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Data governance for young people in the commercialized digital environment

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TikTok (also known by its Chinese name, Dǒuyīn) has quickly captured the interest of children, adolescents, and young adults in 150 countries around the world. The mobile app enables users to create short video clips, customize them with a panoply of user-friendly special effects tools, and then share them widely through the platform's vast social network.[1] A recent industry survey of children's app usage in the United States, the United Kingdom, and Spain reported that young people between the ages of 4 and 15 now spend almost as much time per day (80 minutes) on TikTok as they do on the highly popular YouTube (85 minutes). TikTok is also credited with helping to drive growth in children's social app use by 100 per cent in 2019 and 200 per cent in 2020.[2] Among the keys to its success is a sophisticated artificial intelligence (AI) system that offers a constant stream of highly tailored content, and fosters continuous interaction with the platform.[3] Using computer vision technology to reveal insights based on images, objects,

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texts, and natural-language processing, the app "learns" about an individual's preferences, interests and online behaviours so it can offer "high-quality and personalized" content and recommendations. TikTok also provides advertisers with a full spectrum of marketing and brand-promotion applications that tap into a vast store of user information, including not only age, gender, location, and interests, but also granular data sets based on constant tracking of behaviours and activities.[4]

TikTok is just one of many tech companies deploying these techniques. The forces of Big Data and advances in sophisticated computer software applications are creating a powerful and rapidly expanding children's digital media marketplace, which is already well established throughout most of the world. Many leading tech companies, including Google, Facebook and Viacom, are now using AI and machine learning (ML) techniques to reach and engage young people, amplifying the ability of digital marketers to "learn"

about an individual's preferences, interests and on-line behaviours.[5] Investors are pouring additional resources into new streaming-video services and other digital content for children, based on pre-dictions that they will consume even more video content, much of it commercially driven, on con-nected TVs, mobile phones, and other devices.[6] The internet-connected toy market is expected to reach US$25 billion in the next several years, with more and more products designed to react to a child's be-haviour in real time and "grow" with them as they become older.

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Many of these new products include voice-recogni-tion software that can monitor not only the individ-ual child user, but also playmates and others, and in some cases share sensitive personal information with third parties, raising safety and security issues.[7] "Smart speakers," such as Amazon's Echo, and the emerging business based on "voice search" also gather extensive amounts of "home life data" based on family interactions and activities.[8] One study pre-dicts that by 2021, US$1.7 billion will be spent by ad-vertisers annually to reach children online.[9] Children and teens are also the focus of continuous scrutiny from global marketing research, performed by a network of specialist firms and media companies, closely following their interests and behaviours.[10]

Underlying all of these developments is a complex, far-reaching, global media, marketing and sales ap-paratus, capable of gathering and using unprece-dented amounts of data.[11] Data and advertising have become so inextricably intertwined that almost all of today's marketing is now *data-driven.* As young people eagerly embrace a growing number of so-cial media, gaming platforms and mobile apps, the imperatives of this new business model are shaping

the structures, operations, and affordances of their digital experiences. Although privacy and data pro-tection laws — including both the European Union's General Data Protection Regulation (GDPR) and the United States' Children's Online Privacy Protection Act (COPPA) — have influenced some of the advertis-ing and data practices targeting young children, they have done little to slow the growth of today's exten-sive and sophisticated digital marketing operations.[12]

The purpose of this paper is to explain how data -driven marketing systems are being incorporated into the wide spectrum of digital platforms and ser-vices popular with young people, and to argue for a comprehensive approach to data governance that takes into account the integration of data in today's online marketplace. We will begin by identifying sev-eral key trends that are deepening the role of data throughout its operations, highlighting their impact on children's interactions with digital culture. We will discuss how the tech industry's extensive and ubiq-uitous data practices raise serious threats to young people's privacy and subject them to unfair and ma-nipulative advertising techniques, many of which are not adequately addressed by current regulations. We will assess how this commercialized technology system affects children's well-being more broadly, both on an individual and a societal level, including its disparate impacts on youth of colour, low-income communities, and vulnerable populations. Finally, we will present our recommendations for a frame-work of principles, policies, corporate best practices and accountability measures to ensure that the ex-panding digital landscape evolves in such a way that maximizes the opportunities for young people, while minimizing the harms.

Key marketplace trends

We have identified three trends that are emblemat-ic of major changes in today's digital marketplace, each of which is discussed briefly below.

1. The rise of adtech and kidtech. Major companies, including Google and Facebook, are now part of an integrated chain of relationships — collectively known as "adtech" or "martech" — that include ad agencies, data brokers, marketing clouds, data man-agement platforms, e-commerce applications, lead generators, artificial-intelligence ad specialists, media companies, measurement providers, and many oth-er specialized services.[13] Advertising technology has introduced a new generation of tracking and target-ing software systems that make it possible to access, analyze and act upon a wealth of data on individual

consumers, including purchasing behaviours, device use, social media communications, online interests, location and geographic movements, financial status, health concerns and much more. For example "cross-device tracking" enables advertisers to follow and target users across all of their digital devices, determining, through a single identifier, that the same person who is on a social network is also viewing a TV programme and later watching video on a mobile phone.[14] "Programmatic" advertising uses superfast computers to generate targeted marketing to someone in milliseconds, and is now the dominant global method for online marketing.[15] AI and machine learning applications can assess how someone reacts to a particular ad or piece of content, and then deliver a subsequent series of ads with altered messaging specifically designed to be more appealing to the individual user. Through Google's "Director's Mix" ads, advertisers can more effectively target YouTube viewers. Facebook and many others offer similar systems.[16]

Paralleling these developments is a growing "kidtech" enterprise, which uses many of these same advertising technologies, with some adjustments in response to child data protection laws and online safety concerns.[17] Kidtech services and other child-directed content providers argue that they are complying with privacy and data regulations by using "contextual" marketing techniques, instead of the more intrusive data-driven behavioural or programmatic practices that trigger data-protection issues. However, contextual advertising has been transformed through machine learning, natural language processing and other advanced techniques, all of which use data to identify and target users. As a consequence, many of the "kid-friendly" marketing operations do not differ substantially from those that are aimed at adults.[18] The fundamental goal is to facilitate advertisers' ability to reach and influence children, to forge ongoing relationships with them, and to create lifelong loyal consumers.

2. Marketing and advertising drive the design and functionality of media experiences. Digital platforms are structured to optimize engagement, foster habitual behaviours, and maximize the impact of marketing messages, as opposed to being neutral spaces for social interaction, entertainment, and expression. The concept of *engagement* has become a linchpin of tech industry Big Data strategy. Its purpose is to ensure that users are continuously and seamlessly interacting with digital media platforms,

responding to brands and marketing, and generating data points. With children's content increasingly distributed across tablets, smartphones, streaming devices and other platforms, programmers and advertisers are embracing new interactive storytelling technologies, including games, virtual reality and augmented reality experiences, and creating advertising formats that can be integrated directly into these powerful immersive environments, all designed to maximize engagement and trigger impulsive actions. For example, so-called "playable ads" are incorporated into gaming platforms, "constructed with well-known icons and strong game UI [user interface]" so that "users can immerse themselves in game-play" and respond instantly to various "calls to action", such as downloading coupons, entering sweepstakes, or making purchases online.[19]

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Digital marketers are also drawing from behavioural science to create particularly powerful new methods for directing user behaviours and influencing decision-making. The tech industry uses the somewhat benign term of "persuasive design" to describe these practices.[20] However, consumer groups and other researchers refer to many of these design interfaces as *dark patterns,* especially when they are intended to "benefit an online service by coercing, steering, or deceiving users into making unintended and potentially harmful decisions." Such techniques are routinely incorporated into e-commerce sites and other commercial online platforms.[21]

3. Increasing sophistication of ad testing and measurement. Over the last ten years or so, there has been a large uptick of research specifically aimed at developing powerful advertising techniques and measuring the impact of digital advertising.[22] For example, Nielsen, which is a leader in the new field of *neuromarketing*, uses a variety of neuroscience techniques to maximize the impact of digital advertising on human behaviour, including electroencephalography (EEG) to monitor brainwaves in order to identify "three key measures of engagement: attention, emotion, and memory"; "facial coding"

to capture a variety of emotions; and eye-tracking technologies to measure how individuals engage with visual content on screens.[23] Using these and other methods, marketers can design and refine advertising messages so they can trigger "attention processing" and embed themselves solidly into an individual's memory.[24] Neuromarketing services are available throughout the world, and are used by many companies to test ad techniques for products marketed to both adults and young people alike.[25]

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Measurement and analytics systems have also evolved considerably, and are now altering the overall operation of digital marketing, with increasing focus on children. Simple, one-dimensional measures such as "clicks", "likes", views, and impressions are now only a tiny part of a highly complex system that includes detailed analytics covering the full range of a consumer's digital media interactions.[26] New metrics can monitor not only how a viewer responds to an ad, but also whether that same user purchased the product featured in the ad.[27] The media and advertising industries have explored the creation of a new measurement standard designed to provide a "comprehensive view of cross-platform, digital and mobile measurement of content and ads among children and teens aged from 2 to 17."[28] Advertisers routinely create proprietary panels of children and adolescents who agree, along with their parents, to participate and are then provided with devices to enable continuous tracking of their online activities. This information is then used to develop effective models for targeting other young people. Measurement can also take place in real time, following users' movements, communications and activities from moment to moment and measuring their reactions to various advertising and sales appeals. As a result, marketing techniques can be tested, refined and tailored for maximum effect.

Addressing the impact of data-driven marketing systems on youth

The developments described above offer a glimpse of the many ways that data and advertising are converging in today's Big Data digital marketplace. The practices are deployed throughout the entire global digital media system, encompassing all of the major social media networks, gaming platforms, mobile apps and video streaming services that young people are embracing. Because of their hidden and complex nature, they are not easily discerned or well understood by children, parents or data-protection authorities. Youth around the world continue to rely on digital media as essential tools in their personal and social lives, helping them explore their identities, providing a vital link for friendships and peer groups, and empowering them to mobilize on behalf of climate change, racial justice and other political causes. But as key targets for "monetizing" the digital economy, children are growing up in an online environment where they are subjected to constant commercial surveillance and inundated with marketing messages that are woven throughout their online experiences.[29]

Government policies in countries around the world offer only limited protections for young people in this expanding, commercialized media culture. Scholars Ingida Milkaite and Eva Lievens reviewed government data-protection regulatory frameworks in the United States, Europe and selected countries in Africa and Latin America, finding a "fragmented landscape when it comes to the rights of the child to privacy and data protection."[30] The same is true for advertising and marketing policies, which are often handled separately from data protection and privacy regulation, and in some cases by different government entities without fully addressing the nature and scope of contemporary digital practices.

While regulation has produced some safeguards for children, tech industry strategies have mitigated the impact on digital marketplace practices. For example, in the United States the 1998 Children's Online Privacy Protection Act (COPPA) was the first government law to establish privacy and marketing protections for children on the internet.[31] Advocates sought to include all children under 18, but opposition from the marketing and tech industries kept the age limit at 13.[32] Many of the major technology and social media companies have chosen to respond to COPPA by setting terms of service that officially ban children under the age of 13 from their platforms and, in some cases, by looking the other way when under-aged youth are accessing them.[33] As a consequence, many of the children and all of the

adolescents who engage with social media are subjected to the entire spectrum of sophisticated data techniques and online marketing applications that are currently state of the art in today's commercial digital media system.

As Big Data continues to drive the growth of commercialized technology, its values, imperatives, and operations are influencing young people's lives, raising concerns beyond data protection and marketing. Constructed around the fundamental goal of optimizing ad delivery and impact, digital platforms can shape user behaviours — triggering and rewarding certain actions, while promoting some kinds of content and suppressing others.[34] For example, the algorithms deployed by Facebook, Twitter, and other social media privilege material that sparks a strong reaction from users, and is likely to be shared virally. These systems contribute to widespread disinformation and political polarization, which can have serious consequences for young people's socialization as citizens, and for the health of democratic institutions themselves.[35] Predictive analytics and personalization enable marketers to treat individuals or groups of consumers differently, which impacts social and economic equality.[36] "Discrimination by association" has become commonplace in the online advertising industry, where people are grouped according to their assumed interests or inferred traits and are offered, or excluded from, different products, services, or prices on the basis of their presumed affinity.[37] A growing body of academic research has documented how these systems can lead to disparate impacts on communities of colour, low-income groups, and other vulnerable populations.[38]

Recommendations for data governance policies

Integrated approach. Only a comprehensive and integrated approach to data governance will produce effective policies for children.[39] There is a growing awareness among many researchers, advocates, and regulators that the digital marketplace needs to be understood and approached more holistically. For example, policymakers in a number of countries have launched investigations into the ways that issues of antitrust and competition are linked to data protection and privacy.[40] We need to address youth data protection through a similar cross-cutting approach, exploring the interconnections between data and marketing operations, the overall structure of the digital marketplace, and the impact of all these systems on the well-being of children as a whole. This requires us to define more

specifically, based on universal shared principles, what outcomes are desirable, and to assess whether these technologies produce those outcomes. It will also require us to rethink how data policies have been traditionally formulated. While fundamental concepts of the Fair Information Practice Principles (FIPPs) — such as data minimization and purpose specification — remain important, we should adopt an approach that ensures that data governance truly reflects the "best interests of the child". Regulators, civil society, scholars and others should create a framework that incorporates the kind of outcomes we wish our children to experience from the commercial data culture. Privacy, human rights, fairness, justice, equity, and healthy child development must be moved to the centre of the policy debate.[41] Data protection authorities should be structured to operate across the key domains that impact the lives of youth in their country, and to ensure adherence to the principles of the UN Convention on the Rights of the Child.[42] In addition to addressing the needs of the individual child, policies should be developed that ensure specific groups of young people, including those from marginalized socioeconomic and ethnic backgrounds, are treated fairly and protected from discriminatory and other disparate impacts.

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Building protections into the design of digital operations. The "Precautionary Principle", long used to ensure that foods, drugs and other products "do no harm", should be the foundation for such a new governance regime. Building on the United Kingdom Information Commissioner's Office "Age Appropriate Design" code, a set of policies and principles from different countries could be developed, along with "best practice" rules for corporate compliance, and a system for the ongoing oversight of emerging technologies and data practices.[43] Regulators should identify "defaults" that must be incorporated into the design of digital services for young people to specifically address data and marketing practices. These systems could build on existing social media and tech company internal policies for

addressing online safety, cyberbullying, and advertising of harmful products, such as tobacco, alcohol, and unhealthy foods.[44]

Independent assessment. Data use and advertising applications in development, as well as those already in practice, should undergo a careful independent assessment to determine whether they take unfair advantage of young people's developmental vulnerabilities, health, or well-being. For example, before allowing tech companies to deploy AI, personalized advertising, virtual reality or facial recognition in commercial services for children and teens, regulators should require formal reviews to determine if they are appropriate for young people.[45] Techniques or practices judged as harmful to children and/or adolescents should then be restricted through a regulated approval process.

Addressing broader impacts of youth interactions with commercial platforms. Regulators and industry should also reexamine the functionalities and affordances of digital media platforms that attract large numbers of youth, making changes in operations that encourage habitual engagement, foster addictive responses, or promote circulation of false and misleading information. A Human Rights, Ethical and Social Impact Assessment (HRESIA) tool, as suggested by Alessandro Mantelero, could be developed so that companies can better assess anticipated and unanticipated consequences more effectively.[46]

Young people throughout the world must be guaranteed the right to grow up in a digital media environment that supports their healthy development, fosters personal and collective growth, and strives to engender democratic values. Policies must ensure that all are treated with fairness and dignity in the growing digital marketplace, but are also socialized to be responsible consumers and citizens who embrace their digital rights.

Good Governance of Children's Data project

The Office of Global Insight and Policy is bringing together 17 global experts in a project to explore trends in the governance of children's data, including the tensions between different rules and norms, emerging concepts and practice, and implications for policy and regulation. Debate on the future of children's data affects a diverse range of issues, including data ownership and control, data fiduciaries, profiling for digital marketing purposes, child-friendly privacy notices, data erasure upon request, age verification, parental responsibility, data protection by design and default, algorithmic bias, and individual and group data.

The project aims to highlight the gap between the world we want for children and today's reality, developing a manifesto on how children's data could be optimally managed and what steps need to be taken. To help develop this manifesto, members of the working group will publish short analyses of different approaches to data governance.

Endnotes

1   "What We Know about Marketing on TikTok", WARC Best Practice, March 2020 (personal copy).

2   Perez, Sarah, "Kids Now Spend Nearly as Much Time Watching TikTok as YouTube in US, UK and Spain", TechCrunch. 4 June 2020; "US Teens Use TikTok as Much as Facebook", WARC, 7 November 2019.

3   Perez, "Kids Now Spend Nearly as Much Time Watching TikTok as YouTube in US, UK and Spain"; "Content Discovery and Creation Powered by AI and ML – Building the Future", Asia Tech Daily, 7 December 2018,; "Welcome to TikTok Ads Manager!" TikTok, accessed 30 June 2020.

4   Perez, "Kids Now Spend Nearly as Much Time Watching TikTok as YouTube in US, UK and Spain"; "Content Discovery and Creation Powered by AI and ML – Building the Future", Asia Tech Daily, 7 December 2018,; "Welcome to TikTok Ads Manager!" TikTok, accessed 30 June 2020.

5   Chow, Marvin, "AI and Machine Learning Get Us One Step Closer to Relevance at Scale", Think with Google, September 2017; Dischler, Jerry, "Putting Machine Learning into the Hands of Every Advertiser", Google Ads Help, 10 July, 2018; Facebook, "Boost Liquidity and Work Smarter with Machine Learning", Facebook IQ, 27 March 2019; Willens, Max, "How Viacom Uses Artificial Intelligence to Predict the Success of its Social Campaigns", Digiday, 13 June 2018.

6   Owen, Rob, "Cornucopia of Children's Content Comes to Streaming Services", *Variety*, 2 August 2018.

7   Myrstad, Finn, "Connected Toys Violate European Consumer Law", Forbrukerradet, 6 December, 2016.

8   Barassi, Veronica, "Home Life Data and Children's Privacy", Child Data Citizen, 19 September 2018; Barassi, Veronica, "Digital Citizens? Data Traces and Family Life", *Contemporary Social Science, Journal of the Academy of Social Sciences* 12, n. 1-2 (2017): 84-95.

9   Dahl, Christopher, "In the US, Kids Play a Central Role in Household Purchases", ViacomCBS, 12 July 2018; "The Power of Gen Z Influence: Marketing to Gen Z", Millennial Marketing, accessed 1 July 2020; Whyte, Alexandra, "More Than 40% of New Global Internet Users are Kids", Kidscreen, 11 June 2019; "PwC: Kids Digital Ad Market Worth $1.7bn by 2021", Advanced Television, 12 June 2019.

10 See, for example, "Kids & Youth Research 2019", Market Research Society; "Kids & Family", ViaconCBS.

11 McDonald, James, "One in Four Ad Dollars Goes to the Google/Facebook Duopoly", WARC Data Points, March 2019.

12 Montgomery, Kathryn C. and Chester, Jeff, "Data Protection for Youth in the Digital Age: Developing a Rights-Based Global Framework", *European Data Protection Law Review* 1, no. 4 (2015): 277–91.

13 "The Beginners Guide to the Programmatic AdTech Ecosystem: Explained in an Interactive Graphic!" Martech Advisor, 9 March 2018.

14 Nicastro, Dom, "What Is Cross-Device Identification and How Can Marketers Use It?", CMS Wire, 27 June 2018.

15 "Programmatic Adspend to Exceed US$100bn for the First Time in 2019", Zenith, 25 November 2019.

16 Google, "Director Mix", Create with Google, accessed 2 July 2020.

17 Perez, Sarah, "Kidtech Startup SuperAwesome is Now Valued at $100+ Million and Profitable", TechCrunch, 19 February 2018.

18 Sawers, Paul, "YouTube Taps Machine Learning to Serve the Best Contextual Ads for Each User", VentureBeat, 23 September 2019.

19 IAB, "Playable Ads for Brands, An IAB Playbook", 5 June 2019; Hershkovitz, Idan, "Playable Ads: Our Top 3 Examples", Bidalgo, 5 August 2018.

20 Craig, Michael, "Pixels of Influence – Breaking Down Persuasive Design Principles", accessed 30 July 2020.

21   Forbrukerradet, "New Study: Google Manipulates Users Into Constant Tracking", 27 November 2018; "Dark Patterns at Scale: Findings from a Crawl of 11K Shopping Websites", 20 September 2019.

22   Fussell, Sidney, "The Endless, Invisible Persuasion Tactics of the Internet", *The Atlantic*, 2 August 2019.

23   Barley, Emily, "Applying Neuroscience Techniques to Improve Ad Creative", WARC, April 2019.

24   Farmsworth, Bryn, "15 Powerful Examples of Neuromarketing in Action", Imotions, 5 March 2019; Affectiva, "Emotion AI Overview: What Is It and How Does It Work?" accessed 2 July 2020; Tobiipro, "Shopper Research", accessed 2 July 2020.

25   See, for example, Canada-based True Impact; Nielsen, "Consumer Neuroscience"; Neuro-Insight; Neurosense; Neuro-Insight, all accessed 2 July 2020.

26   "What We Know About Audience Measurement", WARC Best Practice, December 2018.

27   Kohl, Nadya, "PlaceIQ & comScore Announce a New Way To Measure Cross-Channel", 3 October 2017; Alphonso, "IRI and Alphonso Combine Industry's Largest TV Data Set with Consumer Shopping Data for Cross-Platform Sales Attribution Measurement", 6 February 2018; Levine, Barry, "Catalina Adds First Attribution Tracking Service", Marketing Land, 11 January 2019.

28   "Nielsen and Krux Collaborate on Multi-touch Attribution Solution for Marketers", 6 May 2015; "RealityMine Chosen by Coalition for Innovative Media Measurement to Conduct Youth Total Cross-Media Usage Measurement Project", 16 June 2015; Comscore, "Audience Analytics: Video Metrix Multi-Platform"; Nielsen Catalina, "True Mobile Measurement Is Here"; SproutSocial, "Measure Performance with Social Media Analytics Tools" all accessed 2 July 2020.

29   Radesky, Jenny et al, "Digital Advertising to Children", *Pediatrics* 146, n. 1, July 2020; "Tackling Food Marketing to Children in a Digital World: Trans-Disciplinary Perspectives. Children's Rights, Evidence Of Impact, Methodological Challenges, Regulatory Options and Policy Implications for the WHO European Region", 2016; Social Issues Research Centre, "The Impact of the Commercial World on Children's Wellbeing: Report of an Independent Assessment", 2009.

30   Milkaite, Ingida and Lievens, Eva, "Children's Rights to Privacy and Data Protection Around the World: Challenges in the Digital Realm", *European Journal of Law and Technology* 10, n. 1, 2019.

31   The authors spearheaded the campaign in the 1990s that led to COPPA's passage. For a detailed case study of that effort, see Montgomery, Kathryn C., *Generation Digital: Politics, Commerce, and Childhood in the Age of the Internet* (Cambridge, MA: MIT Press, 2007), 67-106.

32   Requiring protections for children until they turn 12 reflected a U.S. regulatory regime that provided some safeguards for children in broadcast and cable TV. Montgomery, *Generation Digital*, pp. 69-72.

33   Montgomery, Kathryn C., "Youth and Surveillance in the Facebook Era: Policy Interventions and Social Implications", *Telecommunications Policy* 39, n. 9 (October 2015): 771-786.

34   Stray, Jonathan, "Aligning AI to Human Values Means Picking the Right Metrics", Partnership on AI, 15 April 2020.

35   United Kingdom House of Lords, "House of Lords Committee – Democracy Under Threat from 'Pandemic of Misinformation' Online – Recommends DfE Digital Media Literacy Becomes 'Embedded Across The Curriculum,'" 29 June 2020; Bradshaw, Samantha and Howard, Phillip N., "The Global Disinformation Order: 2019 Global Inventory of Organised Social Media Manipulation", Project on Computational Propaganda, 2019.

36   Eubanks, Virginia, *Automating Inequality: How High-Tech Tools Profile, Police, and Punish the Poor* (New York: Picador, St Martin's Press, 2018), pp. 9-10; Madden, Mary, Gilman, Michele, Levy, Karen and Marwick, Alice, "Privacy, Poverty, and Big Data: A Matrix of Vulnerabilities for Poor Americans", *Washington University Law Review* 95, n. 1 (2017): 53-125. See also Ledford, Heidi, "Millions of Black People Affected by Racial Bias In Health-Care Algorithms: Study Reveals Rampant Racism In Decision-Making Software Used By US Hospitals – And Highlights Ways to Correct It", *Nature*, October 24, 2019; Hannak, Aniko, Soeller, Gary, Lazer, David, Mislove, Alan and Wilson, Christo, "Measuring Price Discrimination and Steering on E-commerce Web Sites", MC'14, 5–7 November 2014, Vancouver, BC, Canada; Mikians, Jakub, Gyarmati, László, Erramilli, Vijay and Laoutaris, Nikolaos, "Detecting Price and Search Discrimination on the Internet", 2012; Valentino-DeVries, Jennifer, Singer-Vine, Jeremy and Soltani, Ashkan, "Websites Vary Prices, Deals Based on Users' Information", *Wall Street Journal*, 24 December 2012; Shpanya, Ari, "What is Price Discrimination and is it Ethical?" Econsultancy, 3 January 2014.

37   Wachter Sandra and Mittelstadt, Brent, "A Right to Reasonable Inferences: Re-Thinking Data Protection Law in the Age of Big Data and AI", *Columbia Business Law Review* (2019).

38   See, for example, Barocas, Solon and Selbst, Andrew D., "Big Data's Disparate Impact" 104 *California Law Review* 671 (2016); Barocas, Solon and Nissenbaum, Helen, "Big Data's End Run Around Anonymity and Consent", in *Privacy, Big Data, and the Public Good: Frameworks for Engagement*, eds. Julia Lane, Victoria Stodden, Stefan Bender, Helen Nissenbaum, (Cambridge, UK: Cambridge University Press, 2014). 44-75.

39   Schuh, Justin, "Building a More Private Web", Google Chrome, The Keyword, 22 August 2019; IAB, "IAB Europe Launches Comprehensive Guide to Navigating the 'Post Third-Party Cookie Era'", 7 May 2020.

40   Torabi, B. John, "Is Privacy an Antitrust Issue? A Growing Movement", *Fordham Journal of Corporate & Financial Law*, 1 April 2020; Meyer, David, "The Privacy and Antitrust Worlds Are Starting to Cross Over", The Privacy Advisor, 23 April 2019.

41   See Verdoodt, Valerie, "The Role of Children's Rights in Regulating Digital Advertising", *International Journal of Children's Rights*, 9 August 2019.

42 UNICEF, "Four Principles of the Convention on the Rights of the Child", 24 June 2019.

43 Denham, Elizabeth, "Age Appropriate Design: A Code of Practice for Online Services", UK Information Commissioner's Office, accessed 3 July, 2020.

44 Facebook and other social media companies have developed a full set of anti-bullying practices that are built into their operating systems, along with advertising policies that restrict the promotion of certain products to teens. See Montgomery, "Youth and Surveillance in the Facebook Era: Policy Interventions and Social Implications"; Milosovec, Tijana, *Protecting Children Online? Cyberbullying Policies of Social Media Companies* (Cambridge, MA: MIT Press, 2018); Facebook, "Advertising Policies", accessed 3 July 2020.

45 Montgomery, Kathryn C., Chester, Jeff and Milosevic, Tijana, "Ensuring Young People's Digital Privacy as a Fundamental Right", in *International Handbook of Media Literacy Education*, eds. Belinha S. De Abreu, Paul Mihailidis, Alice Y.L. Lee, Jad Melki, and Julian McDougall (New York: Routledge, 2017), 85-102.

46 Mantelero, Alessandro, "AI and Big Data: A Blueprint for a Human Rights, Social and Ethical Impact Assessment", *Computer Law & Security Review* 34, n. 4: 754–772, 17 August 2018.

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