

Children's Privacy in the Big Data Era: Research Opportunities

Kathryn C. Montgomery, PhD,^a Jeff Chester, MSW,^b Tijana Milosevic, PhD^c

abstract

This article focuses on the privacy implications of advertising on social media, mobile apps, and games directed at children. Academic research on children's privacy has primarily focused on the safety risks involved in sharing personal information on the Internet, leaving market forces (such as commercial data collection) as a less discussed aspect of children's privacy. Yet, children's privacy in the digital era cannot be fully understood without examining marketing practices, especially in the context of "big data." As children increasingly consume content on an ever-expanding variety of digital devices, media and advertising industries are creating new ways to track their behaviors and target them with personalized content and marketing messages based on individual profiles. The advent of the so-called Internet of Things, with its ubiquitous sensors, is expanding these data collection and profiling practices. These trends raise serious concerns about digital dossiers that could follow young people into adulthood, affecting their access to education, employment, health care, and financial services. Although US privacy law provides some safeguards for children younger than 13 years old online, adolescents are afforded no such protections. Moreover, scholarship on children and privacy continues to lag behind the changes taking place in global media, advertising, and technology. This article proposes collaboration among researchers from a range of fields that will enable cross-disciplinary studies addressing not only the developmental issues related to different age groups but also the design of digital media platforms and the strategies used to influence young people.

^aSchool of Communication, American University, Washington, District of Columbia; ^bCenter for Digital Democracy, Washington, District of Columbia; and ^cDepartment of Media and Communication, University of Oslo, Oslo, Norway

Dr Montgomery conceptualized and designed the manuscript, drafted the original manuscript, consulted with all authors on the analysis and use of sources, and finalized the manuscript; Mr Chester conducted the research on the contemporary digital marketplace, drafted sections of the manuscript, and participated in the editing of the manuscript; Dr Milosevic conducted the research on current studies in the United States and Europe of digital marketing's effect on children, drafted sections of the manuscript, and participated in the writing and editing of the final version; and all authors approved the final manuscript as submitted.

The analysis, conclusions, and recommendations contained in each article are solely a product of the individual workgroup and are not the policy or opinions of, nor do they represent an endorsement by Children and Screens: Institute of Digital Media and Child Development or the American Academy of Pediatrics.

DOI: <https://doi.org/10.1542/peds.2016-17580>

Accepted for publication Apr 19, 2017

Address correspondence to Kathryn C. Montgomery, PhD, School of Communication, American University, 4400 Massachusetts Ave NW, Washington, DC 20016. E-mail: kcm@american.edu

PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

Copyright © 2017 by the American Academy of Pediatrics

FINANCIAL DISCLOSURE: The authors have indicated they have no financial relationships relevant to this article to disclose.

FUNDING: Supported in part by the Robert Wood Johnson Foundation and Digital Trust. This special supplement, "Children, Adolescents, and Screens: What We Know and What We Need to Learn," was made possible through the financial support of Children and Screens: Institute of Digital Media and Child Development.

Today's young people are growing up in an always-on, interactive media culture, in which they engage continuously with social media, mobile apps, and games. Curating personal profiles, texting friends, and posting opinions online have become routine and commonplace behaviors.^{1,2} New participatory platforms enable youth to contribute to a shared culture, find their own voices, and join social causes.³ Many of these online activities tap into such core developmental needs as identity exploration, peer relationships, and individual expression.⁴ Because digital media have become an important arena for young people's social development, the tension between freely expressing oneself online and protecting one's privacy has been an ongoing source of debate among scholars, parents, health professionals, and policy makers for the past 2 decades.⁵

Much of the public discourse has focused on the safety risks involved when young people share personal information about themselves online.⁶ However, digital privacy needs to be considered in terms of its broader relationship to a child's health and well-being. For example, privacy is important to young people's psychosocial development, ensuring they have the freedom and autonomy to explore and try out a variety of possible selves in their search for identity, without risk of surveillance or exposure. It is essential to their ability to engage with others through social media, developing and maintaining relationships with their peers, choosing freely how much information about themselves to share, with whom, and under what circumstances. Youth need privacy protection to seek health information online and search for answers to sensitive personal questions that they are afraid to ask their parents or teachers. Finally, privacy is essential to such core democratic values as

autonomy, self-determination, and dignity, and thus, it is a fundamental prerequisite to fostering civic and political engagement among young people.⁷

Yet even as today's digital media culture plays an increasingly central role in children's lives, it poses a growing threat to their privacy. This threat cannot be fully understood or addressed without taking into account how market forces shape contemporary digital media's relationship with young people. The Internet emerged as a mainstream commercial medium during a period when children's buying power and value as a target for advertisers were rising. As early adopters of new technologies, children were positioned at the center of a burgeoning e-commerce marketplace. Its core business model, one-to-one marketing, relies on continuous data collection and monitoring of online behavior patterns to target individual users. Thus, marketing and privacy are inextricably intertwined. Big data can be defined as "the data sets and analytical techniques in applications that are so large and complex that they require advanced and unique data storage, management, analysis, and visualization technologies."¹ This integration has become even deeper as big data principles and practices have begun to transform the digital landscape, resulting in a complex set of data collection, tracking, and targeting applications that monitor and monetize individual users' behaviors as well as their interactions with friends and acquaintances.⁸

US privacy law provides some protections for children in today's contemporary media environment, but that protection is limited and continually challenged by increasingly sophisticated marketing and data collection techniques. Moreover, scholarship on children and privacy continues to lag far

behind the rapid changes taking place in global media, advertising, and technology.

CURRENT STATE

Big Data's Transformation of Children's Media and Marketing

Although television still plays an important role in children's viewing time, young people are also consuming content on a growing spectrum of digital screens and devices.^{9,10} The media and advertising industries have shifted their strategies to take advantage of these changing, cross-platform engagement patterns.⁹ This has created a ubiquitous media environment in which content, culture, and commerce are highly interconnected, reaching and engaging users across the Web, on mobile devices, and in the real world.¹¹

Advances in computer technology, artificial intelligence, digital communication networks, and sophisticated data processing and analysis have vastly increased the amount, speed, and variety of data that can be gathered and processed.^{12,13} This big data paradigm is shaping the core business models of contemporary media and spurring the proliferation of new, sophisticated, data-driven, digital marketing practices. Marketers can now follow individuals and their social networks across the Web regardless of where they are and what devices they are using, employing conversation surveillance and other Web analytics to monitor in minute detail and in real time how they are influenced and how they, in turn, influence their friends and acquaintances.^{14,15} Sophisticated algorithms make it possible to tailor and personalize each user's experience, alter what an individual sees in a newsfeed or other online content, and create advertising messages based on the user's

interests, friends, and routine actions. These tools and techniques are frequently used to identify children and youth of color, including Hispanic people and African Americans, and create targeted marketing messages based on their ethnicities and cultures.^{16,17}

With the growth of the Internet of Things (Internet-connected sensors that change ordinary objects such as cars, refrigerators, and toys into “smart” devices¹⁸), children’s daily tools and surroundings can monitor, analyze, and transmit individual and aggregate data and communicate with other objects that are linked through wired and wireless networks.¹⁹ Mattel’s “Hello Barbie” is emblematic of a new generation of interactive digital toys; it records a child’s voice, sends the recording to the Cloud, uses voice-recognition software to decode the content, and learns the child’s name, conversational styles, habits, and interests.²⁰ These trends raise the specter of digital dossiers following young people into adulthood, affecting their access to education, employment, health care, and financial services.

Limited Protection Under US Privacy Law

The Children’s Online Privacy Protection Act (COPPA), which was enacted in 1998, provides important protections from many digital marketing and data collection practices. The law requires commercial Web sites and other digital media targeting children younger than 13 years old to limit the collection of personal information, mandates a mechanism for parental involvement, and places obligations on companies for adequate disclosure and protection of data.²¹ The regulations were updated in 2013 to address some of the new and emerging practices, adding restrictions on behavioral targeting, personalized advertising,

and location-based marketing.²² Although COPPA has served to shield children from some of the most egregious data collection and targeted marketing tactics, the law’s basic framework has major limitations. For example, instead of prohibiting companies from engaging in certain practices, it requires verifiable parental permission before a marketer can collect personal information from a child, thus putting the burden on parents to evaluate confusing, legalistic privacy policies. Moreover, nothing prevents children from simply lying about their age, and research has documented that this is common, particularly on highly popular social networking platforms.²³ Finally, COPPA applies only to children younger than 13 years old, leaving teenagers without privacy protections in an essentially unregulated, commercial, digital media environment.

Academic Research on Children’s Privacy

For the most part, academic research on children’s privacy is limited in scope and has failed to stay abreast of marketplace developments. Researchers in a handful of studies have attempted to provide insight into youth perceptions of privacy and risk in the online environment and their use of privacy tools on social networking platforms. These researchers have focused primarily on what young people share about themselves voluntarily, without taking into account the largely invisible tracking and data mining techniques that gather information from users without their knowledge.²⁴ The limited research exploring children’s and teenagers’ understanding of privacy in the context of commercial data collection suggests that most young people do not fully understand the complex marketing operations of the digital media they encounter or the nature and extent of the risks they face. For example, although high

school students in 1 study expressed little concern about the future use of their personal data, they also demonstrated limited knowledge of the actual business practices involved in using such information for commercial purposes.²⁵ Researchers in another study of tweens found that although they were “beginning to develop skills and knowledge to understand the motivations and objectives of advertisers,” they had “not fully consolidated these abilities.” As a consequence, they tended to “overestimate their understanding and invulnerability to engage in risky behaviors.”²⁶

The parameters of US children’s privacy and marketing policies are based primarily on studies originally conducted in the 1970s documenting children’s cognitive developmental vulnerabilities to the persuasive techniques of advertising.²⁷ Established during a period when television was the dominant vehicle for children’s advertising, this model draws from psychologist Jean Piaget’s theories and is rooted in the notion that cognitive abilities are the key to understanding the persuasive intent of an advertisement and defending against it.²⁸ According to this approach, safeguards are necessary only for the younger segment of the youth population.²⁹ In recent years, a number of scholars have begun to critique this model, arguing, for example, that it oversimplifies the persuasive process and fails to address how contemporary advertising and marketing work.³⁰

Because of the continuing focus on cognitive vulnerabilities of young children, adolescents have been largely overlooked in the regulatory arena. Yet, there is a small but growing body of research identifying biological and psychosocial attributes of adolescence that may play a role in how teenagers respond to commercial media environments.³¹ Studies have shown, for example,

that teenagers are inclined to behave impulsively and often do not think about the consequences of their actions before taking them, even in situations involving considerable risk.³² They also experience greater emotional volatility than either younger children or adults, including frequent and intense negative emotions and fewer positive emotions. All these factors may make teenagers more susceptible to digital marketing and data collection techniques, especially when they are distracted, in a state of high arousal, or subjected to peer pressure.³¹

FUTURE RESEARCH

Developing innovative approaches for understanding the complex ways in which children and adolescents engage with this new, commercial media culture requires collaboration among researchers from a range of fields, including psychology, anthropology, communication, marketing, and human-computer interaction. Such interdisciplinary collaboration will enable studying not only the developmental issues related to different age groups but also the design and functionality of digital media platforms and the strategies used to influence young people. The changing nature of children's media also requires rethinking the theories, concepts, and research designs that have been used in the past. For example, a narrow focus on measuring exposure to content cannot capture the myriad ways that today's youth engage

with interactive media. The concept of discrete periods of screen time is being rendered obsolete by the proliferation of mobile devices, the expanding cross-platform media universe, and the growing spectrum of Internet-enabled objects.

The following are several key questions that should serve as building blocks for a larger research agenda to guide future scholarship that can inform policy makers and other important stakeholders:

- What are the most relevant theoretical and conceptual models for assessing how children in different age ranges, ethnic groups, and socioeconomic categories are affected by digital marketing and data collection techniques?
- How do varying types of engagement across digital platforms (eg, social media, games, and Internet-connected objects) affect a child's or adolescent's ability to understand the privacy risks involved?
- How can academic researchers access and assess the data analytics systems (including algorithms, software applications, measurement, and data management platforms) that digital marketers routinely employ to profile and target young people through digital media?
- What new methods are needed for conducting media-effects research in a complex and evolving digital system in which each child's

experience is personalized and constantly changing?

RECOMMENDATIONS

Clinicians and Providers

Health professionals need to update their policy statements on children's media and advertising to reflect the contemporary, data-driven practices in the digital media system, identify the risks to privacy, and address the vulnerabilities of older children and adolescents.

Policy Makers

Policy makers should expand children's privacy safeguards to encompass data collection and marketing practices across digital platforms, including toys and other objects that are part of the Internet of Things.

Educators

Schools, in collaboration with nonprofits and other institutions, should develop media education and digital literacy programs to help young people participate fully in the contemporary digital media culture without compromising their fundamental right to privacy. Training children and parents in particular about privacy threats and how to protect children's privacy could also fall in this domain of activity.

ABBREVIATION

COPPA: Children's Online Privacy Protection Act

POTENTIAL CONFLICT OF INTEREST: The authors have indicated they have no potential conflicts of interest to disclose.

REFERENCES

1. Mauro AD, Greco M, Grimaldi M. What is big data? A consensual definition and a review of key research topics. In: *AIP Conference Proceedings*. 2015;1644:97–104
2. Watkins SC. *The Young and the Digital: What the Migration to Social-network Sites, Games, and Anytime, Anywhere Media Means for Our Future*. Boston, MA: Beacon Press; 2009
3. boyd d. *It's Complicated: The Social Lives of Networked Teens*. New Haven, CT: Yale University Press; 2014
4. Subrahmanyam K, Šmahel D. *Digital Youth: The Role of Media in Development*. New York, NY: Springer; 2012
5. Montgomery KC. *Generation Digital: Politics, Commerce, and Childhood in the Age of the Internet*.

- Cambridge, MA: MIT Press; 2007:179–207
6. Livingstone S, Ólafsson K, Staksrud E. Social networking, age and privacy. *EU Kids Online*. 2011. Available at: [www.lse.ac.uk/media@lse/research/EUKidsOnline/EU Kids II \(2009-11\)/EUKidsOnlineIIReports/ShortSNS.pdf](http://www.lse.ac.uk/media@lse/research/EUKidsOnline/EU Kids II (2009-11)/EUKidsOnlineIIReports/ShortSNS.pdf). Accessed September 12, 2017
 7. Hurley D. Taking the long way home: the human right of privacy. In: Rotenberg M, Horwitz J, Scott J, eds. *Privacy in the Modern Age*. New York, NY: The New Press; 2015:70–77
 8. Mayer-Schönberger V, Cukier K. *Big Data: A Revolution That Will Transform How We Live, Work, and Think*. New York, NY: Houghton Mifflin Harcourt; 2013
 9. Nielsen. Kids' audience behavior across platforms. Available at: www.nielsen.com/us/en/insights/reports/2015/kids-audience-behavior-across-platforms.html. Accessed August 6, 2015
 10. Council on Communications and Media. Media use in school-aged children and adolescents. *Pediatrics*. 2016;138(5):e20162592
 11. Turow J. *The Daily You: How the New Advertising Industry is Defining Your Identity and Your Worth*. New Haven, CT: Yale University Press; 2013
 12. Sicular S. Gartner's big data definition consists of three parts, not to be confused with three "V"s. Available at: <https://www.forbes.com/sites/gartnergroup/2013/03/27/gartners-big-data-definition-consists-of-three-parts-not-to-be-confused-with-three-vs>. Accessed September 12, 2017
 13. MIT Technology Review. The big data conundrum: how to define it? Available at: <https://www.technologyreview.com/s/519851/the-big-data-conundrum-how-to-define-it/>. Accessed September 12, 2017
 14. Salesforce. Industry solutions. Available at: <https://www.salesforce.com/solutions/industries/>. Accessed September 12, 2017
 15. Noreen S. A lot to 'like' about social CRM. All Analytics. Available at: www.allanalytics.com/author.asp?section_id=2220&doc_id=245991. Accessed June 20, 2012
 16. MaxPoint. Find Hispanic consumers based on country of origin. Available at: <https://maxpoint.com/us/find-top-communities-multicultural-consumers/>. Accessed September 12, 2017
 17. Applebaum M. Ethnic marketing research, part 1: where culture meets shoppers. Path to Purchase Institute. Available at: <https://ppi.org/article/ethnic-marketing-research-part-1-where-culture-meets-shoppers>. Accessed July 22, 2015
 18. Maddox T. Top IoT and wearable tech trends for 2016: smartwatches in transition as smartglasses rule. *TechRepublic*. Available at: <http://www.techrepublic.com/article/top-iot-and-wearable-tech-trends-for-2016-smartwatches-in-transition-as-smartglasses-rule/>. Accessed January 14, 2016
 19. Burrus D. The internet of things is far bigger than anyone realizes. *Wired*. Available at: www.wired.com/insights/2014/11/the-internet-of-things-bigger/. Accessed November 2014
 20. Hu C. Mattel's new "Hello Barbie" records kids' voices and sends the intel back to corporate. Quartz. Available at: <http://qz.com/362891/new-hello-barbie-records-kids-voices-and-sends-the-intel-back-to-mattel/>. Accessed March 15, 2015
 21. US Government Publishing Office. Part 312—children's online privacy protection rule. Electronic Code of Federal Regulations. Available at: www.ecfr.gov/cgi-bin/text-idx?SID=4939e77c77a1a1a08c1cbf905fc4b409&node=16:1.0.1.3.36&r&n=div5. Accessed September 12, 2017
 22. Federal Trade Commission. FTC strengthens kids' privacy, gives parents greater control over their information by amending children's online privacy protection rule. Available at: www.ftc.gov/news-events/press-releases/2012/12/ftc-strengthens-kids-privacy-gives-parents-greater-control-over. Accessed December 19, 2012
 23. Boyd D, Hargittai E. Facebook privacy settings: who cares? *First Monday*. 2010;15(8)
 24. Marwick AE, Boyd D. Networked privacy: how teenagers negotiate context in social media [abstract]. *New Media Soc*. 2014;16(7):1051–1067
 25. Lapenta GH, Jorgensen RF. Youth, privacy and online media: framing the right to privacy in public policy-making. *First Monday*. 2015;20(3)
 26. Wonsun S, Jisu H, Faber RJ. Tweens' online privacy risks and the role of parental mediation. *J Broadcast Electron Media*. 2012;56(4):632–649
 27. John DR. Consumer socialization of children: a retrospective look at twenty-five years of research. *J Consum Res*. 1999;26(3):183–213
 28. Kunkel D. The role of research in the regulation of U.S. children's television advertising. *Sci Commun*. 1990;12(1):101–119
 29. Strasburger VC; Committee on Communications; American Academy of Pediatrics. Children, adolescents, and advertising. *Pediatrics*. 2006;118(6):2563–2569
 30. Wright P, Friestad M, Boush DM. The development of marketplace persuasion knowledge in children, adolescents, and young adults. *J Publ Pol Market*. 2005;24(2):222–223
 31. Pechmann C, Levine L, Loughlin S, Leslie F. Impulsive and self-conscious: adolescents' vulnerability to advertising and promotion. *J Publ Pol Market*. 2005;24(2):202–221
 32. Committee on the Science of Adolescence, Board on Children, Youth, and Families, of the Institute of Medicine and National Research Council. *The Science of Adolescent Risk-taking: Workshop Report*. Washington, DC: The National Academies Press; 2011

Children's Privacy in the Big Data Era: Research Opportunities

Kathryn C. Montgomery, Jeff Chester and Tijana Milosevic

Pediatrics 2017;140;S117

DOI: 10.1542/peds.2016-17580

Updated Information & Services

including high resolution figures, can be found at:
http://pediatrics.aappublications.org/content/140/Supplement_2/S117

References

This article cites 9 articles, 2 of which you can access for free at:
http://pediatrics.aappublications.org/content/140/Supplement_2/S117.full#ref-list-1

Permissions & Licensing

Information about reproducing this article in parts (figures, tables) or in its entirety can be found online at:
<https://shop.aap.org/licensing-permissions/>

Reprints

Information about ordering reprints can be found online:
<http://classic.pediatrics.aappublications.org/content/reprints>

Pediatrics is the official journal of the American Academy of Pediatrics. A monthly publication, it has been published continuously since . Pediatrics is owned, published, and trademarked by the American Academy of Pediatrics, 141 Northwest Point Boulevard, Elk Grove Village, Illinois, 60007. Copyright © 2017 by the American Academy of Pediatrics. All rights reserved. Print ISSN:

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™



PEDIATRICS®

OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

Children's Privacy in the Big Data Era: Research Opportunities

Kathryn C. Montgomery, Jeff Chester and Tijana Milosevic

Pediatrics 2017;140;S117

DOI: 10.1542/peds.2016-17580

The online version of this article, along with updated information and services, is located on the World Wide Web at:

http://pediatrics.aappublications.org/content/140/Supplement_2/S117

Pediatrics is the official journal of the American Academy of Pediatrics. A monthly publication, it has been published continuously since . Pediatrics is owned, published, and trademarked by the American Academy of Pediatrics, 141 Northwest Point Boulevard, Elk Grove Village, Illinois, 60007. Copyright © 2017 by the American Academy of Pediatrics. All rights reserved. Print ISSN:

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™

