.58)	.11 (.21)
Legacy media								
Books								
12th # in last year	3.93 (4.02)	3.77 (4.04)	3.36 (3.740)	3.31 (3.84)	3.43 (3.84)	3.24 (3.87)	-0.46	-.14
12th books/magazines (1–5 scale)	3.52 (1.22)	3.43 (1.26)	3.29 (1.27)	3.17 (1.29)	3.07 (1.30)	3.03 (1.30)	-1.38	-.44
12th books/magazines every day	25%	24%	21%	18%	16%	16%	-0.94	-.24
Magazines (1–5 scale)								
8th	2.60 (1.23)	2.53 (1.22)	2.38 (1.21)	2.22 (1.16)	2.08 (1.12)	1.93 (1.08)	-1.50	-.66
10th	2.61 (1.16)	2.54 (1.16)	2.37 (1.14)	2.17 (1.10)	2.03 (1.07)	1.90 (1.03)	-1.60	-.76
Newspapers (1–5 scale)								
8th	2.03 (1.19)	1.95 (1.15)	1.85 (1.11)	1.76 (1.06)	1.71 (1.02)	1.62 (0.98)	-1.43	-.44
10th	2.24 (1.23)	2.16 (1.20)	2.00 (1.14)	1.88 (1.09)	1.82 (1.06)	1.71 (1.00)	-1.73	-.58
Going to movies (1–5 scale)								
8th	2.70 (0.74)	2.68 (0.73)	2.63 (0.74)	2.64 (0.73)	2.63 (0.72)	2.59 (0.72)	-0.37	-.22
10th	2.57 (0.68)	2.61 (0.67)	2.54 (0.67)	2.51 (0.67)	2.49 (0.67)	2.48 (0.67)	-0.35	-.25
12th	2.53 (0.66)	2.57 (0.65)	2.49 (0.66)	2.49 (0.66)	2.48 (0.67)	2.44 (0.66)	-0.42	-.27
TV (hr/day)								
8th	2.44 (1.63)	2.29 (1.57)	2.34 (1.63)	2.28 (1.63)	2.13 (1.60)	2.04 (1.61)	-0.57 (-0.91)	-.28 (-.45)
10th	2.21 (1.54)	2.10 (1.52)	2.06 (1.43)	2.01 (1.53)	1.86 (1.51)	1.81 (1.51)	0.47 (-0.72)	.25 (-.38)
12th (weekdays only)	2.13 (1.77)	2.07 (1.75)	1.89 (1.69)	1.88 (1.69)	1.87 (1.75)	1.87 (1.79)	-0.32 (-0.58)	-.14 (-.25)

Note Dashes indicate that the item was not asked during those years or that the survey was not conducted during those years for that age-group. *d* = difference in standard deviations. Differences in hours given in parentheses. All *ds* > .03 are significant at *p* < .05 or lower. For the 1–5 scale: never = 1, a few times a year = 2, once or twice a month = 3, at least once a week = 4, and almost every day = 5. Hours per day are estimated from the ranges given and are thus not precise. Standard deviations for the means are given in parentheses.

use of digital media increases legacy media use (Dienlin, Masur, & Trepte, 2017; Robinson & Martin, 2009; Vergeer & Pelzer, 2009).

This article has two primary goals. First, we aim to use large, nationally representative samples collected every year to determine how much time U.S. adolescents spent interacting with digital media, including texting, the Internet, social media, and gaming, and whether the frequency of digital media use has increased over the years. (Note that although texting is not media per se, it involves a screen and is a new form of communication; thus, we include it under digital media use.) Second, we seek to determine whether increases in time spent on digital media have been accompanied by increases or decreases in the use of legacy media (e.g., print, TV, and going to movies). Thus, instead of examining how these activities relate to each other among individuals, we seek to understand trends in leisure time media use at the group level (that of cohorts or generations; Twenge, 2014, 2017). Thus, we seek to examine how cultural change, in this case changes in technology, shapes how individuals use their time (Grossmann & Varnum, 2015; Varnum & Grossmann, 2017).

To accomplish these goals, we draw from large, nationally representative time-lag surveys of American adolescents: the Monitoring the Future (MtF) survey of 12th graders (conducted since 1976) and the MtF surveys of 8th and 10th graders (conducted since 1991). These surveys measure time spent on Internet use, texting, social media, electronic gaming, watching TV, reading print media, and going to movies. With their time-lag design surveying the same age-group over several decades, these surveys can disentangle time period and generational trends in adolescents' media use from age effects, as age is held constant (Schaie, 1965; Twenge, 2014). As the design is time lag (with a different sample every year) rather than longitudinal, the focus is on trends at the cohort level, not on tracing individuals' use over time (which would require a different design). Instead, we focus on whether (e.g.) iGen adolescents (those born after 1995) in the 2010s spent more or less time on digital media or legacy media compared with boomer (born 1946–1964), Generation X (1965–1979), and millennial (1980–1994) adolescents in the 1970s–2000s (Twenge, 2017).

Models of Media Use

Two competing models make different predictions about the relationship between new and legacy media use: the displacement model (Bauerlein, 2007; McComb, 1972) and the complementary model (Dutta-Bergman, 2004; Nguyen & Western, 2006). Each model presumes distinct underlying processes of media use. Although these models were primarily developed with adults in mind, adolescents face the same, or similar, issues of limited time (Janusik & Wolvin, 2009; van den Berg et al., 2012); thus, these models should apply to these populations as well. Time-use research demonstrates that media-based time-use clusters emerge in the study of adolescents independent of culture and geography (Ferrar, Chang, Li, & Olds, 2013), and although adolescents may have fewer work commitments than adults in structuring their time use, as digital natives they also face information overload and time inelasticity (Barber & Santuzzi, 2017; Serrano-Puche, 2017).

The displacement model tends to take one of two primary forms—functional or chronemic. Functional displacement is typically predicated on an individual-differences explanation or a media-based explanation. The individual-differences account hypothesizes that the use of digital media fulfills niches or affordances previously provided by a former medium. Displacement of media use occurs, as individuals seek to fulfill their uses and gratifications through digital media rather than legacy media. For example, printed books or magazines that previously fulfilled entertainment functions may be displaced by online sites and games. In contrast, the media-based explanation is that digital media are richer or more adaptive than legacy media and are

adopted as a normal process of innovation diffusion adoption decisions, in which the newer media fulfill existing affordances better and more enjoyably than older media (Newell et al., 2014). Digital media offer advantages over legacy media across a spectrum of uses and gratifications; for example, they are often on-demand, frequently updated, and/or portable.

The chronemic displacement perspective is generally predicated on an attention and information economy in which time and cognition are constraints on activity and media selection. Various theories have proposed an attention economy (Ciampaglia, Flammini, & Menczer, 2015; Huberman & Wu, 2008; Jang & Pasek, 2015; Simon, 1971; Wagner, 2015; Webster, 2014) or information ecology (Spitzberg, 2014; Weng, Flammini, Vespignani, & Menczer, 2012), in which messages and media compete for attention and any given activity must compete with other alternative activities. Digital media contents have an almost infinite capacity for expansion, but of course both available time and attention spans are limited (Jang & Pasek, 2015, p. 581). This creates a highly competitive environment in which information and media compete for time and attention (Ha & Fang, 2012; Simon, 1971). The chronemic model, therefore, predicts that the use of certain media more than others is due less to individual or function and more to time. Time spent on digital media is time that is not spent engaging some other medium or activity. Although some amount of “multitasking” (consuming more than one type of media at the same time) is possible, the chronemic displacement perspective assumes that multitasking would not completely account for the time displacement from one media type to another.

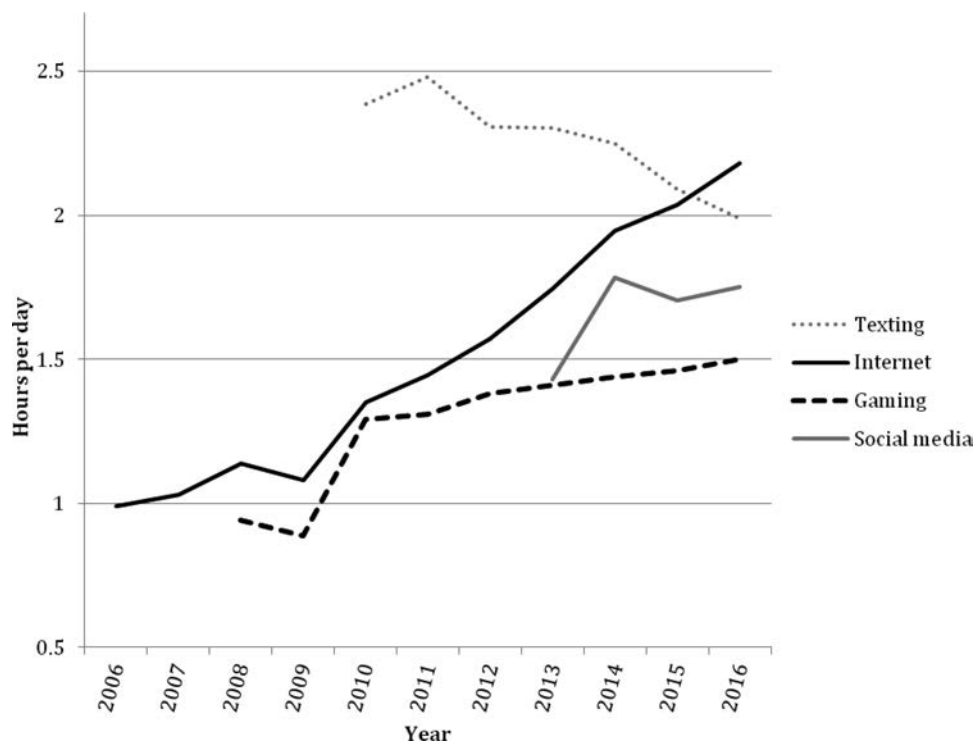


Figure 1. Digital media use, hours per day, 12th graders, 2006–2016.



Figure 2. Hours per day spent online, by gender, race/ethnicity, and SES, 8th and 10th graders, 2006–2016.

Both the functional and chronemic models of displacement would be supported by finding opposing trends in time spent on digital media compared with legacy media. That is, increases in digital media use will be accompanied by declines in the use of legacy media such

as TV, movies, books, newspapers, and magazines. The displacement model expects that teens will spend a relatively fixed amount of time on media consumption; therefore, time spent on the Internet and on mobile phones will decrease time spent on legacy media.



Figure 3. Hours per day spent online, by gender, race/ethnicity, and SES, 12th graders, 2006–2016.

In contrast, the complementary model hypothesizes that the use of digital media will have no effect on, or even increase, interest in legacy media. Digital media may reinforce and supplement the affordances of legacy media. Whereas the chronemic displacement model anticipates that time elasticity is made up by media replacement, the complementary model anticipates that time elasticity may be reflected in less sleep (Exelmans & Van den Bulck, 2017; LeBourgeois et al., 2017; Levenson, Shensa, Sidani, Colditz, & Primack, 2016; Lissak, 2018; Twenge, Krizan, & Hisler, 2017), travel (McDonald, 2015), physical activity (Iannotti, Kogan, Jansen, & Boyce, 2009; Spengler, Mess, & Woll, 2015), or leisure (Ortega et al., 2010; Vilhelmson, Thulin, & Elldér, 2017), or more time multitasking (Moreno et al., 2012; Rideout et al., 2010; Voorveld & van der Goot, 2013; Webster, 2014), also known as multiscreening/multitasking (Dias, 2016), including the use of digital media in the context of face-to-face social interaction (Belo Angeluci & Huang, 2015). Such activity-based chronemic elasticities permit legacy media and digital media to be more additive in time use.

Digital media may be additive to legacy media (Näsi & Räsänen, 2013). In several studies from the early to mid-2000s, those who used the Internet more heavily were actually more likely to participate in offline activities such as movies and sports (Robinson, 2011b) and were more likely to use older media (Robinson & Martin, 2009). Internet users were also more, not less, likely to participate in arts activities (Robinson, 2011a). New technology may facilitate the use of some legacy media; for example, books can now be bought and delivered to an electronic device instantly, and devices can hold hundreds of books. Magazines can be read online or on tablets.

Overall, digital media may provide efficiencies in achieving both mediated and unmediated affordances previously provided by legacy media without displacing those older media or activities (Blank & Groselj, 2014; Brandtzæg, 2012; Eynon & Malmberg, 2011; Ruppel & Burke, 2015). Thus, the complementary model would be supported by finding either little change or increased use of legacy media along with increased use of digital media.

Research Questions and Predictions of the Models

We seek to discover whether adolescents' use of legacy media has declined or increased as their use of digital media (presumably) increased. Because these surveys collect samples of different individuals every year, we focus on trends at the level of cohorts. Given that previous literature provides support for both the displacement and the complementary models, we do not propose a specific hypothesis favoring one over the other. We therefore propose the following questions:

Research Question 1: How much time do iGen adolescents spend on digital media (texting, social media, the Internet, and gaming), and how is this different in more recent cohorts/years? We expect that the use of digital media has increased.

Research Question 2: As use of digital media increased, did adolescents' use of legacy media (books, magazines, newspapers, TV, and movies) increase or decrease? The displacement model predicts that the use of legacy media will decrease, whereas the complementary model predicts that the use of legacy media will stay the same or increase.

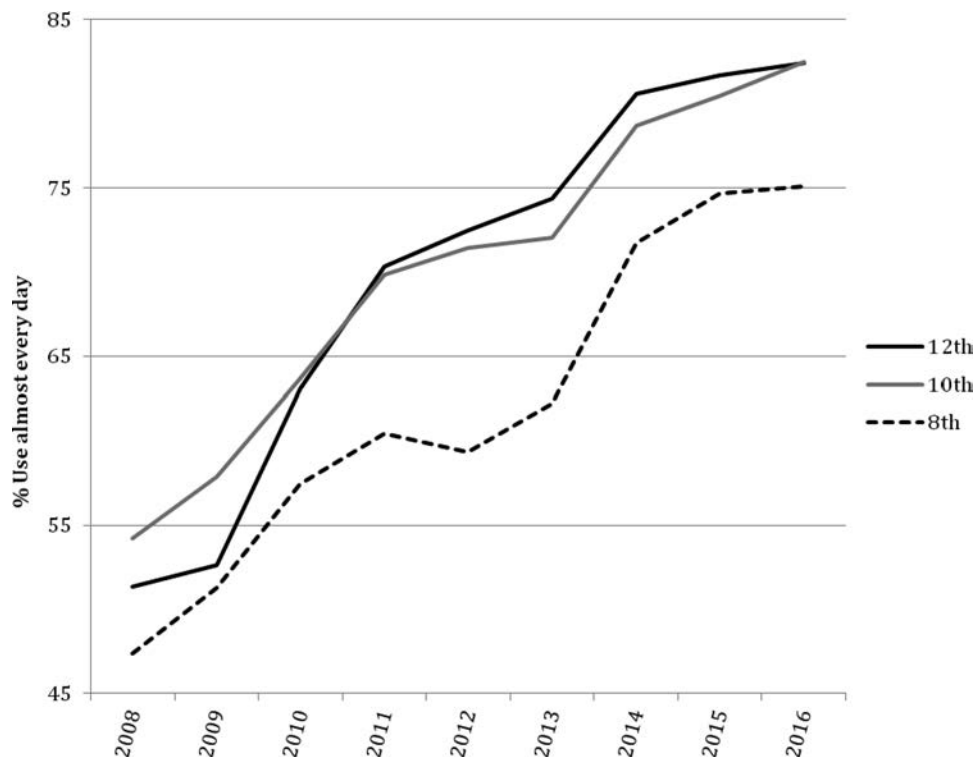


Figure 4. Percent of 8th, 10th, and 12th graders who use social media sites almost every day, 2008–2016.

Overall, our goal is to determine generational/cohort and time period trends in adolescents' media use. We seek to document how the introduction of digital media technologies including texting, social media, and Internet access interacted with adolescents' use of legacy media.

Method

Samples

The MtF survey samples middle and high schools across the United States chosen to represent a cross-section of the U.S. population. The participation rate of schools is between 66% and 80%, and the student participation rate is between 79% and 83% (Johnston, Bachman, O'Malley, Schulenberg, & Miech, 2017). About 15,000 students in each grade (8th, 10th, and 12th) are sampled each year in the spring. Some questions are only asked of subsamples (called a form). All procedures of the survey are annually reviewed and approved by the University of Michigan Institutional Review Board.

MtF surveyed a nationally representative sample of 12th graders (high school seniors) each year since 1976 and 8th and 10th graders since 1991 (on items included here, maximum N for 8th graders = 440,279; N for 10th graders = 400,826; and N for 12th

graders = 180,104). MtF data are publicly available online as SPSS data files up to 2016 (Johnston et al., 2017).

Because these samples are nationally representative, the demographics reflect those of U.S. adolescents as a whole. Until 2004, the survey measured race/ethnicity as Black and White only; in 2005 and later, it categorized students as Black, White, and Hispanic, with other groups marked as missing values. For 12th graders, from 2005 to 2016, 12% were Black, 56% White, 15% Hispanic, and 18% missing. For 8th and 10th graders, from 2005 to 2016, 12% were Black, 52% White, 17% Hispanic, and 19% missing. SES was assessed by parental education; we used mother's education, as it had less missing data than father's education. Across all years 1976–2016 for 12th graders, 32% of their mothers completed college. Across all years 1991–2016 for 8th and 10th graders, 43% of their mothers completed college. The samples were 51% female across all grades and time periods.

Measures

Digital media. An item on Internet use was asked beginning in 2006: "Not counting work for school or a job, about how many hours a week do you spend on the Internet e-mailing, instant messaging, gaming, shopping, searching, downloading music, etc.?" Response choices from 2006 to 2009 were recoded to none = 0, less than 1 hr = 0.5, 1–2 hr = 1.5, 3–5 hr = 4, 6–9 hr =

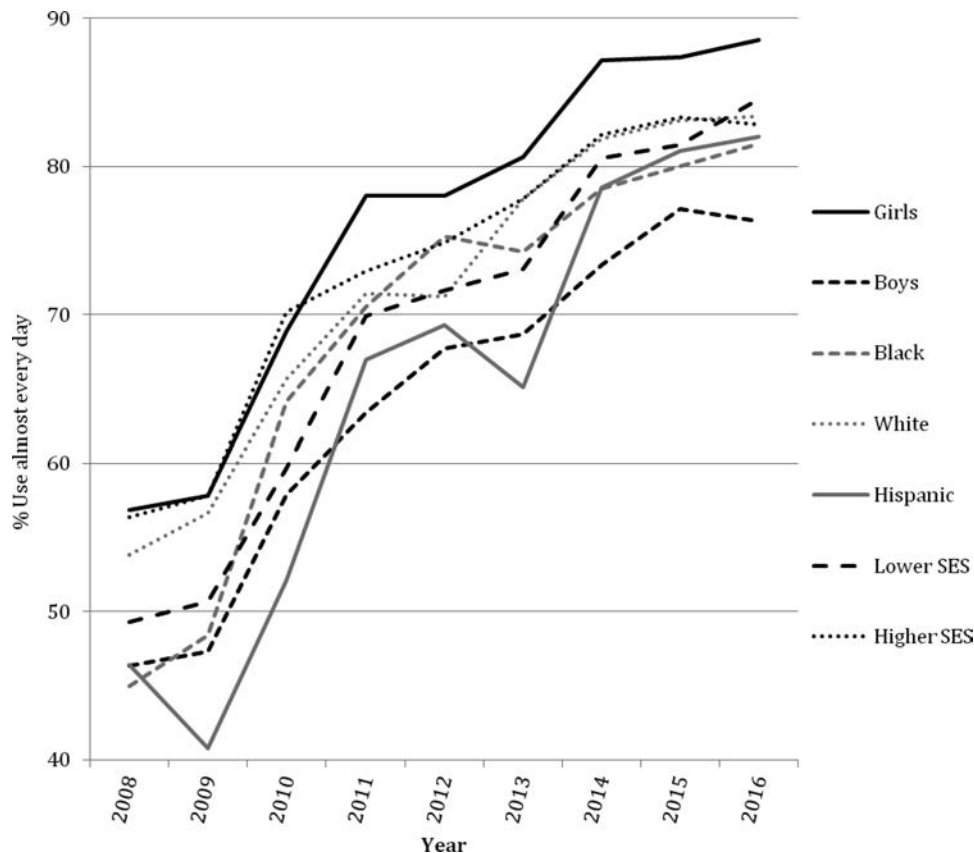


Figure 5. Percent of 12th graders who use social media sites almost every day, by gender, race/ethnicity, and SES, 2008–2016.

7.5, 10–19 hr = 14.5, 20–29 hr = 24.5, and 30 hr or more = 35. In 2010–2016, “30 hr or more” became 30–39 hr and a new choice, 40 hr or more, was added; we estimated these as 30–39 hr = 34.5 and 40 hr or more = 45. Because the choices differed between 2009 and 2010, changes over these time periods should be interpreted with caution. We divided the numbers by 7 to obtain a daily average.

In 2008, an item on gaming was added: “About how many hours a week do you spend . . . playing electronic games on a computer, TV, phone, or other device?,” with the same response choices in hours as aforementioned, also shifting between 2009 and 2010. In 2010, the item “texting on a cell phone” was added, and in 2013, “social networking websites like Facebook, Twitter, Instagram, etc.” was added, both with the same response choices in hours. In 2008 for 12th graders and in 2009 for 8th and 10th graders, the item “visit social networking websites (like Facebook)” (until 2011, “like MySpace or Facebook”) was asked with the response choices of never = 1, a few times a year = 2, once or twice a month = 3, at least once a week = 4, and almost every day = 5.

Legacy media. Students were asked, “How often do you do each of the following?” Items on legacy media included “go to movies” (for 8th, 10th, and 12th), “read books, magazines, or newspapers” (12th), “read newspapers” (8th and 10th), and “read magazines” (8th and 10th). Response choices were never = 1, a few times a year = 2, once or twice a month = 3, at least once a week = 4, and almost every day = 5. The 12th graders were also asked, “In the past year, how many books have you read just because you wanted to—that is, without their being assigned?”

with response choices recoded to none = 0, one = 1, two to five = 3.5, six to nine = 7.5, and 10 or more = 12.

All grades were asked, “How much TV do you estimate you watch on an average weekday?” Response choices were recoded to none = 0, 0.5 hr or less = .25, about 1 hr = 1, about 2 hr = 2, about 3 hr = 3, about 4 hr = 4, and 5 hr or more = 6. The 8th- and 10th-grade surveys also asked: “How much TV do you estimate you watch on an average weekend (both Saturday and Sunday combined)?” Response choices were recoded to none = 0, an hour or less = 0.5, 1–2 hr = 1.5, 3–4 hr = 3.5, 5–6 hr = 5.5, 7–8 hr = 7.5, and 9 hr or more = 10. For the 8th and 10th graders, the weekday responses were multiplied by 5, added to the weekend responses, and divided by 7 to obtain a daily estimate.

Data Analysis Plan

Data collected over time can be analyzed in various ways, including grouping by generation blocks (e.g., boomers, Gen X, millennials, and iGen), by decades, or by individual year. We separated the older data into 5-year intervals (e.g., 2000–2004) to provide a compromise between specificity and breadth, dividing at the decade and half-decade marks to enable references to specific time periods (e.g., “the early 2000s,” for 2000–2004). For the years 2010 and later, we display the year-by-year data. We calculated *ds* (difference in standard deviations) between the first and last groups of years but also provide the means and standard deviations so differences between all time points are apparent. In addition, the year-by-year results are portrayed in figures for many variables. Due to the large sample sizes, we focused primarily on

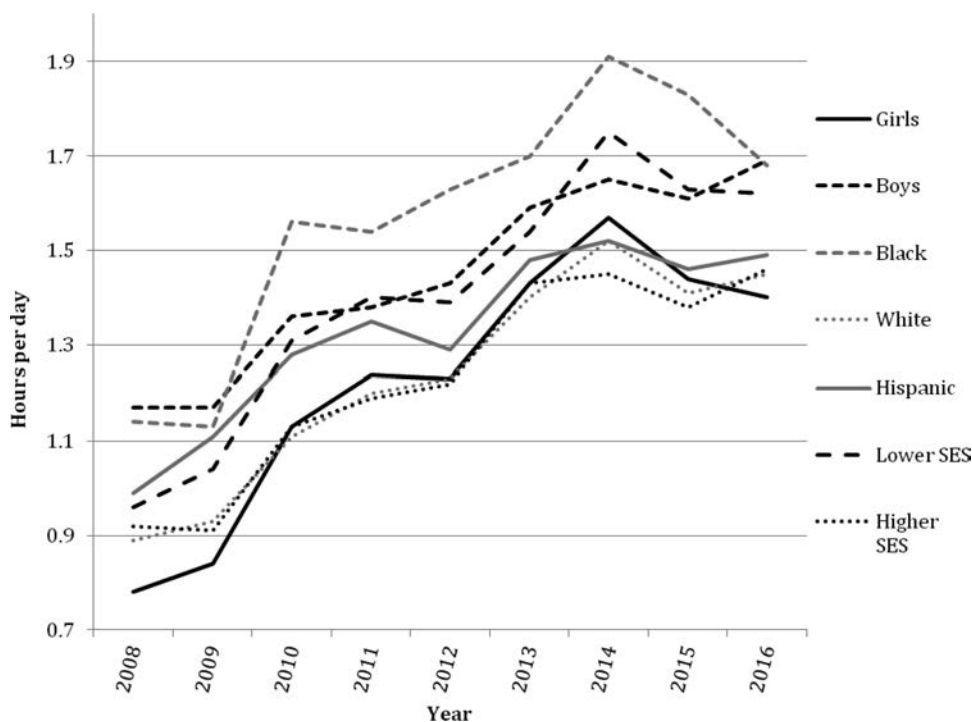


Figure 6. Hours per day spent on electronic gaming, by gender, race/ethnicity, and SES, 8th and 10th graders, 2008–2016.

effect sizes rather than statistical significance. As a general rule, we reported means in the tables and some results as percentages in the text or figures. We examined sex, race/ethnicity (White, Black, and Hispanic), and SES (mother without a college degree = lower SES and mother with a college degree = higher SES) as moderators of the cohort/time period differences, reporting those results primarily in figures.

Results

Digital Media

In the mid-2010s, the average American 12th grader reported spending approximately 2 hr a day texting, just over 2 hr a day on the Internet (which includes gaming), and just under 2 hr a day on social media and thus about 6 hr a day in total on three digital media activities during leisure time (Table 1). In comparison, 10th graders and 8th graders reported spending about 5 hr and 4 hr a day, respectively, in total on these three activities.

Use of digital media increased substantially over time (Table 1 and Figure 1). Twelfth graders' reported Internet use during leisure time doubled between 2006 and 2016 (from about 1 hr a day to about 2 hr a day); 8th graders' online time increased 68% and 10th graders' online time increased 75%. These usage rates and increases in Internet use were fairly uniform across gender, race/ethnicity, and SES (Figures 2 and 3). Whereas in 2006, higher SES 12th graders reported spending more time online than those lower

in SES (1.12 hr vs. 0.91 hr), by 2016, higher SES 12th graders reported spending less time online than those lower in SES (2.12 hr vs. 2.28 hr).

Fifty-two percent of 12th graders said they visited social media sites "almost every day" in 2008, compared with 82% in 2016, with comparable increases for 8th and 10th graders (Table 1 and Figure 4). Thus, social media sites went from a daily activity for half of the adolescents to a daily activity for the vast majority. Similarly, the percentage of 12th graders who reported using social media less than once a week declined from 27% in 2008 to 8% in 2016. These increases appeared across gender, race/ethnicity, and SES (Figure 5). Girls used social media more consistently than boys did (89% of 12th graders reported visiting every day in 2016, vs. 76% of boys), with the cohort/time period difference in daily social media use larger for girls ($d = .74$ 2008–2016, vs. $d = .64$ for boys). The cohort/time period difference in daily use was also slightly larger for Black ($d = .81$) and Hispanic ($d = .81$) 12th graders compared with White ($d = .67$) 12th graders. The increase was larger for lower SES 12th graders ($d = .80$) compared with higher SES 12th graders ($d = .60$); although higher SES teens were once slightly more likely to visit social media sites every day, by 2016, lower SES teens were slightly more likely to do so (85% vs. 83%).

Recent adolescents also reported spending more time on gaming; for example, 10th graders spent 21 more minutes a day on gaming in 2016 compared with 2010 (Table 1). The cohort/time



Figure 7. Reading books and magazines, 12th graders, 1976–2016.

period difference was fairly uniform across gender, race/ethnicity, and SES, with boys reporting spending more time than girls (1.69 hr/day in 2016, vs. 1.40 hr/day for girls). Black 8th and 10th graders reported spending more time gaming (1.68 hr/day) than White (1.45 hr/day) and Hispanic (1.49 hr/day) 8th and 10th graders. Lower SES 8th and 10th graders reported spending more time gaming than higher SES 8th and 10th graders (Figure 6). The only exception to the upward trends was texting, which adolescents reported spending less time on in 2016 compared with 2010 (e.g., 32 fewer minutes a day among 10th graders).

Legacy Media

As adolescents reported spending more time with digital media, they reported spending less time with legacy media (books, magazines, newspapers, TV, and movies), in support of the displacement model. The decline in print media was especially steep (Table 1 and Figure 7; several effect sizes exceed $d = -1.00$). In the early 1990s, 33% of 10th graders said they read newspapers almost every day; by 2016, only 2% did. In the late 1970s, 60% of 12th graders said they read a book or magazine almost every day; by 2016, only 16% did. Twelfth graders reported reading two fewer books a year on average in 2016 compared with the late 1970s, and the number who said they did not read any books for

pleasure nearly tripled, reaching one out of three by 2016. The cohort/time period differences in reading books and magazines were fairly uniform across gender, race/ethnicity, and SES (Figure 8).

As Figures 7 and 9 show, the decline in reported reading of books, magazines, and newspapers began in the early 1980s. There was a brief reprieve in the mid-2000s when electronic books were introduced, but print media use continued its downward slide after 2008. (Note that the questions on books, magazines, and newspapers do not specify whether the format is print or electronic, as the question wording was constant over the decades.)

iGen adolescents also reported spending less time watching TV (Table 1 and Figure 9). In the early 1990s, 22% of 8th graders spent 5 hr or more a day watching TV on weekdays, which decreased to 13% by the mid-2010s; 8th graders spent almost an hour less watching TV in 2016 compared with the early 1990s. For 12th graders, time spent online exceeds TV time by 19 min. The cohort/time period decline in watching TV leveled off among 12th graders since 2013 but continued a downward slide among 8th and 10th graders (Table 1 and Figure 4). The cohort/time period differences in TV watching were fairly uniform across gender, but both usage and the cohort/time period difference were larger among Black 8th and 10th graders ($d = -.83$ comparing 1991–1994 and 2016 vs. $d = -.52$ for White 8th and 10th graders).



Figure 8. Percent of 12th graders who read a book or magazine for pleasure almost every day, by gender, race/ethnicity, and SES, 1976–2016.

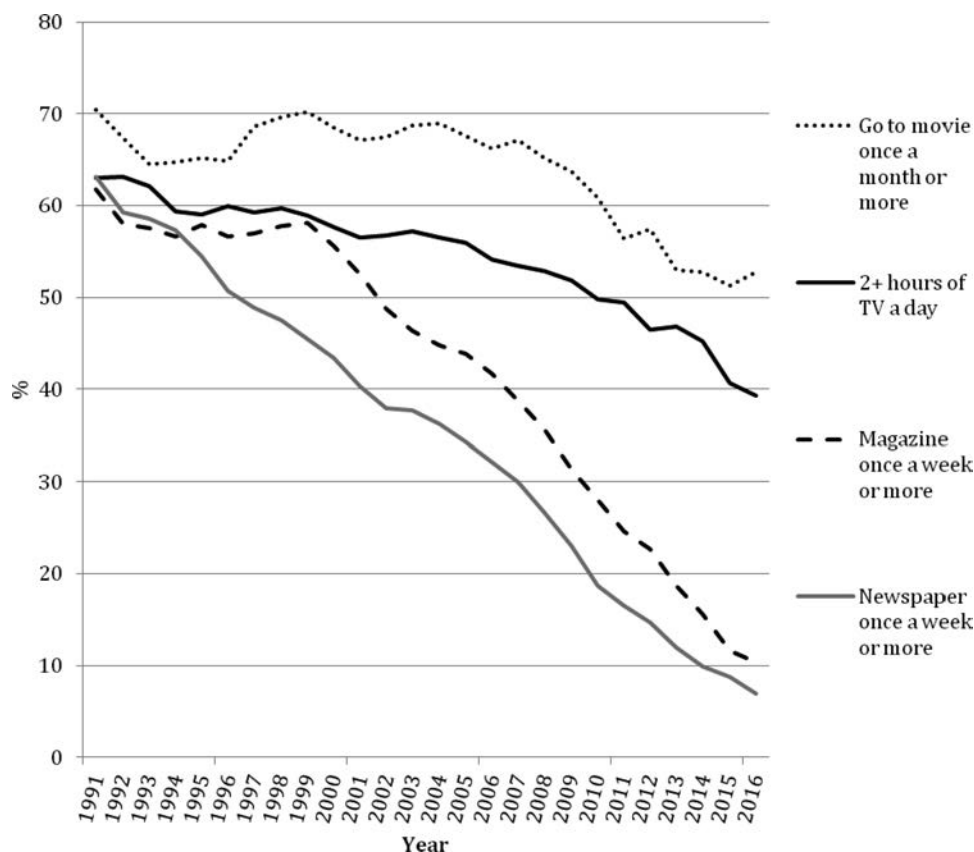


Figure 9. Legacy media use, 8th and 10th graders, 1991–2016.

Usage and the cohort/time period difference were also larger among lower SES 8th and 10th graders ($d = -.54$) than higher SES 8th and 10th graders ($d = -.48$; Figure 10).

Adolescents are also less likely to report going to movies. In the late 1970s, 64% of 12th graders went to movies at least a few times a month; by 2016, only 44% did, with similar declines among 8th and 10th graders (Figure 4). Declines were fairly similar across gender, race/ethnicity, and SES.

Although TV use has declined, it is still at a relatively high rate (about 2 hr a day). Combining TV, texting, Internet use, and social media, 12th graders in 2016 reported spending just under 8 hr a day with screens on average during their leisure time, not counting any screen time they experienced in the classroom, while doing homework, or while working for pay. In the late 1970s, before the widespread availability of computers and cell phones, adolescents reported spending about 2.5 hr a day with screens, all of it watching TV. Thus, adolescents' total screen time nearly tripled between the late 1970s and 2016.

Summary: Z-Scored Variables

To understand the trends in context with each other, we Z-scored Internet use, book and magazine reading, and weekday TV viewing for 12th graders since 2006. As Figure 11 illustrates, time spent on the Internet has steadily increased, and time spent on print media has steadily declined. TV viewing declined as well, particularly after 2011.

Discussion

iGen adolescents in the United States reported spending 4–6 hr a day on average with digital media, including the Internet, texting, and social media. Reported time spent online, gaming, and on social media sites steadily increased. Over the same time period, adolescents reported spending less time with legacy media such as print, TV, and going to movies. The results favor the displacement model, suggesting that as digital media occupy more of adolescents' time, adolescents spend less time on legacy media.

These results diverge from the complementary model, which predicted the same or more use of legacy media as digital media use increased. The crucial difference may stem from the level of analysis. Here, we examined trends at the group level, namely, how cohorts of adolescents spent their time. The studies supporting the complementary model, however, were generally at the individual level. Among individuals, those who (e.g.) watch TV may be more likely to spend time online, likely due to individual differences in interest in media and in time availability. At the level of a cohort, however, when digital media use is higher on average, legacy media use is lower on average, demonstrating effects of cultural change in technology.

The displacement model conforms to some relatively unassailable facts of communication: Information (Hilbert & López, 2011) and mediated access to such media (Backstrom, Boldi, Rosa, Ugander, & Vigna, 2012; Daraghmi & Yuan, 2014) are increasing, whereas time (Liang & Fu, 2015; Malmgren, Stouffer, Campan-



Figure 10. Hours per day spent watching TV, 8th and 10th graders, by gender, race/ethnicity, and SES, 1991–2016.

haro, & Amaral, 2009) and the number of meaningful relationships we can sustain remain constrained (Arnaboldi, Guazzini, & Passarella, 2013; Liang & Fu, 2015; Mac Carron, Kaski, & Dunbar, 2016). Information expands, but the time needed to absorb it does not. The elasticity of time use is limited. In a competitive attention economy, every action and relationship therefore is to some degree another action and relationship foregone.

The results on reading books contrast with those of the Pew Center, which found millennials were more likely to read books than Gen Xers and boomers (Zickuhr & Rainie, 2014). However, the Pew study was conducted at one time and thus cannot separate the effects of age and generation. It is likely that millennials read more books because more were still enrolled in school. Here, age and student status were constant, and millennials and iGeners read markedly less than Gen Xers and boomers did at the same age, with effect sizes exceeding the $d = .80$ criteria for a large effect size (Cohen, 1988).

Implications

The pronounced shift away from legacy media and toward digital media among adolescent populations has implications across several areas. First, college faculty can expect that iGen students will have less experience reading longer form print, especially books, which may make it more difficult for them to complete class readings (Bartolomeo-Maida, 2016). Education will increasingly have to adapt as students experience the intake of information in fundamentally different ways. In addition, young

digital media users tend to switch between tasks at a rapid pace, often every few seconds (Yeykelis, Cummings, & Reeves, 2014), a different model of attention than in previous generations, with still-unknown implications for education and the workplace. In business, marketers and advertisers will find that young consumers can be reached nearly exclusively online rather than through print, with TV a useful but shrinking medium for advertising to younger consumers (Southgate, 2017).

These trends in media use were fairly consistent across gender, race/ethnicity, and SES, with all groups showing increases in digital media use and declines in legacy media use. In terms of main effects, girls reported visiting social media sites more frequently than boys, and boys reported spending more time on electronic gaming. Although lower SES adolescents once reported spending slightly less time with digital media, by 2016, there were few differences in digital media use by SES, suggesting that the adoption of smartphones may have narrowed or eliminated any Internet gap that once existed by social class, at least among adolescents.

Limitations

As these surveys sample U.S. participants exclusively, our conclusions are limited to the United States and may not apply to other nations (Boniel-Nissim et al., 2015). Because the samples are all nationally representative, however, they should apply to U.S. students at each educational level.

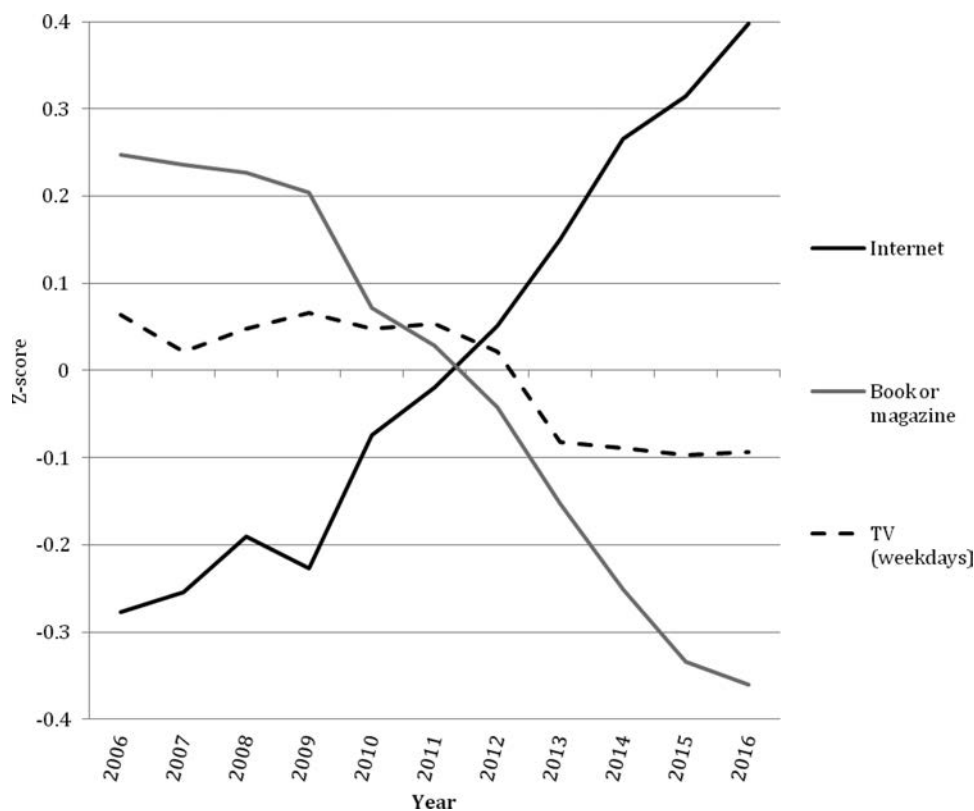


Figure 11. Internet use, book or magazine reading, and TV viewing on weekdays (Z-scored), 12th graders, 2006–2016.

The time-use items in these surveys have limitations. First, they are self-report, and thus subject to the usual biases of self-report measures over more objectively measured indicators. Second, they are retrospective, asking participants to reflect activities over past weeks, rather than contemporaneous time-diary studies, the gold standard in time-use research. However, experience-sampling methods are relatively recent (Rich, Bickham, & Shrier, 2015; Scherer, Bickham, Shrier, & Rich, 2015) and (to our knowledge) have not been used in nationally representative samples going back many decades. Fortunately, comparisons of survey responses and experience sampling in the same individuals show that survey estimates are consistent with experience-sampling results, especially for regularly occurring activities (Sonnenberg, Riediger, Wrzus, & Wagner, 2012). Third, participants are asked to respond using broad response categories (e.g., 6–9 hr), which we then averaged. Thus, the estimates of hours per day spent on these activities are not completely precise and should be considered estimates.

Fourth, there is a need to consider the time-use items in relation to other factors. For example, research indicates that parental use of media time is significantly correlated to children's use of media time (Lauricella, Wartella, & Rideout, 2015). Thus, even though there are generational differences in media use, within social units, one generation is interdependent on the next, and older individuals as well as younger ones are affected. Studies of multiage samples over time are needed to separate generational and time period effects—for example, to determine if older people's media use shows the same trends over time as these young populations do.

Fifth, research indicates that absolute time estimates, such as number of hours per day using a medium, can produce results quite different from relative time estimates, such as amount of time out of a media-use time budget (Lee & Leung, 2008). However, previous research using the MTF data sets found that time spent on extracurricular activities stayed fairly constant, whereas time spent on homework and paid work was lower among recent cohorts of adolescents, suggesting iGen adolescents have more leisure time to devote to media consumption, not less (Twenge & Park, 2018). In addition, iGen adolescents spend less time sleeping (Twenge et al., 2017) and less time on face-to-face social interaction (Twenge & Campbell, 2018), again suggesting more time available for media consumption. Further, several recent studies find that digital media use tends not to displace face-to-face social interaction (Boniel-Nissim et al., 2015; Dienlin et al., 2017; Hall et al., 2018), social capital (Hooghe & Oser, 2015), core discussion networks (Vriens & van Ingen, 2017), or social support (Patulny & Seaman, 2017), although more studies at the group or cohort level over time are needed.

The wording of the questions on reading books, magazines, and newspapers stayed constant over time and does not specify format. Consistent wording in items is generally a strength in research on cohort and time period trends. However, the consistent and neutral wording also means we cannot be certain if students in more recent years interpreted these questions to include reading books, magazines, or newspapers on an electronic device (such as an iPad or Kindle) or online (such as reading a newspaper article online). It seems likely that students might not associate reading an online

news article with reading the same in a print version. However, given that a book is clearly a book whether read on an e-reading device or on paper, the lack of specificity in the questioning is unlikely to have affected the results for books (Sehn & Fragoso, 2015). Thus, this issue of platform may affect the results on the items on newspaper and perhaps magazine reading more than those on books. Similarly, the item on watching TV does not specify format, so in recent years, some adolescents may have included time watching online videos under that time, and some may not. There may also be variation in whether TV shows watched on tablets are included (including those accessed via apps such as Netflix or Hulu). If teens include some of these activities under TV time, the decline in watching TV on an actual TV set is likely even more pronounced than what is reported here. On the other hand, if adolescents are not including time watching online videos and Netflix shows here, it suggests that their digital media time may include some TV or TV-like activities.

In addition, these surveys did not ask about or account for multitasking (i.e., engaging in two or more activities at the same time), which can introduce measurement error in media-use time estimates (Webster, 2014). Thus, it is possible that adolescents' screen time is lower than what is reported here, as they may have been counting time they spent (e.g.) texting and on the Internet in both categories. There is some evidence that iGeners' TV time increasingly consists of multiscreen time (Andò, Pizza, & Corsini, 2016; Dias, 2016; Marinelli & Andó, 2014; McGill, Williamson, & Brewster, 2015; Segijn, Voorveld, Vandenberg, & Smit, 2017), but such a trend in use would seem unlikely to result in the inverse relationship observed in this study between legacy and digital media. In addition, the measure of texting is limited, as it asks about time spent rather than number of messages sent and received.

Overall, we were limited by the questions asked on these large, nationally representative overtime surveys. The questions on texting, Internet use, and social networking websites were not asked until these activities were already widespread, depriving us of the opportunity to document the early growth of digital media in the early 2000s. Nevertheless, they provide a rare view of media use in a large, nationally representative survey conducted over several years.

Conclusions

As adolescents spent more time on digital media, they spent less time with legacy media, including books, magazines, and TV. In many cases, the declines were the most pronounced since the mid-2000s, when smartphones became available and high-speed Internet access became widespread. The extraordinary amount of time iGen adolescents spend on digital media (about 6 hr a day as of 2016) appears to have taken time away from legacy media, especially print. These findings favor the previous theories and research suggesting that digital media displaces and reduces the use of legacy media. They also provide a vivid example of the interplay between culture and individuals.

References

- Anderson, M. (2017). *Digital divide persists even as lower-income Americans make gains in tech adoption*. Washington, DC: Pew Research Center.
- Andò, R., Pizza, S., & Corsini, F. (2016). Watching television today. A comparative survey of Italian and American students' habits in front of television. *Journal of Italian Cinema and Media Studies*, 4, 283–306. http://dx.doi.org/10.1386/jicms.4.2.283_1
- Arnaboldi, V., Guazzini, A., & Passarella, A. (2013). Egocentric online social networks: Analysis of key features and prediction of tie strength in Facebook. *Computer Communications*, 36, 1130–1144. <http://dx.doi.org/10.1016/j.comcom.2013.03.003>
- Backstrom, L., Boldi, P., Rosa, M., Ugander, J., & Vigna, S. (2012, January 6). Four degrees of separation. *Proceedings of the 4th Annual ACM Web Science Conference* (pp. 33–42). New York, NY: ACM. <http://dx.doi.org/10.1145/2380718.2380723>
- Barber, L. K., & Santuzzi, A. M. (2017). Telepressure and college student employment: The costs of staying connected across social contexts. *Stress and Health*, 33, 14–23. <http://dx.doi.org/10.1002/smi.2668>
- Bartolomeo-Maida, M. (2016). The use of learning journals to foster textbook reading in the community college psychology class. *College Student Journal*, 50, 440–453.
- Bauerlein, M. (2007). *The dumbest generation: How the digital age stupefies young Americans and jeopardizes our future*. New York, NY: Tarcher Penguin.
- Belo Angeluci, A. C., & Huang, G. (2015). Rethinking media displacement: The tensions between mobile media and face-to-face interaction. *Revista FAMECOS - Midia, Cultura E Tecnologia*, 22, 122–139.
- Blank, G., & Groselj, D. (2014). Dimensions of internet use: Amount, variety, and types. *Information Communication and Society*, 17, 417–435. <http://dx.doi.org/10.1080/1369118X.2014.889189>
- Boniell-Nissim, M., Lenzi, M., Zsiros, E., de Matos, M. G., Gommans, R., Harel-Fisch, Y., . . . van der Sluijs, W. (2015). International trends in electronic media communication among 11- to 15-year-olds in 30 countries from 2002 to 2010: Association with ease of communication with friends of the opposite sex. *European Journal of Public Health*, 25(Suppl. 2), 41–45. <http://dx.doi.org/10.1093/eurpub/ckv025>
- Brandtzæg, P. B. (2012). Social networking sites: Their users and social implications—A longitudinal study. *Journal of Computer-Mediated Communication*, 17, 467–488. <http://dx.doi.org/10.1111/j.1083-6101.2012.01580.x>
- Callejo, J. (2013). Media time use among adolescents and young adults: Analysis of differences. *Comunicación y Sociedad*, 26, 1–26.
- Campos-Castillo, C. (2015). Revisiting the first-level digital divide in the United States: Gender and race/ethnicity patterns, 2007–2012. *Social Science Computer Review*, 33, 423–439. <http://dx.doi.org/10.1177/0894439314547617>
- Chen, J., Shaw, S.-L., Yu, H., Lu, F., Chai, Y., & Jia, Q. (2011). Exploratory data analysis of activity diary data: A space-time GIS approach. *Journal of Transport Geography*, 19, 394–404. <http://dx.doi.org/10.1016/j.jtrangeo.2010.11.002>
- Ciampaglia, G. L., Flammini, A., & Menczer, F. (2015). The production of information in the attention economy. *Scientific Reports*, 5, 9452. <http://dx.doi.org/10.1038/srep09452>
- Cohen, J. (1988). *Statistical power in the behavioral sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.
- Common Sense Media. (2015). *The common sense census: Media use by tweens and teens*. Retrieved from <https://www.common sense media.org/research/the-common-sense-census-media-use-by-tweens-and-teens>
- Common Sense Media. (2016). *The common sense census: Plugged-in parents of tweens and teens 2016*. Retrieved from <https://www.common sense media.org/research/the-common-sense-census-plugged-in-parents-of-tweens-and-teens-2016>
- Daraghmi, E. Y., & Yuan, S.-M. (2014). We are so close, less than 4 degrees separating you and me! *Computers in Human Behavior*, 30, 273–285. <http://dx.doi.org/10.1016/j.chb.2013.09.014>

- De Waal, E., & Schoenbach, K. (2010). News sites' position in the mediascape: Uses, evaluations and media displacement effects over time. *New Media and Society*, *12*, 477–496.
- Dias, P. (2016). Motivations for multi-screening: An exploratory study on motivations and gratifications. *European Journal of Communication*, *31*, 678–693. <http://dx.doi.org/10.1177/0267323116674111>
- Dienlin, T., Masur, P. K., & Trepte, S. (2017). Reinforcement or displacement? The reciprocity of FTF, IM, and SNS communication and their effects on loneliness and life satisfaction. *Journal of Computer-Mediated Communication*, *22*, 71–87. <http://dx.doi.org/10.1111/jcc4.12183>
- Dutta-Bergman, M. J. (2004). Complementarity in consumption of news types across traditional and digital media. *Journal of Broadcasting and Electronic Media*, *48*, 41–60. http://dx.doi.org/10.1207/s15506878jobem4801_3
- Emanuel, R., Adams, J., Baker, K., Daufin, E. K., Ellington, C., Fitts, E., . . . Okeowo, D. (2008). How college students spend their time communicating. *International Journal of Listening*, *22*, 13–28. <http://dx.doi.org/10.1080/10904010701802139>
- Exelmans, L., & Van den Bulck, J. (2017). Bedtime, shuteye time and electronic media: Sleep displacement is a two-step process. *Journal of Sleep Research*, *26*, 364–370. <http://dx.doi.org/10.1111/jsr.12510>
- Eynon, R., & Malmberg, L. (2011). A typology of young people's Internet use: Implications for education. *Computers and Education*, *56*, 585–595. <http://dx.doi.org/10.1016/j.compedu.2010.09.020>
- Ferrar, K., Chang, C., Li, M., & Olds, T. S. (2013). Adolescent time use clusters: A systematic review. *Journal of Adolescent Health*, *52*, 259–270. <http://dx.doi.org/10.1016/j.jadohealth.2012.06.015>
- Gardner, H., & Davis, K. (2013). *The App Generation: How today's youth navigate identity, intimacy, and imagination in a digital world*. New Haven, CT: Yale University Press.
- GfK. (2014). *Teens' time spent online grew 37% since 2012, outpacing other age groups*. Retrieved from <http://www.gfk.com/us/news-and-events/press-room/press-releases/pages/teens-time-spent-online-grew-37-since-2012.aspx>
- González, M. C., Hidalgo, C. A., & Barabási, A. L. (2008). Understanding individual human mobility patterns. *Nature*, *453*, 779–782. <http://dx.doi.org/10.1038/nature06958>
- Grossmann, I., & Varnum, M. E. (2015). Social structure, infectious diseases, disasters, secularism, and cultural change in America. *Psychological Science*, *26*, 311–324. <http://dx.doi.org/10.1177/09567971614563765>
- Ha, L., & Fang, L. (2012). Internet experience and time displacement of traditional news media use: An application of the theory of the niche. *Telematics and Informatics*, *29*, 177–186. <http://dx.doi.org/10.1016/j.tele.2011.06.001>
- Hall, J. A., Kearney, M. W., & Xing, C. (2018). Two tests of social displacement through social media use. *Information Communication and Society*. Advance online publication. <http://dx.doi.org/10.1080/1369118X.2018.1430162>
- Hanson, T. L., Drumheller, K., Mallard, J., McKee, C., & Schlegel, P. (2010). Cell phones, text messaging, and Facebook: Competing time demands of today's college students. *College Teaching*, *59*, 23–30. <http://dx.doi.org/10.1080/87567555.2010.489078>
- Hilbert, M., & López, P. (2011). The world's technological capacity to store, communicate, and compute information. *Science*, *332*, 60–65. <http://dx.doi.org/10.1126/science.1200970>
- Hooghe, M., & Oser, J. (2015). Internet, television and social capital: The effect of 'screen time' on social capital. *Information Communication and Society*, *18*, 1175–1199. <http://dx.doi.org/10.1080/1369118X.2015.1022568>
- Huberman, B. A., & Wu, F. (2008). The economics of attention: Maximizing user value in information-rich environments. *Advances in Complex Systems*, *11*, 487–496. <http://dx.doi.org/10.1142/S0219525908001830>
- Iannotti, R. J., Kogan, M. D., Janssen, I., & Boyce, W. F. (2009). Patterns of adolescent physical activity, screen-based media use, and positive and negative health indicators in the U.S. and Canada. *Journal of Adolescent Health*, *44*, 493–499. <http://dx.doi.org/10.1016/j.jadohealth.2008.10.142>
- Jackson, L. A., Zhao, Y., Kolenic, A., III, Fitzgerald, H. E., Harold, R., & Von Eye, A. (2008). Race, gender, and information technology use: The new digital divide. *Cyberpsychology and Behavior*, *11*, 437–442. <http://dx.doi.org/10.1089/cpb.2007.0157>
- Jang, S. M., & Pasek, J. (2015). Assessing the carrying capacity of Twitter and online news. *Mass Communication & Society*, *18*, 577–598. <http://dx.doi.org/10.1080/15205436.2015.1035397>
- Janusik, L. A., & Wolvin, A. D. (2009). 24 hours in a day: A listening update to the time studies. *International Journal of Listening*, *23*, 104–120. <http://dx.doi.org/10.1080/10904010903014442>
- Johnston, L. D., Bachman, J. G., O'Malley, P. M., Schulenberg, J. E., & Miech, R. A. (2017). *Monitoring the Future: A Continuing Study of American Youth* (12th-Grade Survey), 2016. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2017-10-26. <http://dx.doi.org/10.3886/ICPSR36798.v1>
- JWT. (2012). "Gen Z: Digital in Their DNA," April 2012. Retrieved from http://icabrazil.org/2016/files/557-corporateTwo/downloads/F_INTERNAL_Gen_Z_0418122.pdf
- Kayany, J. M., & Yelsma, P. (2000). Displacement effects of online media in the socio-technical contexts of households. *Journal of Broadcasting and Electronic Media*, *44*, 215–229. http://dx.doi.org/10.1207/s15506878jobem4402_4
- Lauricella, A. R., Cingel, D. P., Blackwell, C., Wartella, E., & Conway, A. (2014). The mobile generation: Youth and adolescent ownership and use of digital media. *Communication Research Reports*, *31*, 357–364. <http://dx.doi.org/10.1080/08824096.2014.963221>
- Lauricella, A. R., Wartella, E., & Rideout, V. J. (2015). Young children's screen time: The complex role of parent and child factors. *Journal of Applied Developmental Psychology*, *36*, 11–17. <http://dx.doi.org/10.1016/j.appdev.2014.12.001>
- LeBourgeois, M. K., Hale, L., Chang, A. M., Akacem, L. D., Montgomery-Downs, H. E., & Buxton, O. M. (2017). Digital media and sleep in childhood and adolescence. *Pediatrics*, *140*(Suppl. 2), S92–S96. <http://dx.doi.org/10.1542/peds.2016-1758J>
- Lee, P. S., & Leung, L. (2008). Assessing the displacement effects of the Internet. *Telematics and Informatics*, *25*, 145–155. <http://dx.doi.org/10.1016/j.tele.2006.08.002>
- Lee, S., & Lee, S. (2015). Online video services and other media: Substitutes or complement. *Computers In Human Behavior*, *51*(Part A), 293–299. <http://dx.doi.org/10.1016/j.chb.2015.03.073>
- Lenhart, A., Duggan, M., Perrin, A., Stepler, R., Rainie, L., & Parker, K. (2015). *Teens, social media & technology overview 2015*. Washington, DC: Pew Research Center.
- Levenson, J. C., Shensa, A., Sidani, J. E., Colditz, J. B., & Primack, B. A. (2016). The association between social media use and sleep disturbance among young adults. *Preventive Medicine*, *85*, 36–41. <http://dx.doi.org/10.1016/j.ypmed.2016.01.001>
- Liang, H., & Fu, K. W. (2015). Testing propositions derived from Twitter studies: Generalization and replication in computational social science. *PLoS ONE*, *10*, e0134270. <http://dx.doi.org/10.1371/journal.pone.0134270>
- Lissak, G. (2018). Adverse physiological and psychological effects of screen time on children and adolescents: Literature review and case study. *Environmental Research*, *164*, 149–157. <http://dx.doi.org/10.1016/j.envres.2018.01.015>
- Lloyd, B. T. (2002). A conceptual framework for examining adolescent identity, media influence, and social development. *Review of General Psychology*, *6*, 73–91. <http://dx.doi.org/10.1037/1089-2680.6.1.73>

- Mac Carron, P., Kaski, K., & Dunbar, R. (2016). Calling Dunbar's numbers. *Social Networks*, *47*, 151–155. <http://dx.doi.org/10.1016/j.socnet.2016.06.003>
- Malmgren, R. D., Stouffer, D. B., Campanharo, A. S., & Amaral, L. A. (2009). On universality in human correspondence activity. *Science*, *325*, 1696–1700. <http://dx.doi.org/10.1126/science.1174562>
- Marinelli, A., & Andó, R. (2014). Multiscreening and social TV. *VIEW: Journal of European Television History and Culture*, *3*, 24–36.
- McComb, M. (1972). Mass media in the marketplace. *Journalism Monographs*, *24*, 1–102.
- McDonald, N. C. (2015). Are millennials really the “go-nowhere” generation? *Journal of the American Planning Association*, *81*, 90–103. <http://dx.doi.org/10.1080/01944363.2015.1057196>
- McGill, M., Williamson, J., & Brewster, S. (2015). A review of collocated multi-user TV. *Personal and Ubiquitous Computing*, *19*, 743–759. <http://dx.doi.org/10.1007/s00779-015-0860-1>
- Miritello, G., Moro, E., Lara, R., Martínez-López, R., Belchamber, J., Roberts, S. G., & Dunbar, R. I. (2013). Time as a limited resource: Communication strategy in mobile phone networks. *Social Networks*, *35*, 89–95. <http://dx.doi.org/10.1016/j.socnet.2013.01.003>
- Moreno, M. M., Jelenchick, L. L., Koff, R. R., Eikoff, J. J., Diermyer, C. D., & Christakis, D. D. (2012). Internet use and multitasking among older adolescents: An experience sampling approach. *Computers in Human Behavior*, *28*, 1097–1102. <http://dx.doi.org/10.1016/j.chb.2012.01.016>
- Muscanel, N., & Guadagno, R. E. (2012). Make new friends or keep the old: Gender and personality differences in social networking use. *Computers in Human Behavior*, *28*, 107–112. <http://dx.doi.org/10.1016/j.chb.2011.08.016>
- Näsi, M., & Räsänen, P. (2013). Changing media preferences? *Nordicom Review*, *34*, 77–92. <http://dx.doi.org/10.2478/nor-2013-0055>
- Newell, J., Genschel, U., & Zhang, N. (2014). Media discontinuance: Modeling the diffusion “s” curve to declines in media use. *Journal of Media Business Studies*, *11*, 27–50. <http://dx.doi.org/10.1080/16522354.2014.11073587>
- Nguyen, A., & Western, M. (2006). The complementary relationship between the Internet and older mass media: The case of online news and information. *Information Research*, *11*, 151–183. Retrieved from <https://espace.library.uq.edu.au/view/UQ:8188>
- Ortega, F. B., Chillón, P., Ruiz, J. R., Delgado, M., Albers, U., Álvarez-Granda, J. L., . . . Castillo, M. J. (2010). Sleep patterns in Spanish adolescents: Associations with TV watching and leisure-time physical activity. *European Journal of Applied Physiology*, *110*, 563–573. <http://dx.doi.org/10.1007/s00421-010-1536-1>
- Patulny, R., & Seaman, C. (2017). ‘I’ll just text you’: Is face-to-face social contact declining in a mediated world? *Journal of Sociology*, *53*, 285–302. <http://dx.doi.org/10.1177/1440783316674358>
- Pea, R., Nass, C., Meheula, L., Rance, M., Kumar, A., Bamford, H., . . . Zhou, M. (2012). Media use, face-to-face communication, media multitasking, and social well-being among 8- to 12-year-old girls. *Developmental Psychology*, *48*, 327–336. <http://dx.doi.org/10.1037/a0027030>
- Perras, M. T., & Weitzel, A. R. (1981). Measuring daily communication activities. *Florida Communication Journal*, *9*, 19–23.
- Perrin, A. (2015, October). *Social networking usage: 2005–2015*. Washington DC: Pew Research Center. Retrieved from <http://www.pewinternet.org/2015/10/08/2015/Social-Networking-Usage-2005-2015/>
- Primack, B. A., & Escobar-Viera, C. G. (2017). Social media as it interfaces with psychosocial development and mental illness in transitional age youth. *Child and Adolescent Psychiatric Clinics of North America*, *26*, 217–233. <http://dx.doi.org/10.1016/j.chc.2016.12.007>
- Reid Chassiakos, Y. L., Radesky, J., Christakis, D., Moreno, M. A., & Cross, C.; Council on Communications and Media. (2016). Children and adolescents and digital media. *Pediatrics*, *138*, e20162593. <http://dx.doi.org/10.1542/peds.2016-2593>
- Rich, M., Bickham, D. S., & Shrier, L. A. (2015). Measuring youth media exposure: A multimodal method for investigating the influence of media on digital natives. *American Behavioral Scientist*, *59*, 1736–1754. <http://dx.doi.org/10.1177/0002764215596558>
- Rideout, V. J., Foehr, U. G., & Roberts, D. F. (2010). *Generation M2: Media in the lives of 8–18 year-olds*. Menlo Park, CA: Kaiser Family Foundation.
- Robinson, J. P. (2011a). Arts and leisure participation among IT users: Further evidence of time enhancement over time displacement. *Social Science Computer Review*, *29*, 470–480. <http://dx.doi.org/10.1177/0894439310385643>
- Robinson, J. P. (2011b). IT use and leisure time displacement. *Information Communication and Society*, *14*, 495–509. <http://dx.doi.org/10.1080/1369118X.2011.562223>
- Robinson, J. P., & Martin, S. (2009). IT and activity displacement: Behavioral evidence from the U.S. General Social Survey (GSS). *Social Indicators Research*, *91*, 115–139. <http://dx.doi.org/10.1007/s11205-008-9285-9>
- Ruppel, E. K., & Burke, T. J. (2015). Complementary channel use and the role of social competence. *Journal of Computer-Mediated Communication*, *20*, 37–51. <http://dx.doi.org/10.1111/jcc4.12091>
- Schaie, K. W. (1965). A general model for the study of developmental problems. *Psychological Bulletin*, *64*, 92–107. <http://dx.doi.org/10.1037/h0022371>
- Scherer, E. A., Bickham, D. S., Shrier, L. A., & Rich, M. (2015). Evaluating multiple intensively collected media use measures: Validity and reliability of momentary assessments. *Communication Methods and Measures*, *9*, 170–187. <http://dx.doi.org/10.1080/19312458.2015.1061653>
- Segijn, C. M., Voorveld, H. M., Vandeberg, L., & Smit, E. G. (2017). The battle of the screens: Unraveling attention allocation and memory effects when multiscreening. *Human Communication Research*, *43*, 295–314. <http://dx.doi.org/10.1111/hcre.12106>
- Sehn, T. M., & Fragoso, S. (2015). The synergy between eBooks and printed books in Brazil. *Online Information Review*, *39*, 401–415. <http://dx.doi.org/10.1108/OIR-01-2015-0006>
- Serfass, D. G., & Sherman, R. A. (2015). Situations in 140 characters: Assessing real-world situations on Twitter. *PLoS ONE*, *10*, e0143051. <http://dx.doi.org/10.1371/journal.pone.0143051>
- Serrano-Puche, J. (2017). Developing health habits in media consumption: A proposal for dealing with information overload. In R. P. Figueiredo Marques & J. C. L. Batista (Eds.), *Information and communication overload in the digital age* (pp. 202–222). Hershey, PA: IGI Global. <http://dx.doi.org/10.4018/978-1-5225-2061-0.ch009>
- Shakya, H. B., & Christakis, N. A. (2017). Association of Facebook use with compromised well-being: A longitudinal study. *American Journal of Epidemiology*, *185*, 203–211.
- Simon, H. (1971). Designing organizations for an information-rich world. In M. Greenberger (Ed.), *Computers, communications, and the public interest* (pp. 37–52). Baltimore, MD: The Johns Hopkins Press.
- Song, C., Qu, Z., Blumm, N., & Barabási, A.-L. (2010). Limits of predictability in human mobility. *Science*, *327*, 1018–1021. <http://dx.doi.org/10.1126/science.1177170>
- Sonnenberg, B., Riediger, M., Wrzus, C., & Wagner, G. G. (2012). Measuring time use in surveys—Concordance of survey and experience sampling measures. *Social Science Research*, *41*, 1037–1052. <http://dx.doi.org/10.1016/j.ssresearch.2012.03.013>
- Southgate, D. (2017). The emergence of Generation Z and its impact in advertising: Long-term implications for media planning and creative development. *Journal of Advertising Research*, *57*, 227–235. <http://dx.doi.org/10.2501/JAR-2017-028>

- Spengler, S., Mess, F., & Woll, A. (2015). Do media use and physical activity compete in adolescents? Results of the MoMo Study. *PLoS ONE*, *10*, e0142544. <http://dx.doi.org/10.1371/journal.pone.0142544>
- Spitzberg, B. H. (2014). Toward a model of meme diffusion (M³D). *Communication Theory*, *24*, 311–339. <http://dx.doi.org/10.1111/comt.12042>
- Subrahmanyam, K., Smahel, D., & Greenfield, P. (2006). Connecting developmental constructions to the internet: Identity presentation and sexual exploration in online teen chat rooms. *Developmental Psychology*, *42*, 395–406. <http://dx.doi.org/10.1037/0012-1649.42.3.395>
- Taipale, S. (2016). Synchronicity matters: Defining the characteristics of digital generations. *Information Communication and Society*, *19*, 80–94. <http://dx.doi.org/10.1080/1369118X.2015.1093528>
- Twenge, J. M. (2014). *Generation Me: Why today's young Americans are more confident, assertive, entitled—And more miserable than ever before* (2nd ed.). New York, NY: Atria Books.
- Twenge, J. M. (2017). *iGen: Why today's super-connected kids are growing up less rebellious, more tolerant, less happy—And completely unprepared for adulthood*. New York, NY: Atria Books.
- Twenge, J. M., & Campbell, W. K. (2018). *Less in-person social interaction among U.S. adolescents in the 21st century and links to loneliness*. Unpublished manuscript.
- Twenge, J. M., Krizan, Z., & Hisler, G. (2017). Decreases in self-reported sleep duration among U.S. adolescents 2009–2015 and association with new media screen time. *Sleep Medicine*, *39*, 47–53. <http://dx.doi.org/10.1016/j.sleep.2017.08.013>
- Twenge, J. M., & Park, H. (2018). The decline in adult activities among U.S. adolescents, 1976–2016. *Child Development*. Advance online publication. <http://dx.doi.org/10.1111/cdev.12930>
- van den Berg, P. E., Arentze, T. A., & Timmermans, H. J. (2012). New ICTs and social interaction: Modelling communication frequency and communication mode choice. *New Media and Society*, *14*, 987–1003.
- Van Volkom, M. M., Stapley, J. C., & Malter, J. (2013). Use and perception of technology: Sex and generational differences in a community sample. *Educational Gerontology*, *39*, 729–740. <http://dx.doi.org/10.1080/03601277.2012.756322>
- Varnum, M. E. W., & Grossmann, I. (2017). Cultural change: The how and the why. *Perspectives on Psychological Science*, *12*, 956–972. <http://dx.doi.org/10.1177/1745691617699971>
- Vergeer, M., & Pelzer, B. (2009). Consequences of media and Internet use for offline and online network capital and well-being. A causal model approach. *Journal of Computer-Mediated Communication*, *15*, 189–210. <http://dx.doi.org/10.1111/j.1083-6101.2009.01499.x>
- Vilhelmson, B., Thulin, E., & Elldér, E. (2017). Where does time spent on the Internet come from? Tracing the influence of information and communications technology use on daily activities. *Information Communication and Society*, *20*, 250–263. <http://dx.doi.org/10.1080/1369118X.2016.1164741>
- Voorveld, H. M., & van der Goot, M. (2013). Age differences in media multitasking: A diary study. *Journal of Broadcasting and Electronic Media*, *57*, 392–408. <http://dx.doi.org/10.1080/08838151.2013.816709>
- Vriens, E., & van Ingen, E. (2017). Does the rise of the internet bring erosion of strong ties? Analyses of social media use and changes in core discussion networks. *New Media and Society*. Advance online publication. <http://dx.doi.org/10.1177/1461444817724169>
- Wagner, D. N. (2015). The tragedy of the attentional commons—In search of social rules for an increasingly fragmented space. *Journal of New Frontiers in Spatial Concepts*, *7*, 31–40.
- Webster, J. G. (2014). *The marketplace of attention: How audiences take shape in a digital age*. Cambridge, MA: MIT Press.
- Weng, L., Flammini, A., Vespignani, A., & Menczer, F. (2012). Competition among memes in a world with limited attention. *Scientific Reports*, *2*, 1–8.
- Yeykelis, L., Cummings, J. J., & Reeves, B. (2014). Multitasking on a single device: Arousal and the frequency, anticipation, and prediction of switching between media content on a computer. *Journal of Communication*, *64*, 167–192. <http://dx.doi.org/10.1111/jcom.12070>
- Zickuhr, K., & Rainie, L. (2014). *Younger Americans and public libraries*. Washington, DC: Pew Research Center. Retrieved from <http://www.pewinternet.org/2014/09/10/younger-americans-and-public-libraries/>

Received December 1, 2017

Revision received May 22, 2018

Accepted May 22, 2018 ■