AUTOCORRECTING FOR WHITENESS

RASHMI DYAL-CHAND[*]

ABSTRACT

Autocorrect presumes Whiteness. Across a range of products and applications, autocorrect consistently "corrects" names that do not look White or Anglo. Sometimes autocorrect changes names to their closest Anglo approximations (as in Ayaan to Susan). Sometimes it suggests replacements that are not proper names (as in DaShawn to dash away). Often, autocorrect asserts the implausibility of non-Anglo names by underlining them in red. Autocorrect's changes to names such as these are not just trivial product glitches. In a world rife with the multiplying effects of algorithmic bias in increasingly essential domains of decision-making, autocorrect produces social and cultural harms that disproportionately affect communities of color and those who do not have Anglo identities.

Harnessing both empirical evidence and theory, this Article argues that while autocorrect's Anglo bias harms such individuals and communities, it adds value to the intellectual property of autocorrect's proprietors as well as to the "status property" of more privileged users. We all increasingly rely on smartphones, tablets, word processors, and apps that use autocorrect. Yet autocorrect incorporates a set of defaults—including dictionaries—that help some of its users to communicate seamlessly at the expense of others who cannot. It is a simple but powerful means of self-realization, providing a modern forum for the reinstantiation of Cheryl Harris's concept of Whiteness as property. It is a medium for governing social relations that depends on the devaluation of non-Anglo names. It is a form of smart technology that maintains structural racism today.

The essential nature of autocorrect technology—and its far-reaching effect in structuring social, cultural, and even epistemic understandings of our world—demands legal intervention to fix autocorrect's Anglo bias. Drawing on core

[*] Professor and Associate Dean for Research and Interdisciplinary Education, Northeastern University School of Law; Affiliate Professor of Public Policy and Urban Affairs, College of Social Sciences and Humanities, Northeastern University. I am grateful to Libby Adler, Nestor Davidson, Benjamin Ericson, Howard Erlanger, Sonia Katyal, Joseph William Singer, Ari Waldman, Patricia Williams, and participants in the 2020 Progressive Property Conference at Fordham Law School for extremely helpful comments on the manuscript and also to Joseph William Singer for his scholarship on public accommodations. I received superb research assistance from Kyle Berner, Andrew Farrington, Emily Garrett, Robert Gullo, and Jacob Steinmann.

norms from property law, as well as consumer law and culture, this Article proposes design principles for ensuring more transparency, access, and participation in the design and deployment of autocorrect technology.

CONTENTS

INTRODUCTION

Ask anyone with a name that does not look "White" or "Anglo"[1] whether their name has ever been autocorrected and you will probably get an earful. Aziza is changed to Alicia.[2] Ayaan is changed to Susan. DaShawn and Fatima are underlined with red squiggly lines and offered the respective suggestions "Dash away" and "Fat Imagination" or "Fathomable" to replace them. And even when José is not changed to Joseph, it rarely appears with the accent over the "e." My personal favorite example is an email that really caught my attention because it was addressed: "Dear sashimi."

This Article is about autocorrect, that ubiquitous technology encountered daily by those of us who use Microsoft or Google, have smartphones, or use other computer platforms that facilitate writing and communication. The basic function of the technology is to correct—as efficiently as possible—the misspelling of text as we type, whether on keyboards or through touch-typing technology. Perhaps the most common example of autocorrect in action is the correction of "teh" to "the."[3] The autocorrection typically occurs when the writer presses or touches the space bar before writing the next word.[4]

---

[1] As I will discuss in detail, I use the term White to refer to names that appear to have Anglo origins in explicit reference to Cheryl Harris's foundational article. Cheryl I. Harris, *Whiteness as Property*, 106 HARV. L. REV. 1707, 1743 (1993). I also use the term Anglo to describe such names. *Anglo*, MERRIAM-WEBSTER DICTIONARY, https://www.merriam-webster.com/dictionary/Anglo [https://perma.cc/UBN3-8KCP] (last visited Dec. 29, 2020) ("Anglo . . . : a white inhabitant of the U.S. of non-Hispanic descent"). Throughout this Article, I refer to names that do not look "White" or "Anglo" as non-White or non-Anglo names. I do so both to continue the reference to Harris's work and in recognition of the fact that some of autocorrect's harms accrue to individuals who are White but whose names do not appear to be. I discuss these harms in Part II. Following the practice of Eve Ewing and Kwame Anthony Appiah, I capitalize both the terms White and Black in recognition that Whiteness is neither invisible nor the default category. *See* Eve L. Ewing, *I'm a Black Scholar Who Studies Race. Here's Why I Capitalize 'White.,'* ZORA (July 2, 2020), https://zora.medium.com/im-a-black-scholar-who-studies-race-here-s-why-i-capitalize-white-f94883aa2dd3; Kwame Anthony Appiah, *The Case for Capitalizing the B in Black*, ATLANTIC (June 18, 2020), https://www.theatlantic.com/ideas/archive/2020/06/time-to-capitalize-blackand-white/613159/.

[2] Throughout this Article, I use a range of examples of non-Anglo names that autocorrect technologies change. I have developed these examples on the basis of a mix of methodologies, as described further in Section I.A.

[3] *See* Gideon Lewis-Kraus, *The Fasinatng… Fascinating History of Autocorrect*, WIRED (July 22, 2014, 12:01 AM), https://www.wired.com/2014/07/history-of-autocorrect/ [http://perma.cc/PY39-MSG9]. I note here that it took me three tries to successfully type "teh" in the text without it being autocorrected, despite my use of quotation marks around the word. In this case, I first retyped the word "teh," and it was autocorrected. Then I clicked on the "Undo Typing" function three times to return the word to my purposeful misspelling. But when I pressed the space bar on my keyboard, the word was again autocorrected. Then I repeated the second step again, which finally yielded success.

[4] *See infra* Section I.B.

Specifically, this Article is about the cultural and legal ramifications of autocorrect. Across a range of technologies and proprietors, autocorrect changes names that do not have White or Anglo spellings to the closest White or Anglo approximations of those names or to words that somehow recognize ethnicity without recognizing the value of the names as such. An example of the latter is autocorrect changing my own name, Rashmi, to sashimi (note the lack of initial capitalization in the correction). Indeed, because many people, including those with White- or Anglo-looking names, have friends and associates who have non-Anglo names, this Article is about the common experience of having to correct autocorrect.

This Article argues that distinctive harms, many of which are legally cognizable, flow to those who consistently have to correct the autocorrection of their names because their names are not recognized by the dictionaries maintained by the proprietors of autocorrect technology. Such harms are experienced both at the individual level and among communities with ethnic or social ties. They include economic harms from receiving unequal access to essential products that contribute to a digital infrastructure that is necessary for modern communication and social participation. They also include dignity harms that translate into cultural devaluation of non-Anglo individuals and communities. This Article argues that those who are not White or of Anglo descent or ethnicity disproportionately experience such harms.

Although this Article focuses on autocorrect technology, its analysis applies much more broadly to the myriad forms of technology that contribute to the development and deployment of artificial intelligence and modern computing. The narrower prescriptions with which this Article concludes are straightforward, and there is simply no excuse for the industry not to adopt some version of them.[5] Moreover, given the broadening catalogue of algorithmic bias and other forms of discrimination by technology, the cultural analysis of Whiteness and other biases as, in, and through technology is an important contribution to one of the most significant conversations of our day. Indeed, it contributes to the conversation about the range of racial and other oppressions spawned by algorithms.[6]

Finally, this Article is about whether and how law matters to the use of autocorrect. While there is already a rich literature on the subject of algorithmic bias, the particular nature and effects of autocorrect provide an opportunity to consider the relevance of legal and nonlegal principles and approaches that are underexamined thus far. This Article argues that core legal norms informing property and consumer law can provide foundations for policymaking and law reform that are increasingly crucial as artificial intelligence continues to pervade

[5] *See infra* Section IV.C.1 (discussing simple fixes such as not autocorrecting capitalized words).

[6] *See generally, e.g.*, SAFIYA UMOJA NOBLE, ALGORITHMS OF OPPRESSION: HOW SEARCH ENGINES REINFORCE RACISM (2018).

more, and more important, sectors of contemporary society. In proposing new legal approaches to regulating artificial intelligence, this Article relies on public accommodations law as a basis for designating technologies such as word processing systems and autocorrect as modern forms of public accommodation.

This Article proceeds in four parts. Part I examines autocorrect technology in more detail. Based partly on empirical analysis, it traces the contours of the Anglo bias in autocorrect, focusing especially on the range of consumer experiences of this technology. One of the most important observations that flows from this analysis is that it is virtually impossible for consumers even to *know* the scope or extent of the Anglo bias in autocorrect technology, let alone to control or limit the effect of this bias. This Part also examines the creation and development of autocorrect, largely to understand the goals and values as described by two of its creators. Part II examines the economic, social, and cultural harms flowing from this technology as it is deployed across the industry today. In cataloguing these harms, this Part surveys both harms that are legally cognizable in court today and harms that require a range of legal and nonlegal remedies, only some of which are recognized by our current legal structure.

Part III uses theories grounded in property and consumer law to better understand these harms. It discusses the revitalization of the concept of Whiteness as property, both by autocorrect's reinforcement of such a norm in electronic communications and by its translation of Whiteness into intellectual property owned by autocorrect's proprietors. This Part also argues that this version of Whiteness as property is particularly potent due to the logic of American consumerism.

Part IV relies on the insights gained from my empirical and theoretical examinations to justify legal intervention and to propose a range of guiding principles for such intervention. Focusing especially on public accommodations as a backbone of property law, this Part explores avenues for increasing transparency of, access to, and participation through, essential technologies such as autocorrect. Part IV also contends that consumer activism plays a crucial role in dismantling the structure of racism through technology.

I. DEAR SASHIMI

It is inconvenient and annoying to have to correct the spelling of a name—sometimes repeatedly—even when writing a short email or text. And it is embarrassing to realize only after sending an email or text that the spelling of a name was autocorrected to something not intended by the sender. But is the harm any worse than inconvenience, annoyance, and embarrassment? Moreover, is the harm one that the law can and should address? Answering these questions requires a deeper understanding of both the nature of the technological issue and the nature of the harm. This Article focuses particularly on the autocorrection of a typed word when that word is a proper name. Autocorrect is obviously a much broader technology that changes many words. While many of us are annoyed, inconvenienced, and embarrassed by autocorrections to words that are not

proper names ("patties" to "panties," "job" to "john," and so on),[7] the much narrower technical problem examined here is the autocorrection of names.

This particular form of autocorrection is what produces harms, including individual and collective economic and dignity harms, that go beyond annoyance and that are disproportionately experienced by non-White and non-Anglo communities. In making this claim, I acknowledge that not all members of such communities experience the individualized harms that flow from autocorrect, as described in Part II. Many have names that are recognized by autocorrect. By the same token, what I describe as a Whiteness or Anglo bias in autocorrect affects many White individuals. However, as I elaborate in the remainder of this Article, autocorrect has a Whiteness problem because of the range of social and cultural harms it imposes on non-Anglo individuals and communities. Those who are White with non-Anglo names are harmed by virtue of getting a lesser product, as are people of color with non-Anglo names. But in a context of pervasive institutional racism that contributes to the proliferation of algorithmic biases, autocorrect produces specific harms that uniquely affect people of color. One purpose of this Article is to examine the full range of harms.

A. *Autocorrect's Technical Manifestations*

Quite possibly, if this Article caught your attention, it was because you have experienced the phenomenon of name autocorrection described in the first few paragraphs of the Introduction. For this reason, it may have sufficed in this Section simply to assert the ubiquity of this phenomenon and move on to a description of the harms wrought by autocorrect and the challenge of addressing this and other multiplying examples of algorithmic bias. Alternatively, it may have sufficed to attach a list of names as an appendix for readers to test on their own devices. Nevertheless, this Section begins by providing an empirical foundation for this Article. To understand the technological nature and scope of the autocorrection of names, I developed a research design for testing a range of devices, operating systems, and applications to determine the extent to which and the manner in which they autocorrect names. In this Section, I describe the results of the tests that my research assistants and I performed, which provide a basic proof of concept of the existence of an Anglo bias in autocorrect technology and a sense of the qualitative experience of users of this technology. In the following Section, I expand this analysis by reviewing the history of autocorrect's creation and development, largely as described by the inventors themselves.

While the Anglo bias that this Article describes is universal in a meaningful sense, my empirical testing provides information not only about the phenomenon in general but also about the variations of it. My empirical approach thus supports the development of additional inquires. For example, are some products worse than others? Is the autocorrection of names happening

[7] Lewis-Kraus, *supra* note 3.

more during word processing, emailing, or texting? Are some types of names autocorrected more often than others? Additionally, because we tested a range of older and newer devices, the empirical research provides some information about the history of autocorrect that supplements my review of this history in the Section that follows. Finally, and most importantly, the empirical analysis provides critical information for translating theory into prescription in addressing algorithmic bias.

1. Research Method

Two sets of scholarly inquiries influenced my research method and served as foundations for this Article. The first is the extensive literature that unequivocally establishes the proliferation of algorithmic bias, especially on the basis of race and gender, across a range of technologies. Using diverse research methodologies, these studies describe the extent of the problem of bias in technology.[8] They demonstrate its existence in a diverse range of technologies.[9] They also catalogue some of the core harms flowing from algorithmic bias, for example in fields such as criminal justice processes and sentencing.[10] In meaningful respects, these studies confirm that biases that predated smart technologies, far from being alleviated by algorithms, are indeed perpetuated

[8] *See* OSONDE OSOBA & WILLIAM WELSER IV, RAND CORP., AN INTELLIGENCE IN OUR IMAGE: THE RISKS OF BIAS AND ERRORS IN ARTIFICIAL INTELLIGENCE 7-12 (2017), https://www.rand.org/content/dam/rand/pubs/research_reports/RR1700/RR1744/RAND_RR1744.pdf [https://perma.cc/JA7E-D97G] (surveying literature on "misbehaving" algorithms, meaning those "whose results lead to incorrect, inequitable, or dangerous consequences"); Amit Datta, Michael Carl Tschantz & Anupam Datta, *Automated Experiments on Ad Privacy Settings*, 2015 PROC. ON PRIV. ENHANCING TECHS., no. 1, at 92, 102, 105 (using automated tool to study discrimination in online ads and concluding that Google showed advertisements for high-paying jobs to men more often than women). *See generally* Till Speicher, Muhammad Ali, Giridhari Venkatadri, Filipe Nunes Ribeiro, George Arvanitakis, Fabrício Benevenuto, Krishna P. Gummadi, Patrick Loiseau & Alan Mislove, *Potential for Discrimination in Online Targeted Advertising*, 81 PROC. MACH. LEARNING RSCH. 1 (2018) (demonstrating how advertisers use targeted advertising practices which have discriminatory effects along, among others, racial and political lines).

[9] *See generally* NOBLE, *supra* note 6 (search engines); Latanya Sweeney, *Discrimination in Online Ad Delivery*, COMM. ACM, May 2013, at 44, 47 (online advertising); Julia Angwin & Terry Parris Jr., *Facebook Lets Advertisers Exclude Users by Race*, PROPUBLICA (Oct. 28, 2016, 1:00 PM), https://www.propublica.org/article/facebook-lets-advertisers-exclude-users-by-race [https://perma.cc/5NZ8-2JUV] (Facebook); Julia Angwin, Jeff Larson, Surya Mattu & Lauren Kirchner, *Machine Bias*, PROPUBLICA (May 23, 2016), https://www.propublica.org/article/machine-bias-risk-assessments-in-criminal-sentencing [https://perma.cc/G8ME-D4QM] (criminal justice system).

[10] *See generally* Clinton Castro, *What's Wrong with Machine Bias*, 6 ERGO 405, 406, 416 (2019) (examining biases against historically marginalized groups in decision-making technology used in criminal justice system); Anja Lambrecht & Catherine Tucker, *Algorithmic Bias? An Empirical Study of Apparent Gender-Based Discrimination in the Display of STEM Career Ads*, 65 MGMT. SCI. 2966, 2967 (2019) (showing that women were less likely than men to see ads about jobs in STEM field).

and extended by them. Recent research on facial recognition technology is just one of many compelling examples.[11] As the analysis in this Article will describe, my focus on autocorrect technology contributes to the scholarship on algorithmic bias in smart technology by considering the implications of bias in this particular form of smart technology. Because the literature already catalogues the existence and extent of algorithmic bias across smart technologies, I have chosen a qualitative approach that focuses on the particular characteristics of bias in autocorrect technology.

My choice also relates to the second scholarly conversation that frames my research design—namely, the recognition in sociolinguistic research that language is a crucial vehicle for defining social relationships, including by means of defining and maintaining social hierarchies.[12] The Anglicization of names is a well-known historical—and current—example of the relationship between language and social hierarchy.[13] Mari Matsuda's pioneering work has inspired examinations of the law's role in dismantling such hierarchies.[14] Another example of such work is the recent legal scholarship on the use of pronouns.[15] Moreover, research and policy agendas focusing on social and economic development have begun to envision protections of "linguistic diversity" as a means of social inclusion.[16] Finally, recent scholarship has also captured examples of various forms of smart technology butchering names.[17] My research methods contribute to this conversation by examining the forms and features of autocorrection of diverse names to consider legal responses. In particular, this Article adds information about the ways autocorrect contributes

[11] *See, e.g.*, K.S. Krishnapriya, Vítor Albiero, Kushal Vangara, Michael C. King & Kevin W. Bowyer, *Issues Related to Face Recognition Accuracy Varying Based on Race and Skin Tone*, 1 IEEE TRANSACTIONS ON TECH. & SOC'Y 8, 15-17 (2020).

[12] *See* Adrian Blackledge, *The Magical Frontier Between the Dominant and the Dominated: Sociolinguistics and Social Justice in a Multilingual World*, 27 J. MULTILINGUAL & MULTICULTURAL DEV. 22, 23 (2006).

[13] *See* Jon Haworth & Stacy Chen, *Student Asked to Change Her Name to Make It Sound English Says She Hopes Experience Can Empower People*, ABC NEWS (June 21, 2020, 7:09 AM), https://abcnews.go.com/US/college-professor-demands-student-change-make-sound-english/story?id=71370111 [https://perma.cc/5RXS-6PZV].

[14] Mari J. Matsuda, *Voices of America: Accent, Antidiscrimination Law, and a Jurisprudence for the Last Reconstruction*, 100 YALE L.J. 1329 (1991).

[15] *See, e.g.*, Jessica A. Clarke, *They, Them, and Theirs*, 132 HARV. L. REV. 894, 957 (2019) (discussing discrimination against nonbinary people from misgendering and using incorrect pronouns).

[16] *See generally* Ingrid Piller & Kimie Takahashi, *Linguistic Diversity and Social Inclusion*, 14 INT'L J. BILINGUAL EDUC. & BILINGUALISM 371 (2011).

[17] *See generally* Anjola Anu Robbin, *Mind Your Spellings: A Study of the Current Trend of Anglicization of Names on Facebook*, 20 IFE PSYCHOLOGIA, Sept. 2012, at 1; Jiyoon Ha, *My Name Is a Typo*, ROOM, https://roommagazine.com/writing/my-name-typo [https://perma.cc/VVM2-7JV5] (last visited Dec. 29, 2020).

to a view of "ordinariness" or "neutrality" with significant implications for developing legal norms, standards, and rules.

Briefly described, my methodology was to test the ninety-two most popular "ethnic" names on a range of devices (including Apple and PC), operating systems (including those produced by Apple, Microsoft, and Android), and applications (including Microsoft Word, Notes, iMessage, Gmail, and WhatsApp). I defined "popularity" of names by choosing the top ninety-two names that appeared on any one of three different lists of most popular baby names in 2014 and 2016 maintained by the City of New York,[18] the Georgia Department of Public Health,[19] and the Texas Department of State Health Services.[20] I defined "ethnic" by choosing all the top names on these three lists that were designated as having an ethnicity other than "white, non-Hispanic" and that did not also appear on the lists of most popular White names.[21] In addition to information about the products and names tested, my research assistants and I recorded information about the form of autocorrect, as well as any automatic replacements or suggested alternatives that were provided for the word perceived as mistyped. The Appendix contains a more detailed description of my methodology as well as a set of tables with the results of the tests.

The most important observation about the research design is that it was qualitative in nature; it was an effort to clarify the existence of the bias without necessarily defining its statistical significance. I originally decided to test a range of devices and applications for Anglo bias because I wanted to know more about why certain names, including my own, were habitually autocorrected when I typed them. I discovered early in the testing process and in my research about the nature of autocorrect technology that it is impossible to use a testing process like mine to determine *why* certain names are autocorrected and others are not. Nor is it possible to determine why autocorrections take the forms they do using such testing.

My testing takes the perspective of a consumer—a user of autocorrect technology. Understanding why certain names are autocorrected and why the technology is designed as it is requires information that is not publicly available about the algorithms used, as well as the perspective of a computer scientist in

[18] *Popular Baby Names*, NYC OPENDATA [hereinafter *New York Baby Names*], https://data.cityofnewyork.us/Health/Popular-Baby-Names/25th-nujf [https://perma.cc/72QX-TFKN] (last updated Dec. 16, 2020).

[19] *Popular Baby Names*, ONLINE ANALYTICAL STAT. INFO. SYS. [hereinafter *Georgia Baby Names*], https://oasis.state.ga.us/oasis/babynames/ (select "2016"; then click "Get Data!") (last visited Dec. 29, 2020).

[20] *Table 8 Most Popular Baby Names*, TEX. DEP'T OF STATE HEALTH SERVS., https://www.dshs.texas.gov/chs/vstat/vs14/t08.aspx [https://perma.cc/6BQE-MKD7] (last updated Aug. 25, 2016).

[21] As the Appendix describes in more detail, this list still includes many names associated with White individuals but excludes names that appeared on *both* a list of most popular ethnic names and a list of most popular White names.

interpreting them.[22] Thus, my testing was useful in generating the second-order questions that flow from a consumer's perspective, such as whether some devices are more "biased" than others. However, it was not capable of answering them. For example, beyond providing a very basic proof of concept, my empirical testing cannot tell us the statistical significance of the various manifestations of Anglo bias in different autocorrect technologies. Nor was my testing comprehensive in scope or coverage of the phenomenon of algorithmic bias in autocorrect; the nature of intellectual property protection in this industry precludes this.[23] Finally, the research design was not intended to determine whether any particular White or non-Anglo user experiences one or more of the harms described in this Article. Additional qualitative and quantitative methods are necessary to understand the range and scope of such harms. Ultimately, as I learned in the course of testing, part of the value of this research design is examining the extent to which algorithmic bias in autocorrect *can* be discovered by consumers.

2. Results

Forms of autocorrect fall along a spectrum of inconvenience to the user. To focus on the user's experience, I have arranged the description of our research results along this spectrum, beginning with versions of autocorrect that are more difficult to override. At the less invasive end of the spectrum described below, autocorrect does not correct the perceived misspelling but rather simply highlights the word with a red or blue squiggly underline or similar device. I refer to this full spectrum as autocorrect technology, which may be inaccurate from a technological perspective but is faithful to the consumer's perspective.

Automatic replacement upon pressing the space bar or pressing send. On the more invasive end of the spectrum are those technologies in which the word typed by the user is automatically replaced with a different word when the user presses the space bar after typing the "mistyped" word. In email and texting applications, this form of correction can occur immediately after the user clicks or touches the "send" function.[24] In our testing, this form of autocorrect occurred in the iMessage application of the iPhone 6s (for example, "Amari" to

[22] For example, my research assistants and I would have had to wipe our devices clean in order to avoid getting results biased by our previous uses of devices or systems in which we had already typed certain names.

[23] *See infra* Section III.A.2 (discussing Whiteness as intellectual property).

[24] This appears to be what happened to the user who sent me an email that began with the words "Dear sashimi." Microsoft's description of its spell-check function is vague. *See Check Spelling Before Sending a Message*, MICROSOFT: SUPPORT, https://support.office.com/en-gb/article/check-spelling-before-sending-a-message-620b24fc-9cc5-4a2f-a26b-9ff4e02cc193 [https://perma.cc/6XFC-TV8X] (last visited Dec. 29, 2020). Thus, it is not clear whether Microsoft still uses the feature I describe here or whether it has replaced this feature with something less interventionist.

"amazing" and "Ayaan" to "Susan");[25] the Notes application of the iPad (iPadOS 13.3; for example, "Journee" to "Journey")[26] and (iOS 9.3.5; for example, "Aarav" to "aardvark");[27] and the WhatsApp application of the Moto e5 Play (Android Version 8.0.0; for example, "Jayla" to "Kayla").[28] This version of autocorrect requires the user to backtrack to retype the intended name or override autocorrect another way.

There are several observations about the occurrence of this form of autocorrect in our testing. First, it cropped up across a range of devices, both those newer to the market and those more dated.[29] Second, this form of autocorrect appeared both in word-processing and texting applications, though it appeared more frequently in texting applications. Third, from a consumer's perspective, there appears to be no rhyme or reason explaining why this version of autocorrect occurs with some names and other, less invasive versions occur with other names that appear equally "ethnic" on the very same devices and applications.[30]

Pop-up boxes. In this version of autocorrect, when a word appears to be mistyped, a small box pops up near that word with a suggested spelling for it. If the user presses the space bar, the suggested word replaces the word that appears to have been mistyped. However, the user can override autocorrect by clicking or touching a tiny "x" in the corner of the pop-up box.[31] Some versions of Apple's iPad have had this feature, and we also have anecdotes of it appearing in Gmail.[32] While it allows for more control than the automatic replacement version of autocorrect described above, the tininess of the "x" in the corner of the pop-up box combined with the clumsiness of touch-typing on small screens makes it very difficult to use in practice. It appears that this form of autocorrect is more of a historical example than a current one. My research assistants and I have plenty of personal experiences and anecdotes from others about this form of autocorrect. However, it did not occur during our testing, in which we used newer devices and operating systems.

Red squiggly line, with or without offered suggestions. The least intrusive form of autocorrect is also one of the oldest forms and one that both designers and writers in the industry describe as having been replaced by better forms—precisely because newer versions of autocorrect are more intrusive.[33] This form

[25] *See* Appendix, tbl.3.

[26] *See* Appendix, tbl.5.

[27] *See* Appendix, tbl.4.

[28] *See* Appendix, tbl.7.

[29] This is best demonstrated by scanning the different tables in the Appendix.

[30] *See, e.g.*, Appendix, tbl.3.

[31] As with many forms of autocorrect, the nature of the technological fix appears to prioritize typing efficiency over considerations of diversity.

[32] For example, I still use a first-generation iPad that included this feature until very recently, when a software update replaced it with the predictive text feature described below.

[33] Early developers of spell-checking technology divided the different systems into two categories: spelling checkers and spelling correctors. James L. Peterson, *Computer Programs for Detecting and Correcting Spelling Errors*, 23 COMM. ACM 676, 676 (1980) ("The

does not in fact automatically correct a word. Rather, it signals that a word appears to be misspelled by inserting a squiggly red or blue line under it. This form of "spell check" remains ubiquitous in word processing programs. For example, it was the only form of correction that occurred in our testing of Microsoft Word ("Word") on both Apple and PC devices.[34] In that application, it was most often combined with offered suggestions for replacing the word that appeared when the user "right-clicked" on the word.[35] This form of autocorrect was also the only form to occur in our testing of the Gmail application, which underlined many ethnic names.[36] It also regularly appeared in the Notes application on the iPad,[37] the iMessage application on the iPhone,[38] and the WhatsApp application on the Android smartphone.[39]

Correcting autocorrect: predictive keyboards/text and autopersonalizing. It appears that the state of the art in autocorrect incorporates one or both of two features that can be layered onto the forms described above and that also are replacing the older forms. The first feature is predictive text, which in many respects appears to be a more expansive form of correction. This often involves a suggestion bar containing one or more options to choose from instead of the word that appears to have been mistyped.[40] Regularly, the options include the exact word that has been typed, which is often included in quotation marks on

problem for a spelling checker is quite simple: Given an input file of text, identify those words which are incorrect. A spelling corrector both detects misspelled words and tries to find the most likely correct word."). The red squiggly line is indicative of spell-check systems, while many of the functions discussed here are the modern progeny of "spelling correctors." *Id.* at 678.

[34] *See* Appendix, tbls.1 & 6.

[35] *See* Appendix, tbls.1 & 6.

[36] *See* Appendix, tbl.8.

[37] *See* Appendix, tbls.4 & 5.

[38] *See* Appendix, tbl.3. Additionally, there are some times that the program offers no suggestions, such as when the word appears so badly misspelled that the program cannot make an association to a correctly spelled word. *See, e.g.*, Appendix, tbl.1 (for Aaliyah); *see also Check Spelling and Grammar in Office*, MICROSOFT: SUPPORT, https://support.office.com/en-gb/article/check-spelling-and-grammar-in-office-5cdeced7-d81d-47de-9096-efd0ee909227 [https://perma.cc/H5F8-7B4M] (last updated Oct. 28, 2019); *Check Spelling and Grammar in Office for Mac*, MICROSOFT: SUPPORT, https://support.office.com/en-gb/article/check-spelling-and-grammar-in-office-for-mac-05cae673-16e9-4917-9346-6d01a2b9d8ef [https://perma.cc/78TH-3HBU] (last visited Dec. 29, 2020).

[39] *See* Appendix, tbl.7 (showing offered suggestions for Android operating system).

[40] *See QuickType*, https://www.apple.com/my/ios/whats-new/quicktype/ [https://perma.cc/FY2C-Z2XC] (last visited Dec. 29, 2020) (describing how predictive text works in context of autocorrect). Indeed, predictive text is arguably increasingly intrusive in that it begins as soon as the user starts typing and offers suggestions midword, not just when something has been misspelled.

the far left of the suggestion bar.[41] Regularly also, one of the words in the suggestion bar is highlighted and if the user does not click any of the options in the suggestion bar but rather continues to type, the apparently mistyped word is replaced with the highlighted option.[42] Often, the highlighted word is not the exact word that was typed.[43]

When the "mistyped" name is automatically replaced upon pressing the space bar, this version of autocorrect is as difficult to override as automatic replacements that occur without a suggestion bar. However, it may be that one trend in autocorrect is to provide a suggestion bar and a red or blue squiggly line but no automatic replacement.[44] This at least allows the user more options in deciding whether to replace the apparently mistyped word, including the option of retaining the word as is. It also provides a more physically feasible means of rejecting the suggestion than the tiny "x" in the corner of a pop-up box.[45] Nonetheless, even this less invasive form still requires action to add the word to one's personalized dictionary.

In addition, it appears that many autocorrect algorithms now include a feature that I will call "autopersonalize," whereby repeated typing of the same name by a user automatically places the name in the user's personalized dictionary.[46] It is automatic in the sense that the user does not have to do anything to customize their dictionary other than to type the same name more than once in their device.[47] This streamlined form of customizing or personalizing a dictionary greatly increases the efficiency of typing a non-Anglo name once it is autopersonalized, but obviously it is ineffective for users typing non-Anglo names for the first (few) time(s).

---

[41] *See id.*

[42] *See id.*

[43] *See id.*

[44] We did not collect enough data to make an educated guess on this question.

[45] In a number of recent smartphones, the predictive text feature also increases the clicking size of the most probable next letters that the user will type. For example, if I type "happ" into the phone, the phone will predict that I will continue typing either "happy" or "happiness" and enhance the touchable area for keys like "y" so that I am less likely to accidently hit unwanted letters like "t" or "u." Adrian Covert, *The iPhone's Future Predictive Keyboard Makes Certain Keys Larger Without You Ever Noticing*, GIZMODO (July 31, 2012, 3:03 PM), https://gizmodo.com/the-iphones-future-predictive-keyboard-makes-certain-ke-5930577 [https://perma.cc/86ZW-44TP].

[46] As a technical matter, this feature seems very closely related to the predictive keyboard/text function because it appears to incorporate artificial intelligence to aid the device in anticipating what the user will type next rather than correcting a "misspelled" word. Alan Henry, *How Predictive Keyboards Work (and How You Can Train Yours Better)*, LIFEHACKER (Oct. 8, 2014, 11:00 AM), https://lifehacker.com/how-predictive-keyboards-work-and-how-you-can-train-yo-1643795640. Different applications describe this feature under different labels, which is why I have settled on the term "autopersonalize."

[47] *See* Amy-Mae Turner, *8 Essential Keyboard Tips Every iPhone Owner Should Know*, MASHABLE (July 17, 2020), https://mashable.com/article/8-keyboard-tips-every-iphone-owner-should-know/ [https://perma.cc/2GL7-9GRT].

3. Analysis

To begin with the obvious, from a consumer's perspective, the data produced by my testing capture a bewildering variety of experiences with the Anglo bias in autocorrect. Across a range of devices, operating systems, and applications, non-Anglo names are identified as misspelled or mistyped while names that are more commonly identified with White individuals appear not to be similarly treated.[48] Some devices, operating systems, and applications use more aggressive forms of autocorrect to automatically "fix" the names. Others use less invasive versions that nevertheless, by means of the wavy red underline, signify that a name has been incorrectly typed. While there are no doubt computer design reasons for this variety of outcomes, the apparent randomness from a consumer's perspective is an important outcome that our testing captured. We repeatedly puzzled over the fact that the same device, operating system, and application would sometimes automatically replace a non-Anglo name and sometimes underline but not replace a name that seemed just as non-Anglo. We tried researching and controlling for various differences, but we ultimately could not explain the differences in autocorrect forms. We simply do not have access to the data that these forms of autocorrect incorporate or the processes by which they use those data to autocorrect a word. From a remedial perspective, it was the variety of results, rather than any statistical patterns, that ended up being meaningful. This is one of the most critical results of our empirical work.

Moreover, our qualitative empirical work has generated crucial second-order questions that flow from the fact of algorithmic bias in autocorrect. For example, from a consumer's perspective, it appears that autocorrect's Anglo bias is more pervasive in some technologies than in others. While we do not have access to the information necessary to determine whether Anglo bias is most attributable to the device, the operating system, or the application, our testing did reveal a significantly higher level of autocorrection of non-Anglo names in Apple products.[49] Additionally, although Gmail was the only Google application we tested, the pervasiveness of wavy red lines in our testing of Gmail also supports claims by Safiya Umoja Noble and others that Google has a serious Whiteness problem.[50] These results compel further qualitative and quantitative testing.

Our testing also suggests that devices that require touch typing, especially on small keyboards, incorporate more invasive forms of autocorrect that exacerbate some of the harms flowing from Anglo bias by making it more difficult for users to override autocorrect.[51] Thus, while the red squiggly line in Word and Notes

[48] Although our testing focused on popular "ethnic" names, as the Appendix describes, we tested enough common White or Anglo names to at least justify more systematic research on the appearance of disparate autocorrection of non-Anglo names as compared to White or Anglo names.

[49] *Compare* Appendix, tbls.1, 2, 3, 4 & 5, *with* Appendix, tbls.6 & 7.

[50] Appendix, tbl.8; *see also* NOBLE, *supra* note 6.

[51] *Compare* Appendix, tbls.2 & 7, *with* Appendix, tbls.1 & 6.

may remind users that non-Anglo names are more improbable, and while such lines may slow the typing process by requiring users to double-check that what they wrote was what they intended, this form of autocorrect does not require backtracking, retyping, or some more active form of overriding. By contrast, products that are intended more for emailing and texting seem to use invasive forms more regularly, presumably for the sake of enhancing speed and ease of communication—at least for some. This finding takes on added significance, given recent research that "[m]obile devices play a larger role [than laptop or desktop computers] for black and Hispanic people when it comes to their online access options."[52] Again, in raising even the possibility of disparate results and impacts for communities of color, our testing establishes a crucial need for more robust testing of such devices.

As my research assistants and I discovered when we tried to retest names, more recent versions of autocorrect use autopersonalizing features that very quickly recognize names that users previously typed. Consequently, this seems to be the current state of the art for autocorrect technology. As I will discuss in detail, even this self-regulatory best practice has significant limitations that necessitate a greater level of regulatory oversight.[53] It is also important to note here, however, that some of the older, more invasive forms are still very much a part of some consumers' experiences with autocorrect, particularly in older devices. It is worthwhile to pause over which segments of the population likely have higher percentages of older devices. One obvious answer is that such devices are disproportionately owned by those with lower incomes, who are less able to afford the newest technology.[54] Given the disproportionate representation of people of color at lower income levels, this is both a story about wealth and a story about race—and one that contributes additional data and dimensions to the pioneering work of Virginia Eubanks on the automated nature of inequality.[55]

[52] Andrew Perrin & Erica Turner, *Smartphones Help Blacks, Hispanics Bridge Some – but Not All – Digital Gaps with Whites*, PEW RSCH. CTR.: FACTTANK (Aug. 20, 2019), https://www.pewresearch.org/fact-tank/2019/08/20/smartphones-help-blacks-hispanics-bridge-some-but-not-all-digital-gaps-with-whites/ [https://perma.cc/57DM-FV3P].

[53] *See infra* Section IV.C.1 (suggesting design alternatives for autocorrect flaws).

[54] For example, there are charities that specialize in providing old computers to schools with fewer resources. *See, e.g.*, Tercius Bufete, *What to Do with Your Old Laptop*, CONSUMER REPS. (Apr. 18, 2018), https://www.consumerreports.org/laptop-computers/what-to-do-with-your-old-laptop/ [https://perma.cc/P2EM-7DP2]; Lauren Indvik, *5 Charities for Donating Your Old Electronics*, MASHABLE (Apr. 29, 2010), https://mashable.com/2010/04/29/donating-electronics/; *see also Individuals Donating Used Computers*, COMPUTS. FOR CLASSROOMS, http://www.computersforclassrooms.org/individuals-donating-used-computers/ [https://perma.cc/FE79-AQXR] (last visited Dec. 29, 2020).

[55] *See generally* VIRGINIA EUBANKS, AUTOMATING INEQUALITY: HOW HIGH-TECH TOOLS PROFILE, POLICE, AND PUNISH THE POOR (1st ed. 2018).

B. *Autocorrect's History and Values*

The comments from those in the industry that more intervention is better provide a useful clue about the goals and perspectives of the designers who created autocorrect, which are reasonably clear thanks partly to the ubiquitous adoption of essentially the same technology by the entire industry. It is also useful that the individuals who created autocorrect for two of the major industry players have been open about their thinking.

Dean Hachamovitch is the individual listed on Microsoft's patent for autocorrect.[56] In an interview with *Wired Magazine*'s Gideon Lewis-Kraus, Hachamovitch described his motivation: typing involves "a little bit of creativity and a whole lot of scutwork."[57] As Lewis-Kraus notes: "[Hachamovitch] could improve the typing experience by delivering us from scut. His aim was to make our typing sleek and invisible, smooth as speaking from a teleprompter."[58]

To accomplish this function—to free us from the inefficiencies of typing with our clumsy fingers, thereby allowing us to use the written word more freely and efficiently—Hachamovitch built on the work of other Microsoft colleagues whose job was to improve the "functionality" of typing.[59] He began by writing code to use the space bar as a trigger for automatically replacing a misspelled word with a correctly spelled alternative.[60] He and his team then developed a list of common spelling errors and appropriate replacements, a list that was substantially expanded when Hachamovitch's nineteen-year-old summer intern wrote code to include the customized dictionaries of Hachamovitch's colleagues.[61] These periodically expanded lists were the basis for several versions of autocorrect used in Word.[62] Eventually, as Lewis-Kraus describes, autocorrect technology came to involve algorithms and cloud technology that sorted huge amounts of data to examine the probabilities of intended word choices. These algorithms take into consideration such things as "keyboard proximity, phonetic similarity, [and] linguistic context."[63] But, Lewis-Kraus concludes, "it's essentially a big popularity contest. . . . Autocorrect has become an index of the most popular way to spell and order certain words."[64]

A similar story emerges from Ken Kocienda, the creator of iPhone's autocorrect. Kocienda and his team's challenge was to translate autocorrect, and the many other functionalities of a basic word processing system, to a

---

[56] *See* Sys. & Method for Automatically Correcting a Misspelled Word, U.S. Patent No. 6,047,300 (filed May 15, 1997) (issued Apr. 4, 2000).

[57] Lewis-Kraus, *supra* note 3.

[58] *Id.*

[59] *Id.*

[60] *See id.*

[61] *See id.*

[62] *See id.*

[63] *Id.*

[64] *Id.*

touchscreen operating system that allowed the "keyboard . . . to get out of the way when it wasn't needed so the rest of the apps on the phone could shine."[65] While his ultimate goal was obviously to increase the utility of the entire iPhone, his expression of the goal of software-assisted typing is quite similar to Hachamovitch's, though with an added touch of sentimentality. He noted,

> One of my favorite things is watching people at the end of airline flights, soon after the landing, as the plane taxis to the gate. When the flight attendant announces over the intercom that everyone can turn their phones on, what do many people do next? They open a messaging app and type a short note to a companion, a friend, a loved one. They write, "Just landed," or "On the ground. See you soon." These countless trivial but human moments are enabled by technology and made possible, in some small part, by an autocorrecting software keyboard.[66]

The objectives of these developers are both understandable and laudable. It is indeed a wondrous thing to be able to type so freely as to almost imitate spoken communication—and to be free to do so in airplanes, on subways, on walks, and with spontaneity thanks to our handheld devices.

This view from the developers' perspective also explains the push within the industry toward greater intervention, for intervention seems key to the "auto" part of autocorrect. It is what increases the efficiency of typing to the point of imitating the spoken word. Returning to the technical innovations that moved the industry from spell-checking to autocorrecting, it makes sense that simply inserting a red squiggly line under each misspelled word would require much more backtracking for the average typist to correct all the misspellings on a page. Autocorrect, on the other hand, catches and corrects the vast majority of these mistakes, seamlessly inserting correctly spelled words as the typist presses the space bar between the words being typed. It also appears that the developers' perspective encompasses a relatively limited range of names, thereby occluding obvious fixes such as providing users the option of simply turning off spell-check for initially capitalized words in addition to fully capitalized words.

Moreover, it is clear that for the sake of convenience, efficiency, spontaneity, and human connection, American consumers have been willing to give up many protections and even rights. The raging debates about technology and privacy exemplify the tradeoffs in this arena, although they are by no means exhaustive.[67] The ubiquity of impenetrable click-through contracts that require

---

[65] Ken Kocienda, Opinion, *I Invented the iPhone's Autocorrect. Sorry About That, and You're Welcome*, WIRED (Sept. 4, 2018, 8:00 AM), https://www.wired.com/story/opinion-i-invented-autocorrect/.

[66] *Id.*

[67] *See* WOODROW HARTZOG, PRIVACY'S BLUEPRINT: THE BATTLE TO CONTROL THE DESIGN OF NEW TECHNOLOGIES 7-11 (2018) (critiquing intentionally exploitative design of new technologies and lack of privacy protection afforded to consumers, and proposing regulations aimed at protecting consumers' trust, obscurity, and autonomy in connection with their use of technology); FRANK PASQUALE, THE BLACK BOX SOCIETY: THE SECRET ALGORITHMS THAT CONTROL MONEY AND INFORMATION 4-14 (2015) (critiquing lack of transparency and accountability involved in collection, distribution, and use of big data that can result in

us to waive privacy to access Facebook, Snapchat, and Amazon makes it very difficult for us to patrol and control a sphere of privacy while still using these modern tools of connection and intimacy.[68] With many of these services, it appears that we provide access to some data largely for the benefit of the tech companies without clarity on whether or how such access actually benefits us as consumers.[69] Yet as the controversy surrounding geolocation devices reveals, some technologies require us to relinquish privacy in order to receive a more convenient form of the very service we seek. It is easier to obtain directions on a smartphone if we allow the phone to determine where we are when we ask it for directions.[70] Of course, this information is stored and, in some cases, shared.[71] So too with storage on the cloud. We could pay for storage devices that

discriminatory harms); David Gray & Danielle Citron, *The Right to Quantitative Privacy*, 98 MINN. L. REV. 62, 71-72 (2013) (arguing that "the threshold Fourth Amendment question should be whether a technology has the capacity to facilitate broad and indiscriminate surveillance that intrudes upon reasonable expectations of quantitative privacy by raising the specter of a surveillance state if deployment and use of that technology is left to the unfettered discretion of law enforcement officers or other government agents").

[68] *See* Julie Brill, *Privacy & Consumer Protection in Social Media*, 90 N.C. L. REV. 1295, 1297 (2012) (proposing new policy that would require companies to consider consumer privacy at the outset of product development; simplify existing privacy policies; and require greater transparency of data collection, use, and retention by data companies); Dina Srinivasan, *The Antitrust Case Against Facebook: A Monopolist's Journey Towards Pervasive Surveillance in Spite of Consumers' Preference for Privacy*, 16 BERKELEY BUS. L.J. 39, 41-43 (2019) (exploring how Facebook's rise to monopoly status was predicated on consumer privacy and its unique closed communications network, thus consolidating enough power in the company to allow it to break its original promises of privacy and begin mandatory commercial surveillance); Dalvin Brown, *FaceApp's Privacy Concerns: How the App Compares to Facebook, Instagram and Snapchat Terms*, USA TODAY (July 18, 2019, 11:39 AM), https://www.usatoday.com/story/tech/2019/07/18/faceapp-sparks-privacy-concerns-but-dont-forget-facebook/1765101001/ [https://perma.cc/UG39-5VES] (comparing FaceApp's privacy policy to those of other social media giants).

[69] *See* PASQUALE, *supra* note 67, at 9 ("Important corporate actors have unprecedented knowledge of the minutiae of our daily lives, while we know little to nothing about how they use this knowledge to influence the important decisions that we—and they—make."); Brill, *supra* note 68, at 1303-04 (addressing privacy concerns related to social media platforms' collection and analysis of huge volumes of personal data, including risks of reidentification of consumer and data breaches).

[70] Paige M. Boshell, *The Power of Place: Geolocation Tracking and Privacy*, BUS. L. TODAY (Mar. 25, 2019), https://businesslawtoday.org/2019/03/power-place-geolocation-tracking-privacy/ [https://perma.cc/GUH7-UT7E] ("Individuals often opt into location tracking through personal devices and their apps, such as fitness monitors, smartphones, and GPS trackers, for the purposes of allowing the app to provide them with the underlying service, such as determining distance ran, providing the local weather forecast, and locating and obtaining directions to nearby restaurants.").

[71] *Id.*

would not make us store information (including that of the most personal variety) in a virtual file cabinet that could be opened by the provider of the cloud. But many of us choose to trade privacy for convenience and, ironically, also for the perception of more security in the knowledge that the cloud will still be there if the house burns down or the external hard drive breaks.[72]

While there is mounting evidence that the privacy trade-offs we make are regularly the result of misinformation, misperception, and a basic lack of knowledge about what we are giving up, it is also apparent that most of us do in fact make some rational choices to exchange privacy for the benefits offered by these technologies. As a social and cultural matter, Americans appear to be shifting in this regard. In contrast to the prioritization of privacy in Europe, a recent legal translation of which is the General Data Protection Regulation,[73] Americans prioritize the things we gain from these technologies more than the privacy we lose.[74]

Meanwhile, a review of the chronological iterations of autocorrect suggests that efficiency is *the* priority in industry efforts to update autocorrect. At times, these updates have alleviated some of the harms resulting from autocorrect's Anglo bias. As I have described, corrections triggered by clicking send and popup boxes with the tiny "x" are much rarer in newer versions of Microsoft and Apple products. However, both the literature on autocorrect and the ubiquity of red squiggly lines under proper names suggest that the industry's replacement of the more problematic versions of autocorrect responds to concerns about efficiency rather than diversity.

II. AUTOCORRECT'S HARMS

Privacy is not the only thing that people of color lose when we use a range of devices with the autocorrect feature. Indeed, it is not the only thing that many people who do not identify as people of color but whose names appear non-Anglo are losing. This Part surveys the losses for people and communities of color as a result of Anglo bias in autocorrect. Some of these losses also accrue to those who are in the racial and ethnic majority but who have names that appear non-Anglo. In addition, some of the losses are social and cultural losses that accrue to our society as a whole.

---

[72] *See* Eric Johnson, Note, *Lost in the Cloud: Cloud Storage, Privacy, and Suggestions for Protecting Users' Data*, 69 STAN. L. REV. 867, 871 (2017) (arguing that cloud providers need to exercise greater transparency by disclosing their privacy policies and terms of access to user information). *See generally* REGULATING THE CLOUD: POLICY FOR COMPUTING INFRASTRUCTURE (Christopher S. Yoo & Jean-François Blanchette eds., 2015) (presenting range of policy concerns relating to increasing reliance on cloud computing and data storage).

[73] Council Regulation 2016/679, 2016 O.J. (L 119) 1 (EU).

[74] There are important exceptions to my claim, including the California Consumer Privacy Act of 2018. *See* CAL. CIV. CODE § 1798.100 (West 2020); *see also* Philip N. Yannella, *The Differing US and EU Regulatory Responses to Rise in Algorithmic Profiling*, COMMC'NS LAW. Spring/Summer 2018, at 1, 19.

A. *Economic Harms*

Beginning with the basic economic losses, the benefits that the creators of autocorrect claim to provide are meaningfully reduced for people with non-Anglo names and for those who correspond with us. These benefits include efficiency, convenience, and the enhancement of free and spontaneous communication. Instead of being able to type seamlessly while our misspellings are autocorrected, people with non-Anglo names, and those who correspond with us, have the experience of repeatedly needing to correct autocorrect. As a result, we are getting a lesser product. For this (large) group of people, the products we buy for the same price as everyone else are worth less because they do not function as well. While we may also suffer from losing a job or getting a lower grade because we failed to override autocorrect in a résumé or an assignment, the core economic harm here is from paying the same price for a less useful product.

Tort and contract claims for unfair and deceptive trade practices, breach of contract, and breach of warranty, as well as discrimination claims, would be perfectly viable if a certain class of consumers was sold cars with nonfunctional cruise control or other mechanical deficiencies. Indeed, such claims have been brought against auto dealers who provide credit for the purchase of cars on less favorable terms to people of color than to White people.[75] Consumer laws have established that part of the product being sold in such cases is the credit with which to purchase a car. When the credit is offered on less favorable terms to people of color, this violates multiple laws. A version of autocorrect that is less useful for people of color is directly analogous to these examples. It is an economic harm,[76] but given the claimed virtues of enhanced human

[75] *See, e.g.*, Coleman v. Gen. Motors Acceptance Corp., 220 F.R.D. 64, 100 (M.D. Tenn. 2004) (certifying class action under Equal Credit Opportunity Act).

[76] A range of consumer law doctrines, sounding in both tort and contract, provide the basis for consumer claims of economic harms. *See, e.g.*, Consumer Product Safety Act, 15 U.S.C. §§ 2051-2089 (making it unlawful to sell or distribute any product not conforming to statutory safety standards); Magnuson-Moss Warranty—Federal Trade Commission Improvement Act, 15 U.S.C. §§ 2301-2312 (establishing federal private right of action for consumers who can show that they were harmed by breach of warranty or service contract obligations). *See generally* BARKLEY CLARK & CHRISTOPHER SMITH, THE LAW OF PRODUCT WARRANTIES (2019) (detailing consumer warranties under the UCC and Magnuson-Moss Act). For examples of discussions of economic harms in contexts viewed as more attenuated under current law, see Sarah Dadush, *The Law of Identity Harm*, 96 WASH. U. L. REV. 803, 804-05 (2019) (arguing for inclusion in tort, contract, and state consumer protection laws of "identity harm," meaning the anguish experienced by consumers after learning that a product they purchased because it aligned with their values espoused false or exaggerated promises); Linda J. Rusch, *Products Liability Trapped by History: Our Choice of Rules Rules Our Choices*, 76 TEMP. L. REV. 739, 781-84 (2003) (proposing new products liability statute combining contract and tort theories to simplify and make more accessible actions to recover for broad range of injuries caused by products).

communication provided by autocorrect, the harm is more than just economic. Moreover, it is a collective harm as well as an individual harm, because communication with and within communities with predominantly non-Anglo names is more acutely affected.

A second harm, which is already the subject of a rich literature, is that of unequal access to and through technology. Examples of racist algorithms cover a disturbingly broad range of social and legal functions, from racist sentencing guidelines,[77] to credit scoring,[78] to autofills that provide race-based answers to questions,[79] to racially targeted advertisements.[80] Autocorrect belongs on this list. This technology demonstrates the harms that result from "mere" inefficiency. Few of us could deny that we tend to say names less often when we are unsure how to pronounce them. When we call less on people with "hard" names in class or make fewer phone calls to such individuals as part of our jobs, alleviating our own discomfort and inconvenience literally results in fewer opportunities for those individuals. Stripped of technicalities, autocorrect limits opportunity for those with non-Anglo names. This is directly analogous to the algorithm-driven decision to share certain job advertisements with White people but not Black people.[81] An algorithm that notifies Black people of fewer job opportunities than White people limits the ability to access economic (and social and cultural) opportunities through technology.[82] So too, an algorithm that normalizes Anglo names makes it more difficult for non-Anglo job applicants and prospective employers to correspond with each other. By offering a bias-

[77] *See* Margaret Hu, *Algorithmic Jim Crow*, 86 FORDHAM L. REV. 633, 660 (2017) (contending that current immigration- and security-related vetting protocols risk promulgating algorithmically driven form of Jim Crow, disparately impacting minority and immigrant communities); Aziz Z. Huq, *Racial Equity in Algorithmic Criminal Justice*, 68 DUKE L.J. 1043, 1080 (2019) (interpreting ProPublica examination of COMPAS algorithm—"conditional on being a nonrisky type, the COMPAS algorithm is more likely to overstate the risk presented by a black person than a white person").

[78] *See* Danielle Keats Citron & Frank Pasquale, *The Scored Society: Due Process for Automated Predictions*, 89 WASH. L. REV. 1, 13 (2014).

[79] *See* NOBLE, *supra* note 6, at 21 (describing disturbingly disparate Google autosuggest results when searching "why are black women so" versus "why are white women so"); Michael L. Smith, Comment, *Search Engine Liability for Autocomplete Defamation: Combating the Power of Suggestion*, 2013 U. ILL. J.L. TECH. & POL'Y 313, 314-15 (examining whether defamation lawsuits for insulting, suggestive, or derogatory Google autosuggest search results are viable in the United States).

[80] *See* Angwin & Parris Jr., *supra* note 9.

[81] *See* Sonia K. Katyal, *Private Accountability in the Age of Artificial Intelligence*, 66 UCLA L. REV. 54, 56 (2019) [hereinafter Katyal, *Private Accountability*] (referencing option that allows advertisers on Facebook to exclude specific ethnic affinities from viewing advertisements); Pauline T. Kim, *Big Data and Artificial Intelligence: New Challenges for Workplace Equality*, 57 U. LOUISVILLE L. REV. 313, 319 (2019) (arguing that employment ads on Facebook could effectively select on basis of race by using proxies, such as "interested in BlackNews.com," to narrow advertisement's audience).

[82] As I discuss, *infra*, Section IV.A, this problem of unequal access persists even in a context where "passing" or "covering" may be ubiquitous.

enhancing form of convenience, autocorrect makes it more difficult for those with non-Anglo names to participate in a range of markets. More broadly, it makes communication as a basic social and economic necessity more difficult.

Committing ourselves to diversity and equal opportunity requires that we each strive to overcome our own discomfort by learning the correct pronunciations (and spellings) of names and by making sure that we call on people with those names equally. In doing so, we communicate respect and a genuine desire to connect on equal terms. This obligation carries over into cyberspace, although our ability to fulfill it is thwarted by the authoritarianism of the proprietors of algorithm-based technology, just as it is by the social choices made by Google's autofills.[83] Just as algorithmic bias in other contexts is actionable through discrimination and other claims,[84] so too should such bias be the basis of legal action against autocorrect's proprietors.

B. *Identity, Social, and Cultural Harms*

Moving beyond harms that could be characterized primarily as economic, autocorrect's Anglo bias also imposes a range of harms that are best described as relating to dignity. A third loss experienced by non-Anglo people using autocorrect is identity related. Among other things, a name signifies individual and group identity, ethnicity, and culture.[85] There are many contemporary manifestations of the identity values of naming. Parents deliberate not only over their children's first names but also over the choice and construction of last

[83] NOBLE, *supra* note 6, at 21.

[84] *See* Hu, *supra* note 77, at 668-69 (analyzing failure of equal protection claims in "No Fly List" litigation and related national security monitoring cases, and arguing that claims must focus on procedural due process harms effectuated by the *misuse* of algorithms/identity databases); Katyal, *Private Accountability*, *supra* note 81, at 56-57 (describing ACLU action against Facebook, which contended that Facebook's selective affinity group–based advertising function violated labor and civil rights laws).

[85] Abraham D. Lavender, *Hispanic Given Names in Five United States Cities: Onomastics as a Research Tool in Ethnic Identity*, 10 HISP. J. BEHAV. SCIS. 105, 106 (1988); Pablo Mateos, Paul A. Longley & David O'Sullivan, *Ethnicity and Population Structure in Personal Naming Networks*, PLOS ONE, Sept. 2011, at 1, 7-11 (finding that personal naming practices are "based on much more complex attachments than geographic origins alone" and that "socio-cultural practices are sustained for generations after migration"); *cf.* Joshua R. Goldstein & Guy Stecklov, *From Patrick to John F.: Ethnic Names and Occupational Success in the Last Era of Mass Migration*, 81 AM. SOCIO. REV. 85, 100 (2016) (concluding, based on empirical study, that changing first names to assimilate into American society was associated with higher likelihood of occupational success). In legal conversations, the value of names regularly plays out in discussions of family and gender. *See, e.g.*, Elizabeth F. Emens, *Changing Name Changing: Framing Rules and the Future of Marital Names*, 74 U. CHI. L. REV. 761, 814-15 (2007) (arguing that existing state default rules for retaining premarital surname promotes retention of patrilineal name descent).

names to reflect family lines, ethnicity, and gender identities.[86] Many of us include brief guidelines on the pronunciation of our names in our email signatures. Beyond individual names, we see social, cultural, and even legal debates about the naming of neighborhoods and other places.[87] If anything, names are increasingly important to us as identity signals. We communicate a great deal about ourselves when we choose and share our names. Yet as a society, we have thus far given a free pass to autocorrect technologies for consistently botching our names.

Here, it may be useful to reflect on Microsoft's response to complaints it received about the autocorrection of two particular names by its early versions of autocorrect. In one instance, Goldman Sachs complained about the autocorrection of its name to Goddamn Sachs.[88] In the other, a man named Bill Vignola complained about the autocorrection of his name to Bill Vaginal.[89] These complaints prompted Microsoft to develop a list of sensitive or obscene words that its autocorrect function would not use as replacements for misspelled words.[90] Today when one writes a text about Bill Vignola, his name may well be corrected to Bill Victoria or Bill Big Nolan, which were two of the options my iPhone gave me when I typed Vignola, but it will likely not be corrected to Bill Vaginal. I have no idea whether Bill Vignola would be as likely to complain about these more recent autocorrections. Regardless, it is unclear why it is any more technologically challenging to write code that would simply leave his name as is than to write code to avoid sensitive or obscene autocorrections of his name. It appears that proprietors of autocorrect technologies perceive Americans to be sensitive to obscenities (which apparently include female body parts) but not to diversity.

If one of the more powerful values of a name as a signifier of identity is that it also signifies the communities to which a person belongs, then the corollary of having one's name devalued is that of having one's communities devalued. This is another harm that is best captured in noneconomic terms. The algorithmic default to Alicia from Aziza may signify that fewer Azizas in America have access to products that use autocorrect, and in that sense it may be a product of statistical values and probabilities.[91] But, as with other algorithm-driven

[86] Rosalind Edwards & Chamion Caballero, *What's in a Name? An Exploration of the Significance of Personal Naming of 'Mixed' Children for Parents from Different Racial, Ethnic and Faith Backgrounds*, 56 SOCIO. REV. 39, 41 (2008).

[87] Nestor M. Davidson & David Fagundes, *Law and Neighborhood Names*, 72 VAND. L. REV. 757, 823 (2019) (concluding that neighborhood names are a form of cultural property and relevant to urban governance below the city government level).

[88] Lewis-Kraus, *supra* note 3.

[89] *Id.*

[90] *Id.*

[91] *See id.* ("Autocorrection is no longer an overqualified intern drawing up lists of directives; it's now a vast statistical affair in which petabytes of public words are examined to decide when a usage is popular enough to become a probabilistically savvy replacement."); *see also* Sandra G. Mayson, *Bias In, Bias Out*, 128 YALE L.J. 2218, 2222 (2019) (arguing that risk assessment algorithms will always produce biased results since algorithms necessarily

decision-making, the result is expressive. It sends a message that communities that include names like Aziza, DaShawn, and José are valued less as consumers and users of these technologies of communication. It is hardly an extension to conclude that such communities are valued less as participants in these forms of communication, which autocorrect's creators rightly describe as contributing to human interaction. Moreover, the construction and effect of this technology today sends a message that non-Anglo individuals and communities do not belong in American society. It is a way of communicating that this technology is not really for people of color. These identity harms to non-Anglo individuals and communities deeply implicate universal values of equal dignity and respect, and it is especially important to understand them as such given recent claims that technological access is a human right.[92]

One additional loss that is best characterized in cultural terms is that of cultural devaluation. Here, it is important to distinguish many other uses of racist or exclusionary algorithms from autocorrect. In arenas such as criminal sentencing or credit scoring, there is a compelling argument that algorithms have a better chance of avoiding racist outcomes in a society where human decision-making is so saturated with implicit—and explicit—bias.[93] Consequently, the best approach may be to seek to improve algorithms to avoid bias. By contrast, autocorrect was not developed to replace human bias in spelling; its function never included the goal of reducing discrimination or exclusionary behavior on the basis of race and ethnicity. Instead, the trade-off is between ease and efficiency of typing on the one hand and inclusion of those who are non-Anglo on the other. This exposes the cultural devaluation wrought by autocorrect. It highlights the prioritization of typing efficiency and convenience over the recognition of racial and ethnic diversity. In this respect, the expressive function

use the past, permeated with systemic racism, to predict the future); John Murray, *Racist Data? Human Bias Is Infecting AI Development*, TOWARDS DATA SCI. (Apr. 24, 2019), https://towardsdatascience.com/racist-data-human-bias-is-infecting-ai-development-8110c1ec50c [https://perma.cc/HH6L-L2JT].

[92] Patrick Ford, Comment, *Freedom of Expression Through Technological Networks: Accessing the Internet as a Fundamental Human Right*, 32 WIS. INT'L L.J. 142, 161 (2014) (arguing that Internet access is fundamental human right under "freedom of opinion and expression" provision of Universal Declaration of Human Rights (quoting G.A. Res. 217 (III) A, Universal Declaration of Human Rights, art. 19 (Dec. 10, 1948))).

[93] *See* Hu, *supra* note 77, at 695; Katyal, *Private Accountability*, *supra* note 81, at 54 (arguing for mix of tech industry self-regulation—via, for example, codes of conduct and impact statements—and proliferation of whistleblower protection to reduce opacity of artificial intelligence and combat algorithmic discrimination); Anupam Chander, *The Racist Algorithm?*, 115 MICH. L. REV. 1023, 1024-25 (2017) (reviewing PASQUALE, *supra* note 67) (arguing for transparency of algorithmic "*inputs and results*, which allows us to see that the algorithm is generating discriminatory impact. If we know that the results of an algorithm are systematically discriminatory, then we know enough to seek to redesign the algorithm or to distrust its results").

of autocorrect is a cultural devaluation of non-Anglo individuals and communities in American society, a collective statement that we prioritize convenience over diversity.

As Patricia Williams noted in the introduction to her 1987 article on racism as a crime of "spirit-murdering,"

> Racism resembles other offenses against humanity whose structures are so deeply embedded in culture as to prove extremely resistant to being recognized as forms of oppression. It can be as difficult to prove as child abuse or rape, where the victim is forced to convince others that he or she was not at fault, or that the perpetrator was not just "playing around."[94]

More compelling than Kocienda's humanizing and almost lilting description of the comforting role of autocorrect as the plane touches down and passengers text their loved ones is the *experience* that many readers of his description no doubt have of exactly the sort of comfort that Kocienda describes.[95] It is the sense that what Kocienda describes is the norm. When, in her article, Williams disrupted such a norm by describing racism from the perspective of those who experience it, she provided a powerful point of entry into, and translation of, the experience of racism as a legally actionable claim.

Perhaps, then, a more serviceable statement of autocorrect's harms would be to describe the experience of autocorrect by a user with a non-Anglo name. In my own experience, there was at first humor at the inanity of seeing the transmutation of my name into something silly and improbable. Then, there was certainly annoyance, the sense that the word offered in place of my name and that seemed improbable to me was somehow a more probable (or believable? Or appropriate? Or normal?) choice than my own name. Then, frustration at having to retype the name over, and over, and over, and over, and over again. Or of having to repeatedly, again and again, move my hand from the keyboard in order to click on the tiny "x" in the little box that insisted that the name I was trying to type could not be what I intended to type. And over time, anger: my name is not recognized by this technology still today. The technology was never made for me, and despite being stuck with it if I want to word process, or email, or text, I am still not part of the plan.

For me, the experience is worse when the name of someone else with whom I am corresponding is autocorrected. When I accidentally send an email after failing to catch the "autocorrection" of someone else's name, I usually feel deeply embarrassed and indeed ashamed. I feel complicit in the racist act. I own and share the responsibility of having contributed to the harms described in this Section because I failed to take the time to proofread the email carefully enough to override the autocorrect. I feel, with a clutch in my chest, that the failure was mine. When I catch the error, I usually follow up and apologize, and the apology is a communication of that shame. Ironically, I accept this responsibility even though the technology is designed to be seamless—to make it easy for me to

---

[94] Patricia Williams, *Spirit-Murdering the Messenger: The Discourse of Fingerpointing as the Law's Response to Racism*, 42 U. MIAMI L. REV. 127, 129-30 (1987) (footnote omitted).

[95] *See* Kocienda, *supra* note 65.

miss autocorrections. In a very real sense, then, I experience autocorrect's invisibility at the expense of my own visibility.

C. *Refining Harm Definition: At the Nexus of Racism and Linguistic Normativity*

At the same time, describing autocorrect's harms as just racial is both over- and underbroad. Something more is required to successfully translate autocorrect's harms for the purpose of developing a legal prescription. As my analysis has made evident, autocorrect butchers much more than racial and ethnic identity as conveyed through names. The history of autocorrect reveals that, translated into legal terms, autocorrect is a disparate impact problem. The harm does not appear to be intentional, but rather it is a product and function of computer language. As the creators of autocorrect described, the technology relies on frequency metrics, whereby algorithms calculate the likelihood that the user intended to type a particular word on the basis of the letters actually typed.[96] The logic underlying such algorithms evidences a "flat" computer language, meaning that it is much less multidimensional than our human language. It is a numeric discourse that literally overrides the grammatical constructions and linguistic eccentricities that have evolved over centuries of human discourse.

Because the logic of computer language intersects with normative probabilities to produce disparate effects for certain communities of users, the resulting harms certainly can be claimed as harms to non-Anglo identities and communities, as I have described. For example, autocorrect's norms nullify naming "eccentricities," such as alternate spellings of names like Brittany, Candace, Kristin, Scarlet, and Crystal, which can often be attributed to particular racial and ethnic communities. But it is important also to acknowledge that such harms are qualitatively different from those defined by Cheryl Harris, Latanya Sweeney, Safiya Umoja Noble, and others, even though the harms that these scholars describe result from quite similar algorithms.[97] For example, in her rich and extensive work on names, Sweeney catalogues the extraordinarily disproportionate results in Google searches whereby names associated with Black people produced search results of arrest records.[98]

The harms wrought by autocorrect are not primarily about disparate outcomes in education, health, employment, housing, or criminal sentences. Rather, autocorrect's harms result from a forced conformity that sweeps in many things in addition to race and ethnicity. In this respect, it is undercapacious to define the harm as exclusively racial. The definition of harm is also about linguistic normalcy. Autocorrect not only reflects and magnifies the privilege of dominance but also reflects the privilege of frequency. The definition of harm lies at the nexus between autocorrect's frequency metrics and the preference for

[96] *See supra* Section I.B.

[97] *See supra* note 9 and accompanying text.

[98] Sweeney, *supra* note 9, at 46-47.

White and Anglo normativity. It is a nexus that reflects a cultural pressure that intersects with race. It is a norming device that harms poets and polyglots as well as those of non-Anglo identities. Thus, the definition of harm must acknowledge this qualitatively different effect, one that is not only (or even primarily) captured by claims under Titles VII and VIII of the Civil Rights Act of 1964 but rather one that constrains the ability to communicate through the richness of traditions and diversity that human language captures but that machine language does not. Again, this more specific definition of harm is especially important to recognize for the purpose of developing legal prescriptions.

In meaningful respects, then, the harm is best described as a default to "Anglo," rather than to "Whiteness," because it is a default to a certain ethnicity, national origin, religion, and *language*, as well as to a race. A more accurate analogy to the primary harms from autocorrect might be to the accent discrimination described by Matsuda. While Matsuda proposed a doctrinal upgrade to Title VII as one crucial legal response to the problem of accent discrimination in the workplace, she devoted core aspects of her analysis to elaborating the harms to human communication and connection that result from the social and legal controls on accent conformity.[99] In meaningful respects, the dominant harm claimed by Matsuda was the loss of "differences in language, accent, cadence, and sound that have made the streets of the North American cities I love vibrant and alive," and her most compelling articulation of the necessary prescription was a plea to "nurture these voices" in order to "save our national soul."[100]

The harms wrought by facial recognition technology might provide another useful analogy for the more refined definition of autocorrect's harm that I am developing here. While scholars have already identified a broad range of harms from such technology—resulting in calls by some to ban it outright[101]—Nila Bala's argument about the dangers of such technology in the classroom is particularly apt. As she argues,

> Classroom facial recognition poses potential harms by stigmatizing some normal behaviors and punishing children who may not be neurotypical. . . . If performance is just based on eye contact and other facial indicators, facial recognition software cannot distinguish between intentional and unintentional mind-wandering, nor can it account for expressions of non-neurotypical children.[102]

Of course, as Bala discusses, the use of such technology in the classroom and in many other settings also discriminates on the basis of race and gender.[103] In this

[99] *See generally* Matsuda, *supra* note 14.

[100] *Id.* at 1333.

[101] *E.g.*, Woodrow Hartzog & Evan Selinger, *Facial Recognition Is the Perfect Tool for Oppression*, MEDIUM (Aug. 2, 2018), https://medium.com/s/story/facial-recognition-is-the-perfect-tool-for-oppression-bc2a08f0fe66.

[102] Nila Bala, *The Danger of Facial Recognition in our Children's Classrooms*, 18 DUKE L. & TECH. REV. 249, 254 (2020).

[103] *Id.* at 257-58, 262-64.

respect, facial recognition technology produces an analogous set of harms to those wrought by autocorrect. Those who are misidentified by the technology on the basis of race and/or gender have compelling claims of racial and gender discrimination. But the use of such technology in settings such as classrooms also reveals the more generalized harms related to social connection and communication that impact *all* children.

D. *Who Benefits?*

On the other side of the ledger, let us consider what is gained by the proprietors of autocorrect technology. Presumably, the primary benefit is the economic value of selling a product that the proprietors perceive (rightly or wrongly) to be more useful (efficient and convenient) for White or Anglo consumers to use. Why else would the technology function as it currently does when it would be simple enough to avoid autocorrecting capitalized words, or at least to make it easier to override autocorrect? Again, perceptions are key here. Just as there is little motivation for a company that hires a White job applicant on the basis of racist algorithms to correct its algorithms to hire well-qualified applicants of color,[104] there is little motivation for the proprietors of autocorrect technology to make such straightforward fixes to autocorrect. There is no concern about legal liability. Nor, in either of these arenas, has there been enough of a public outcry to shame these actors into changing their algorithms. Nor, puzzlingly, does it appear that the developers of this technology experience autocorrect as a person of color does, even though these companies clearly employ people with non-Anglo names.

Thus, the same cognitive biases, such as attributional and preference-related errors, that constrain employers from hiring candidates of color over White candidates when doing so would be more economically rational[105] and that motivate advertisers to limit their own markets by advertising to a narrower range of potential consumers[106] also apparently shape the behaviors of proprietors of autocorrect technology. It appears that empirical evidence of actual consumer choices is not driving industry behavior, nor is it desired.

There is, however, another possibility. I will discuss the theoretical and legal implications of this possibility in Part III, but I begin here by outlining the factual basis for it. Doing so requires us to reenter the experience of autocorrect from

---

[104] Katyal, *Private Accountability*, *supra* note 81, at 77-91; Kim, *supra* note 81, at 320.

[105] *See* RANDY ALBELDA, ROBERT DRAGO & STEVEN SHULMAN, UNLEVEL PLAYING FIELDS: UNDERSTANDING WAGE INEQUALITY AND DISCRIMINATION 20-34 (3d ed. 2010) (describing racialized unemployment differences that have persisted since the 1950s); Katyal, *Private Accountability*, *supra* note 81, at 79, 81; Kim, *supra* note 81, at 319.

[106] Katie Paul & Akanksha Rana, *U.S. Charges Facebook with Racial Discrimination in Targeted Housing Ads*, REUTERS (Mar. 28, 2019, 8:00 AM), https://www.reuters.com/article/us-facebook-advertisers/hud-charges-facebook-with-housing-discrimination-in-targeted-ads-on-its-platform-idUSKCN1R91E8.

the perspective of a person with a non-Anglo name. The experience that I have described thus far is one of having to repeatedly correct autocorrect to get one's name right. But what if the individual and those with whom they correspond do not correct autocorrect? This seems entirely possible, if for no other reason than fatigue from having to fix a name repeatedly or simply the failure to notice that a name was autocorrected. In that case, autocorrect technology provides a modern tool for such an individual to "pass," or more aptly, to borrow from Kenji Yoshino, "cover" as White or Anglo.[107] Yoshino defines "passing" as the hiding of one's identity, while "covering" is the downplaying of one's identity to make it easier for others to ignore.[108]

On the one hand, this possibility creates an opportunity for individuals who could not otherwise pass or cover as White or Anglo to do so through technology. But of course, just as in the contexts that Harris, Yoshino, and others have described,[109] the perceived benefits of passing or covering come with extraordinary costs to non-Anglo individuals and communities and (as I will describe in the next Part) corresponding benefits for the proprietors of those technologies. For non-Anglo people, one of the costs is the domino effect of autocorrect repolluting[110] algorithms that incorporate racial and ethnic identity into their calculations.[111] The most obvious example here could be the misperception by the proprietors of various algorithms that their users are predominantly Anglo. If for some significant percentage of the time non-Anglo people do not correct the autocorrection of our names (intentionally or unintentionally), then the algorithms that drive autocorrect do not capture the diversity of those who use autocorrect. This misrepresentation in the data used by autocorrect thus proliferates the harms for non-Anglo communities. While it would be an interesting empirical question to examine just what that percentage is, I will leave the empirical question for another day and focus in the following Part on the theoretical implications.

---

[107] Kenji Yoshino, *Covering*, 111 YALE L.J. 769, 772 (2002).

[108] *Id.* (noting that "passing" and "covering" are not always clearly distinct from each other).

[109] *See* Harris, *supra* note 1, at 1710-14 (describing her grandmother's ability to pass because of her "white" features); Yoshino, *supra* note 107, at 812, 836-37 (describing gay people covering their sexual orientation or passing as straight).

[110] I take the term "repollution" from consumer law discussions of the phenomenon whereby consumer reporting agencies fail to remove false information from consumer credit reports with the domino effect of repolluting future credit reports. *See* 15 U.S.C. § 1681s-2.

[111] Matthew Adam Bruckner, *The Promise and Perils of Algorithmic Lenders' Use of Big Data*, 93 CHI.-KENT L. REV. 3, 29 (2018) (explaining that algorithms might discriminate against potential borrowers by race explicitly or through proxies for race); Mikella Hurley & Julius Adebayo, *Credit Scoring in the Era of Big Data*, 18 YALE J.L. & TECH. 148, 152 (2016); Pauline T. Kim & Erika Hanson, *People Analytics and the Regulation of Information Under the Fair Credit Reporting Act*, 61 ST. LOUIS U. L.J. 17, 19 (2016).

III. WE ARE BUYING MORE THAN EFFICIENCY

The purpose of this Part is to gain a deeper understanding of the harms wrought by autocorrect. Given its ubiquity, its purpose, its functions, and the values underlying its development, autocorrect provides a distinctive example of algorithmic bias. This combination of factors opens a window on the broader social and cultural effects of autocorrect and many other forms of algorithmic technology, which may be better understood by examining perspectives on the context in which the range of biases in smart technology has emerged. By examining some of these perspectives, this Part contributes to the broader conversation about algorithmic bias.

A. *Owning Whiteness*

One overriding theme in the scholarship on algorithmic bias is the recognition that such bias is omnipresent and that it is outpacing regulatory responses to it.[112] This is a thoroughly pragmatic problem. Policymakers and lawyers are in constant search of analogies to help us understand the problems of privacy loss, consumer harms, and discrimination so that we can remedy them. In the case of technologies such as autocorrect, the problem is compounded by their role in normalizing Whiteness and other privileged identities.[113]

Autocorrect exemplifies this conundrum, raising the question of just how the law could intervene. There is an argument that White people benefit from Anglo bias in autocorrect, but it would be an impossible stretch at present to say that White people broadly are legally responsible for it. Instead, and especially since autocorrect is developed, controlled, and managed by the proprietors of technology that incorporates autocorrect algorithms, the objects of legal intervention are most appropriately those proprietors. However, the behavior of autocorrect's proprietors currently appears to be outside the realm of regulation. There is no perceived physical harm that flows from Anglo bias in autocorrect.[114] Nor are the noneconomic harms easily captured by standard contract analyses.[115] There is no clear perception of loss of liberty or other core rights, as exists from algorithmic bias in sentencing guidelines and other uses of algorithms in the criminal justice arena.[116] Disturbingly, even our antidiscrimination and affirmative action jurisprudence is so circumscribed that it is hard to develop a legal claim about autocorrect's Anglo bias, though this

[112] *See supra* notes 77-80 (detailing different ways in which racial bias presents in algorithms).

[113] *See* Williams, *supra* note 94, at 129 (describing racism as "so deeply embedded in culture as to prove extremely resistant to being recognized as [a] form[] of oppression").

[114] *Cf.* Jack M. Balkin, *The Three Laws of Robotics in the Age of Big Data*, 78 OHIO ST. L.J. 1217, 1237 (2017) (analogizing algorithmic transgressions to torts such as nuisance because of "social costs that arise from socially unjustified levels of activity").

[115] *Id.* at 1231-32, 1237.

[116] *See* Hu, *supra* note 77, at 669; Huq, *supra* note 77, at 1080.

was Harris's basis for prescription in 1993 and it is still the basis for compelling law-reform arguments concerning other forms of algorithmic bias.[117] Thus, the current role of law in this realm is to acquiesce. Simply put, autocorrect's proprietors perceive no legal limitations to disrupt the ethnic and linguistic norms in their design and operation of autocorrect technology. The mechanisms provided for overriding autocorrect are a powerful example of law standing by. These mechanisms evidence utter disinterest in correcting autocorrect's Anglo bias, and this disinterest is currently protected by law.

Yet, for the law to remedy autocorrect's harms, it is not only necessary to translate the experience of those harms for those who benefit from the convenience autocorrect provides but also to translate such harms into legal harms capable of legal remedies. As the taxonomy of harms in the previous Part demonstrates, part of the challenge of translating autocorrect's harms is that the collective, cultural, and structural harms are so significant and at the same time, they are qualitatively different from the harms resulting from Google autofills and other such forms of artificial intelligence. While employment discrimination and racial profiling in criminal justice are clearly about class-wide injury and exclusion, they also involve individualized harms such as loss of freedom and income.[118] From a remedial perspective, the individual harms are the basis for the remedies. By contrast, structural effects, exclusion from communication and connection, and isolation and segregation are arguably the predominant harms wrought by autocorrect's Anglo bias. A refund of part of the price of a smartphone to a person with a non-Anglo name would barely touch the surface as a remedial response to a claim based on autocorrect's Anglo bias.

Accordingly, the theoretical foundation for translating autocorrect's harms into legal harms and remedies must consider the more structural, collective, and cultural harms. It must focus on the refined understanding of the harms as not only imposing a norming conformity that constrains everyone's ability to communicate using a diversity of language and expression but also harms that affect non-Anglo communities in unique ways. This, in turn, requires consideration of what is gained from autocorrect's bias as well as what is lost.

---

[117] Harris, *supra* note 1, at 1777-91 (describing her effort to "de-legitimate the property interest in whiteness . . . and expected privilege that has attended 'white' skin since the founding of the country"); *see also* Stephanie Bornstein, *Antidiscriminatory Algorithms*, 70 ALA. L. REV. 519, 544 (2018) (arguing for antistereotyping approach in order to expand antidiscrimination law into realm of algorithms); Katyal, *Private Accountability*, *supra* note 81, at 101 (describing conflict between anticlassification and antisubordination principles that make antidiscrimination remedies infeasible for regulating data mining techniques).

[118] *See* Hu, *supra* note 77, at 669 (explaining that No Fly Lists limited "freedom of travel, and freedom from the false stigmatization and association with terrorists" (footnote omitted)); Huq, *supra* note 77, at 1080 (explaining that algorithm used in bail considerations "is more likely to overstate the risk presented by a black person than a white person"); Katyal, *Private Accountability*, *supra* note 81, at 121 (noting that individuals can be made "more vulnerable to behavioral manipulation"); Kim, *supra* note 81, at 324 (explaining that individuals restricted from viewing job advertisements suffer harm of being denied information about work opportunities).

The remainder of this Article argues that what is gained is a property interest in an "Anglo" ethnic, cultural, and linguistic identity. In making this argument, this Section lays the foundation for the argument in Part IV that one important mode of regulatory intervention will be to ensure rights of access as a remedy against such an interest.

1. Whiteness, Technology, and Property

In her groundbreaking 1993 article, *Whiteness as Property*, Cheryl Harris argued that Whiteness as a racial status is a form of property interest in American society and, moreover, that it can be converted to other more traditional forms of property.[119] Harris claimed that "expectations of white privilege are bound up with what is considered essential for self-realization."[120] Using the example of the American workplace near the end of the twentieth century, she argued that "[w]hite workers often identify primarily as white rather than as workers because it is through their whiteness that they are afforded access to a host of public, private, and psychological benefits."[121] As Harris observed, Whiteness has become the subject of property because of its value as a means of self-realization. Relying on Margaret Jane Radin's analysis, she concluded that Whiteness is "the quintessential property for personhood," because, quoting Radin, "[i]f an object you now control is bound up in your future plans or in your anticipation of your future self, and it is partly these plans for your own continuity that make you a person, then your personhood depends on the realization of these expectations."[122]

Whether tangible or intangible, the object is such an essential means of self-realization that the person who relies on it for self-realization has a privileged property interest in it. In developing the concept of property for personhood, Radin's archetypal examples were such things as the family home or a wedding ring.[123] By claiming that Whiteness also belongs on the list of archetypal objects that are vital to personhood, Harris made a powerful observation that Whiteness is privileged as property because of its centrality to American personhood.[124]

Harris examined law's important role in transforming Whiteness into property, arguing that "expectations in tangible or intangible things that are valued and protected by the law are property."[125] Harris built her Whiteness-as-

[119] *See generally* Harris, *supra* note 1.

[120] *Id.* at 1761.

[121] *Id.* at 1760.

[122] *Id.* at 1730 (quoting Margaret Jane Radin, *Property and Personhood*, 34 STAN. L. REV. 957, 968 (1982)).

[123] Radin, *supra* note 122, at 959-60.

[124] Radin's original argument was a normative one in favor of privileging some forms of personal property because of their importance to self-realization. *Id.* at 961. By contrast, Harris's discussion of Whiteness as property is a descriptive claim.

[125] Harris, *supra* note 1, at 1729.

property claim on the foundation of slavery and conquest as legal institutions.[126] But she modernized that claim by examining affirmative action jurisprudence to track the ongoing power of law to enforce the "settled expectations" of White individuals to significant social and psychological benefits: "When the law recognizes, either implicitly or explicitly, the settled expectations of whites built on the privileges and benefits produced by white supremacy, it acknowledges and reinforces a property interest in whiteness that reproduces Black subordination."[127]

Since Harris wrote her article, a rich literature has examined the social function of property and the corresponding role of property law in protecting and enhancing that social function.[128] One foundational example is Joseph William Singer's argument that property rules do not function primarily to enforce a person's rights vis-à-vis things.[129] Rather, property rules support "a social system composed of entitlements which shape the contours of social relationships."[130] Thus the real power of absolute "title" is not the right of the owner to do anything they want with the thing owned but rather the power of that owner to exclude others from their property, a right which many have deemed the sine qua non of property privilege.[131] More generally, property rights

[126] *Id.* at 1737.

[127] *Id.* at 1731.

[128] *See, e.g.*, HANOCH DAGAN, PROPERTY: VALUES AND INSTITUTIONS, at xii (2011) ("[P]roperty institution[s are] designed to match the specific balance among . . . autonomy, utility, labor, personhood, community, and distributive justice . . . ."); Gregory S. Alexander, *The Social-Obligation Norm in American Property Law*, 94 CORNELL L. REV. 745, 748 (2009) (arguing that property includes social-obligation norm that is neither explicitly recognized nor systemically developed); Lynda L. Butler, *Property as a Management Institution*, 82 BROOK. L. REV. 1215, 1218 (2017) (noting that management function of property highlights other facets important to survival of property in democratic society); Nestor M. Davidson, *Standardization and Pluralism in Property Law*, 61 VAND. L. REV. 1597, 1600-01 (2008) (recognizing property "as a tool for resource allocation, as a foundation for individual identity, and as a bulwark against the state"); Joseph William Singer, *Democratic Estates: Property Law in a Free and Democratic Society*, 94 CORNELL L. REV. 1009, 1010 (2009) (discussing how property law "shapes social life and either supports or undermines democratic values"); Joseph William Singer, *No Right to Exclude: Public Accommodations and Private Property*, 90 NW. U. L. REV. 1283, 1294-97 (1996) [hereinafter Singer, *No Right to Exclude*] (analyzing rule against racial discrimination in public accommodations).

[129] *See generally* JOSEPH WILLIAM SINGER, ENTITLEMENT: THE PARADOXES OF PROPERTY (2000).

[130] Joseph William Singer, *Property and Social Relations: From Title to Entitlement*, *in* PROPERTY LAW ON THE THRESHOLD OF THE 21ST CENTURY 69, 70 (G.E. van Maanen & A.J. van der Walt eds., 1996) [hereinafter Singer, *Property and Social Relations*].

[131] *See* Shyamkrishna Balganesh, *Demystifying the* Right *to Exclude: Of Property, Inviolability, and Automatic Injunctions*, 31 HARV. J.L. & PUB. POL'Y 593, 597 (2008); Richard A. Epstein, *Takings, Exclusivity and Speech: The Legacy of* PruneYard v Robins, 64 U. CHI. L. REV. 21, 22 (1997); Thomas W. Merrill, *Property and the Right to Exclude*, 77 NEB. L. REV. 730, 736 (1998); Lior Jacob Strahilevitz, *Information Asymmetries and the Rights to Exclude*, 104 MICH. L. REV. 1835, 1836 (2006).

entail the ability to exercise power over other individuals,[132] a concept that Sonia Katyal has compellingly elaborated in her analysis of the "numerus clausus" model of sex, which settles expectations about assigned gender.[133] As the literature on property as a medium of social relations describes, property and property rules are themselves a powerful system of governance.[134]

Autocorrect is a technological update to Harris's argument, particularly as that argument is extended by recent property scholarship. While slavery and the conquest of Indigenous people were the original institutions for developing Whiteness into a powerful property interest[135] and while segregation and discrimination in employment, education, housing, voting, and manifold other sectors of American life modernized and consolidated that privilege,[136] technologies such as autocorrect further develop and expand the privilege. Across a range of communications technologies, users experience a virtual society in which the default rules presume and impose ethnic, cultural, and linguistic homogeneity. For Anglo users, the experience is obviously affirming. They are able to engage in communications, whether meaningful or inconsequential, lengthy or brief, that validate their identities and contribute to their own self-realization, allowing them to take full advantage of the seamless efficiency intended by the technology's creators. Importantly from a legal and remedial perspective, part of the seamlessness for Anglo users is the likely unawareness that these technologies are functioning to affirm norms and identities built partially on racial and ethnic status. These identity-defining social norms are constructed algorithmically by the coders, rather than, for example, by the individual choosing a workplace or neighborhood partially on the basis of racial composition.[137] Meanwhile, for those with non-Anglo names, the default rules also presume Anglo norms, leaving us (and those who correspond

[132] *See* Singer, *Property and Social Relations*, *supra* note 130, at 77-80 (explaining that social relations model understands property as system of relations among people individually and at societal level); *see also* Merrill, *supra* note 131, at 740-46 (analyzing logical and historical primacy of right to exclude); Eduardo Moisés Peñalver & Sonia K. Katyal, *Property Outlaws*, 155 U. PA. L. REV. 1095, 1164-86 (2007) (challenging idea that right to exclude should be unwaveringly enforced as central property right).

[133] Sonia K. Katyal, *The* Numerus Clausus *of Sex*, 84 U. CHI. L. REV. 389, 406-09 (2017) [hereinafter Katyal, Numerus Clausus]; *see also* Clarke, *supra* note 15, at 895 (arguing for legal recognition of nonbinary gender identities via already existing civil rights concepts). This scholarship informs my analysis of Whiteness, property, and intellectual property.

[134] *See* Gregory S. Alexander, *Governance Property*, 160 U. PA. L. REV. 1853, 1858 (2012) (arguing that governance property has become dominant model of ownership today); Henry E. Smith, *Exclusion Versus Governance: Two Strategies for Delineating Property Rights*, 31 J. LEGAL STUD. S453, S455 (2002) (arguing that "exclusion and governance are strategies that are at the poles of a continuum of methods of measurement" of individual property rights).

[135] Harris, *supra* note 1, at 1716-23.

[136] *Id.* at 1745-76.

[137] *See* Williams, *supra* note 94, at 127.

with us) either the much less seamless experience of repeatedly correcting autocorrect or a default in which such norms override our identities.

In short, autocorrect is a form of "smart technology" that contributes to Harris's claim that Whiteness—or more accurately in the case of autocorrect, Anglo identity—is a "privileged identity."[138] Indeed, while this Article refers to Whiteness in deference to Harris's pioneering work on the propertization of identity, the more suitable description of the privileged identity protected by autocorrect is that of the dominant cultural and linguistic status, which can include, but is not fully captured by, the racial status of Whiteness.

Moreover, if nothing else, the indispensability of autocorrect and many other algorithm-based technologies justifies the conclusion that such technologies do not just privilege Whiteness and Anglo identity; they also propertize it. Recent property scholarship has examined the power of rights of exclusion to protect and enhance certain identities, governing—and limiting—entitlements to a broad range of goods and services on the basis of privileged identities.[139] Even as more American cities change over to majority minority and social institutions adapt in response to the reality of a more diverse society, autocorrect preserves and expands a particular ethnic, cultural, and linguistic norm. It replicates the power of segregation and, before that, slavery and conquest as *social* institutions that operate to reproduce and perpetuate racial and other forms of subordination.[140] It does so by contributing to an ongoing conviction that Anglo normativity should remain a "settled expectation[]."[141] Given autocorrect's ubiquity across a range of applications, sectors, and social functions (including educational, employment, and recreational), most of us use autocorrect. Thus, most of us experience this norm, indeed more so as the autocorrection of our names creates a virtual world in which more of us "cover," unwittingly or purposefully, as White or Anglo. The ubiquity of autocorrect plays a crucial role in structuring our social relationships. By shaping our communications according to specific norms, autocorrect provides a tool for social governance and subordination.

While technology provides the structure for privileging White identity, law does essential work in infusing the privilege of Whiteness with the power of property. Specifically, law's acquiescence to autocorrect's bias supports the entrenchment in increasingly indispensable forms of electronic communications of two of the most powerful mechanisms in property law, namely exclusion and segregation.[142] Autocorrect is a powerful exclusionary mechanism, accomplishing much the same function as buzzers in upscale stores, policing of

---

[138] *See* Harris, *supra* note 1, at 1725 (noting that Whiteness is privileged identity but can become a vested interest when given legal status).

[139] *See, e.g.*, Katyal, Numerus Clausus, *supra* note 133, at 398-99; Isaac Saidel-Goley & Joseph William Singer, *Things Invisible to See: State Action & Private Property*, 5 TEX. A&M L. REV. 439, 452 (2018); Singer, *No Right to Exclude*, *supra* note 128, at 1288.

[140] *See* Harris, *supra* note 1, at 1714 (arguing that even after legalized segregation was overturned, law communicated Whiteness as its legitimate and natural baseline).

[141] *Id.* at 1778.

[142] *See id.* at 1738-41.

communities of color, and refusals to serve.[143] These mechanisms support the perception of linguistic norms associated with Whiteness or Anglo ethnicity as so normal that it is invisible. As Singer has so compellingly described, such mechanisms protect a norm so deeply held and "natural" that it is a state of "not even realizing things are arranged to make you comfortable."[144] Because the fact of Whiteness is taken for granted, the protection of it through exclusionary mechanisms, such as buzzers, is also taken for granted as perfectly justifiable.[145] Thus, for example, the design of the system to make overriding autocorrect difficult evidences a comfort, indeed a certainty, that the expected users of autocorrect either fit the Anglo norm—or that non-Anglo users are irrelevant. The right of exclusion is broad in order to match the norm.

Autocorrect's bias is also a mechanism of separation, isolation, and indeed segregation. A person named Ayaan living in the United States and using autocorrect today would doubtless feel as though there were not many other Ayaans (or Aarnavs, or Manjaris) out there using technology such as this. This likely would not change Ayaan's choices of friends and correspondents, but it may well inhibit her from complaining to the makers of autocorrect technology about how well it works because she might think she was the only one experiencing this problem. It may also limit the likelihood that she would search out others of her ethnicity and expand her community using this form of communication. Through its presence in virtually all forms of electronic communication, this technology functions to separate and weaken some communities while strengthening others.[146] Again as Harris describes, the value of self-realization in and through property is not just a project of defining and experiencing individual and group identity and connection; it is also a project of material realization.[147]

2. Whiteness as Intellectual Property

The property value of autocorrect's bias does not accrue only to those users and communities whose process of self-realization is aided by the prioritization

[143] *See* Williams, *supra* note 94, at 127-29 (discussing how store buzzers that function to keep unwanted people out disproportionately result in Black people being denied entry).

[144] E-mail from Joseph William Singer, Bussey Professor of L., Harvard L. Sch., to author (Sept. 19, 2019) (on file with author).

[145] Williams, *supra* note 94, at 127 ("Predictably, the issue of undesirability has revealed itself to be primarily a racial determination. Although the buzzer system was controversial at first, even civil rights organizations have backed down in the face of arguments that the system is a 'necessary evil'. . . .").

[146] On this point, it is interesting to imagine how the developers with non-Anglo names who work on developing autocorrect algorithms experience the development process. Why aren't their names included in autocorrect's dictionaries?

[147] Harris, *supra* note 1, at 1741-45 (citing examples such as White workers making more money than Black workers or White people becoming citizens before Black people).

of their identities and the subordination of non-Anglo communities. At least from a remedial perspective, autocorrect serves another property interest in Whiteness that is perhaps even more powerful than the interest of White or Anglo users. By enhancing the perceived and, depending on how value is defined, actual value of autocorrect technology, the Anglo bias in autocorrect also serves the property interests of the proprietors of autocorrect technology.

To understand why, it is necessary to start by analyzing the nature of the property interests that proprietors of autocorrect have in this technology, leaving aside for now the question of how, if at all, Anglo bias enhances these property interests. This in turn requires consideration of the structure of intellectual property law. Plainly, since Hachamovitch is listed on the patent for Microsoft's autocorrect technology, there are some aspects of autocorrect technology that are covered by patent protection.[148] Patents are an enormously valuable form of intellectual property protection, in large part because they provide the most expansive rights of exclusion.[149] For those unfamiliar with intellectual property law, it may seem odd to analogize ownership of intellectual property with ownership of physical property, but such analogies are foundational to the structure of intellectual property law.[150] Thus, the right to exclude is arguably the sine qua non of intellectual property law, just as it is in the rest of property law.[151] In patent law, the owner's right to exclude manifests as a prohibition on the use of the patented invention by others without the permission of the owner.[152] As a result of this right, patent owners are able to profit by licensing to others the right to use their inventions, including to build their own inventions that make use of the owner's patented technology.[153] Traditionally, the quid pro

[148] For example, a nonexhaustive list of Microsoft's patents on aspects of its autocorrect technology includes: Spell Checking in Network Browser Based Applications, U.S. Patent No. 8,006,180 (filed Jan. 10, 2006) (issued Aug. 23, 2011); Sys. & Method for Automatically Correcting a Misspelled Word, U.S. Patent No. 6,047,300 (filed May 15, 1997) (issued Apr. 4, 2000); and Sys. & Methods for Improved Spell Checking, U.S. Patent No. 7,254,774 (filed Mar. 16, 2004) (issued Aug. 7, 2007). A nonexhaustive list of Apple's patents on such technology includes: Automatic Supplementation of Word Correction Dictionaries, U.S. Patent No. 9,977,779 (filed Mar. 10, 2014) (issued May 22, 2018); and Method & Apparatus for Correcting Words, U.S. Patent No. 5,594,640 (filed Oct. 19, 1994) (issued Jan. 14, 1997). Google has at least one autocorrect patent as well: Feature-Based Autocorrection, U.S. Patent No. 9,747,272 (filed Mar. 6, 2014) (issued Aug. 29, 2017).

[149] Amy Kapczynski & Talha Syed, *The Continuum of Excludability and the Limits of Patents*, 122 YALE L.J. 1900, 1909-15 (2013) (describing and challenging this assumption); s*ee also* Harold Demsetz, *Information and Efficiency: Another Viewpoint*, 12 J.L. & ECON. 1, 11-14 (1969).

[150] Shyamkrishna Balganesh, *Common Law Property Metaphors on the Internet: The Real Problem with the Doctrine of Cybertrespass*, 12 MICH. TELECOMM. & TECH. L. REV. 265, 313-14 (2006).

[151] *Id.* at 312-14.

[152] *Id.* at 313.

[153] *See id.* (explaining how intangible property's value increases the more people use it).

quo for the broad right to exclude in patent law has been the requirement that inventors fully disclose their inventions.[154]

Algorithms, such as those used in autocorrect technology, can be protected by patents. But as leading intellectual property scholars have noted, many algorithms are also protected as trade secrets.[155] Indeed, Michael Mattioli has observed that "[i]nformation-based processes that are not readily perceived by consumers are particularly well suited for trade secret protection."[156] As these scholars discuss, trade secrets are also a highly valuable form of intellectual property.[157] For the last two decades, there has been an ongoing debate about the extent to which trade secrets empower their owners with exclusionary rights.[158] On the one hand (and in contrast to patent law), there is no disclosure obligation imposed on owners of trade secrets.[159] The very nature of the intellectual property protection is the right to keep the invention secret.[160] On the other hand, Mark Lemley and others have noted that the limitation on this form of property is that once the secret is lost, the owner no longer has the right to exclude others.[161] Such scholars have argued that the ease of reverse engineering source code should be a significant counterbalance to the power of trade secret protection.[162] However, as Mattioli describes,

> [U]nlike software, big data practices cannot be reverse-engineered. That is, an expert cannot decipher just how a set of data was assembled with nothing more to work from than the data itself. As a result, the academic

[154] J. Jonas Anderson, *Nontechnical Disclosure*, 69 VAND. L. REV. 1573, 1577 (2016) (noting that the reason for this quid pro quo is because "the public is the ultimate beneficiary of the patent system").

[155] Michael Mattioli, *Disclosing Big Data*, 99 MINN. L. REV. 535, 550-51 (2014); Wendy Seltzer, *Software Patents and/or Software Development*, 78 BROOK. L. REV. 929, 981 (2013). For a discussion on the "know-how" of programmers, see Pamela Samuelson, Randall Davis, Mitchell D. Kapor & J.H. Reichman, *A Manifesto Concerning the Legal Protection of Computer Programs*, 94 COLUM. L. REV. 2308, 2329 (1994).

[156] Mattioli, *supra* note 155, at 550.

[157] *Id.* at 551.

[158] *Id.* at 551-52.

[159] *Id.* at 551.

[160] *See id.* at 551-52 (noting that private nature of trade secrets can be harmful to software innovation).

[161] Mark A. Lemley, *The Surprising Virtues of Treating Trade Secrets as IP Rights*, 61 STAN. L. REV. 311, 333-34 (2008); *see also* J.H. Reichman, *Computer Programs as Applied Scientific Know-How: Implications of Copyright Protection for Commercialized University Research*, 42 VAND. L. REV. 639, 701 (1989).

[162] Lemley, *supra* note 161, at 319 ("[A] defendant who acquires a trade secret by developing it on her own or by reverse engineering it is free to do what she wants with the secret.").

> arguments that trade secrecy may sometimes promote disclosure of software methods seem inapplicable to big data practices.[163]

If Mattioli is correct, then trade secret protection of algorithms, particularly those that use big data, enshrines an even more powerful right of exclusion than patent protection: it allows the owners of such algorithms to maintain their secrecy, thereby excluding others from both use of the technology *and* knowledge about what data the algorithms use to complete the required tasks.[164] Trade secret protection thus provides the most opaque black box.[165]

While it may be impossible to say conclusively without confirmation from the proprietors of autocorrect technology, it seems logical that autocorrect technology benefits from a combination of patent and trade secret protection. The mechanics of autocorrect are likely protected by patents.[166] It also seems likely that the data that autocorrect algorithms use to conclude that a word is mistyped and to provide suggestions for replacing that word are the subject of trade secret protection.[167]

From a remedial perspective, the difference between patent and trade secret protection matters a great deal. Here, again, a comparison between intellectual property law and the rest of property law is illuminating. As Part IV will elaborate, it is widely recognized in property law that property rules are about more than determining who owns what.[168] They also determine other people's rights to access and use things that they do not own.[169] In this respect, the right to exclude and other core property rights are counterbalanced by the rights of others.[170] Importantly, this recognition reveals that ownership comes not only with a range of powerful rights but also with associated obligations.[171] Owners,

---

[163] Mattioli, *supra* note 155, at 553 (footnote omitted).

[164] *Id.* (distinguishing trade secrecy from patent law, which "might push the developers of some big data practices toward public disclosure").

[165] *See generally* PASQUALE, *supra* note 67.

[166] The titles of the patents listed *supra* note 148 suggest as much. *See also* Martin Campbell-Kelly, *Not All Bad: An Historical Perspective on Software Patents*, 11 MICH. TELECOMM. & TECH. L. REV. 191, 241-43 (2005).

[167] I make this assumption both because the patents for autocorrect technology seem to cover the mechanics of the technology and because of Mattioli's argument that big data seems to be protected more by trade secrets. *See* Mattioli, *supra* note 155, at 550.

[168] SINGER, *supra* note 129, at 2-3.

[169] *Id.* at 2.

[170] *See* Heart of Atlanta Motel, Inc. v. United States, 379 U.S. 241, 258-59 (1964) (holding that hotel's attempt to limit clientele to White people was unconstitutional); Uston v. Resorts Int'l Hotel, Inc., 445 A.2d 370, 371 (N.J. 1982) (holding that casino could not exclude card counter); State v. Shack, 277 A.2d 369, 371-72 (N.J. 1971) (holding that "the ownership of real property does not include the right to bar access to governmental services available to migrant workers"). *See generally* SINGER, *supra* note 129 (discussing limitations on ownership).

[171] SINGER, *supra* note 129, at 197-216.

for example, are in some circumstances obliged to provide access to their property.[172]

By imposing a disclosure requirement on patent owners, patent law arguably recognizes the balance between rights and obligations of ownership. Indeed, patent law goes even further in recognizing ownership obligations through "march-in rights" and other opportunities to access patented inventions.[173] The existence of these obligations is supplemented by a healthy debate about whether the obligations should be expanded to give even greater rights of access to patents.[174] By contrast, trade secret law does not oblige owners either to disclose their inventions or to provide other forms of access.[175] As a result, the legal rules governing algorithms provide an astoundingly unitary and potent set of entitlements to the proprietors of autocorrect with virtually no recognition of any corollary obligations.

Now let us consider how autocorrect's bias fits into this picture. We know that modern forms of autocorrect use big data to prioritize the list of words that will be substituted for words that appear mistyped.[176] Given the ubiquitous conclusion across so many sectors of algorithm-based technology that algorithms function on sophisticated versions of the adage "garbage in, garbage out," it is reasonable to conclude that autocorrect's Anglo bias results, more than anything else, from the use of big data by autocorrect algorithms.[177] Thus, it seems likely that none of us, including the users of autocorrect, can know what data are contributing to Anglo bias unless autocorrect's proprietors tell us. Concomitantly, at present, no one other than the proprietors of autocorrect can do much to change the technology to eliminate Anglo bias.

Thus, assuming that it is possible to convince autocorrect's proprietors that such a bias exists, it is important to consider what incentive they have to eliminate this bias. As I have described, autocorrect's proprietors seem (by their actions) to perceive a value in preserving the default to Anglo identity because it defines what is "normal" for those with Anglo names, whom the proprietors perceive (rightly or wrongly) to be their primary customer base. By this logic, Anglo bias preserves the efficient use of autocorrect by this customer base, and

---

[172] *Id.* at 209-16; Alexander, *supra* note 128, at 747-48; Eduardo M. Peñalver, *Land Virtues*, 94 CORNELL L. REV. 821, 882 (2009).

[173] Ryan Whalen, *The Bayh-Dole Act & Public Rights in Federally Funded Inventions: Will the Agencies Ever Go Marching In?*, 109 NW. U. L. REV. 1083, 1085 (2015).

[174] *See id.* at 1111-15; *see also* Kapczynski & Syed, *supra* note 149, at 1904 (arguing that prizes and public funding may be effective methods of broadening rights).

[175] *See* PASQUALE, *supra* note 67, at 14-15 ("[T]rade secrecy law permits managers to hide their methodologies, and business practices, deflecting scrutiny.").

[176] Lewis-Kraus, *supra* note 3.

[177] Katyal, *Private Accountability*, *supra* note 81, at 118 (describing trade secrecy as a major barrier to improving transparency of algorithm processes and combatting algorithm bias).

more profoundly, it preserves Anglo users' own process of self-realization, communication, and connection through technology. Tracking Harris's argument, this value is built upon the devaluation of non-White identities: whether intentional or borne of indifference, it is a validation of the idea that diversity does not matter and that non-Anglo people are not welcome in these virtual arenas.[178] If autocorrect's proprietors prioritize the convenience of Anglo users of autocorrect, then preserving Anglo bias is a simple matter of maximizing the profit gained from catering to the perceived needs of the perceived primary market. It enhances market value on the basis of settled expectations. Thus, there is at least a strong argument that autocorrect's proprietors have an incentive to preserve Anglo bias in their technology, with no counterbalancing legal or social incentive to eliminate it.

3. Autocorrect as Epistemology

Finally, in examining the effect of autocorrect's bias, let us pause over autocorrect's role in producing a system of knowledge in contemporary America. My claim here is that we must take autocorrect seriously as a "smart technology," a technology that "receive[s] inputs from the environment, then learn[s] from or interpret[s] those inputs, and then potentially take[s] certain actions or decisions that affect the environment."[179] If autocorrect is really a form of artificial intelligence, and if artificial intelligence is really a form of intelligence, then autocorrect is contributing to the creation of knowledge. It is contributing to an epistemological project, and it is incumbent upon us to consider the implications.

Katyal quotes Tarleton Gillespie as defining algorithms as "the computational generation of knowledge or decisions."[180] As Katyal and a growing number of legal and nonlegal scholars discuss, our reliance on math rather than human judgment has not eliminated bias from decision-making.[181] The computations depend on instructions that human beings give to the machines making the computations.[182] While the ideal of artificial intelligence is that the machines learn from their own processes of computation based on environmental inputs, they can be directed—and corrupted—by the environmental inputs we

[178] Of course, this could be exacerbated by intentional and unintentional covering.

[179] Katyal, *Private Accountability*, *supra* note 81, at 62.

[180] *Id.* at 63 (quoting Tarleton Gillespie, *Algorithm [draft] [#digitalkeywords]*, CULTURE DIGITALLY (June 25, 2014), http://culturedigitally.org/2014/06/algorithm-draft-digitalkeyword/ [https://perma.cc/2DED-AT6Y]).

[181] *Id.* at 62-87; *see also* Anupam Chander & Vivek Krishnamurthy, *The Myth of Platform Neutrality*, 2 GEO. L. TECH. REV. 400, 401 (2018) (challenging claim by Internet platform founders generally that their algorithms and platforms do not discriminate); Hu, *supra* note 77, at 637-38 ("[T]his Article advances the claim that DHS vetting and screening protocols risk introducing an algorithmically driven and technologically enhanced form of Jim Crow."); Chander, *supra* note 93, at 1066 (noting discriminatory impacts in hiring algorithms where those with White-sounding names were more likely to be invited to interview).

[182] *See* Chander & Krishnamurthy, *supra* note 181, at 402 (noting that many nonneutral coding deficiencies arise simply from inattention to detail of human inputs).

provide.[183] Currently, these inputs include racist, sexist, ageist, classist, and other forms of biased knowledge.[184] As a result, autocorrect and other algorithms build on, and contribute to, a knowledge system that is regressive rather than progressive in its understanding of social and cultural diversity.

These same scholars have argued compellingly that the law must intervene to correct the reductionist forms of knowledge that are being developed by and through artificial intelligence.[185] Their justification for legal interventions is grounded in the economic, civil, and political harms that civil rights laws attempt to alleviate, especially when supplemented by legal doctrines from torts, contracts, and criminal justice.

While these arguments are critical in correcting an increasingly dire social and legal problem, it is also important to add to the list of considerations the epistemological correction that is required. Doing so requires us to consider a range of extralegal perspectives from diverse domains such as cultural studies, economic sociology, and political economy.[186] One set of perspectives that is highly relevant is the vast literature on postcolonialism and decolonialism, which actively engages with epistemological questions about Whiteness as a project of redefining what colonized societies know of themselves and the world. In a canonical text, Trinh Minh-Ha observed,

> The imperviousness in the West of the many branches of knowledge to everything that does not fall inside their predetermined scope has been repeatedly challenged by its thinkers throughout the years. They extol the concept of decolonization and continuously invite into their fold "the challenge of the Third World." Yet, they do not seem to realize the difference when they find themselves face to face with it—a difference which does not announce itself, which they do not quite anticipate and cannot fit into any single varying compartment of their catalogued world; a difference they keep on measuring with inadequate sticks designed for

[183] Katyal, *Private Accountability*, *supra* note 81, at 70-77.

[184] *Id.*

[185] *See* Chander & Krishnamurthy, *supra* note 181, at 401-10; Hu, *supra* note 77, at 637-38; Huq, *supra* note 77, at 1134; Katyal, *Private Accountability*, *supra* note 81, at 99-117 (arguing that civil rights laws must be updated to reflect realities of algorithmic bias); Kim, *supra* note 81, at 328 (arguing that law must intervene to disincentivize use of algorithms which possess implicit bias and result in workplace inequities); Chander, *supra* note 93, at 1039-45 (arguing for use of "algorithmic affirmative action" to combat biases in algorithms).

[186] For a sampling, see generally JOSÉ MEDINA, THE EPISTEMOLOGY OF RESISTANCE: GENDER AND RACIAL OPPRESSION, EPISTEMIC INJUSTICE, AND THE SOCIAL IMAGINATION (2013); RACE AND EPISTEMOLOGIES OF IGNORANCE (Shannon Sullivan & Nancy Tuana eds., 2007); Owen J. Dwyer & John Paul Jones III, *White Socio-Spatial Epistemology*, 1 SOC. & CULTURAL GEOGRAPHY 209 (2000); Dan Flory, *Black on White:* Film Noir *and the Epistemology of Race in Recent African American Cinema*, 31 J. SOC. PHIL. 82 (2000); Cynthia Tyson, *Research, Race, and an Epistemology of Emancipation*, 195 COUNTERPOINTS 19 (2003); Steven Yates, *Multiculturalism and Epistemology*, 6 PUB. AFFS. Q. 435 (1992).

> their own morbid purpose. When they confront the challenge "in the flesh," they naturally do not recognize it as a challenge. Do not hear, do not see. They promptly reject it as they assign it to their one-place-fits-all "other" category . . . .[187]

Raja Rao has articulated the experience of writing in a language that is not one's own: "One has to convey in a language that is not one's own the spirit that is one's own. One has to convey the various shades and omissions of a certain thought-movement that looks maltreated in an alien language."[188] The red squiggly line signals that autocorrect is not the language of an ever-growing number of Americans. Thus, when we think about the importance of including people of color in the process of writing code, developing and testing products, and marketing and distributing those products, it is important to remember that one reason for including diverse perspectives is not only to make and sell better products or to ensure more fairness and equality in their use and impact[189] but also because these products contribute to an epistemological project. They are, in fact, contributing to our knowledge of the world and our ability to communicate the features of that world. They are contributing to an infrastructure that defines the rules of communication and participation in society.

In these respects, while autocorrect's bias is a quite specific form of Whiteness, ethnicity, and normativity bias, it teaches crucial lessons about the structure of racism today. By understanding the harms that flow from autocorrect, we can begin to better understand the ways in which normalcy is defined—even if subtly and indirectly—partly along racial lines.

B. *Consumerism as an Exacerbating Influence*

Autocorrect is a technological update to Harris's argument for another reason. American consumerism in the last several decades exacerbates the Anglifying effect of autocorrect. At the close of the twentieth century, a number of books and studies were published about the consumerist tendencies in American

---

[187] TRINH T. MINH-HA, WHEN THE MOON WAXES RED: REPRESENTATION, GENDER AND CULTURAL POLITICS 16 (1991).

[188] RAJA RAO, KANTHAPURA, at vii (Oxford Univ. Press 1963) (1938).

[189] *See* Huq, *supra* note 77, at 1134; Katyal, *Private Accountability*, *supra* note 81, at 99-117; Chander, *supra* note 93, at 1039-45.

society.[190] A prominent and insightful example is Juliet Schor's 1998 book, *The Overspent American*.[191] Schor argues that

> very wealthy people feel no need to let the world know they can afford to live much better than their neighbors.
>
> Millions of other Americans, on the other hand, have a different relationship with spending. What they acquire and own is tightly bound to their personal identity. Driving a certain type of car, wearing particular designer labels, living in a certain kind of home, and ordering the right bottle of wine create and support a particular image of themselves to present to the world.
>
> . . . .
>
> . . . The result is that millions of us have become participants in a national culture of upscale spending. I call it the new consumerism.[192]

While Schor's data provide evidence of the American obsession with technology such as answering machines, VCRs, basic cable, and "fancy computer equipment," the icons of overspending and consumerism in her book are items that were once considered luxuries, such as personal trainers and "McMansions."[193] In the intervening decades since Schor's book was published, there is mounting evidence that, although such items continue to be important to American consumers, technology purchases have taken on an increasingly prominent role. Take, for example, comments captured by numerous studies that smartphones are the most important item that many Americans feel they own, regardless of their income level, race, ethnicity, or gender.[194] It appears that

---

[190] *See generally, e.g.*, LIZABETH COHEN, A CONSUMERS' REPUBLIC: THE POLITICS OF MASS CONSUMPTION IN POSTWAR AMERICA (2003) (arguing that the push for prosperity in America following World War II eventually led to harmful consumerist culture that perpetuates economic inequities); GARY CROSS, AN ALL-CONSUMING CENTURY: WHY COMMERCIALISM WON IN MODERN AMERICA (2000) (arguing that America is the pinnacle of consumerism and that even seemingly anticonsumer movements worked to propel consumerism to new heights); JOHN DE GRAAF, DAVID WANN & THOMAS H. NAYLOR, AFFLUENZA: THE ALL-CONSUMING EPIDEMIC (2001) (examining root causes and origins of consumerism, and offering solutions for individuals to minimize consumerist urges); JULIET B. SCHOR, THE OVERSPENT AMERICAN: WHY WE WANT WHAT WE DON'T NEED (1998) (exploring social causes of consumerism in America). In legal conversations, a key contribution was TERESA A. SULLIVAN, ELIZABETH WARREN & JAY LAWRENCE WESTBROOK, THE FRAGILE MIDDLE CLASS: AMERICANS IN DEBT (2000) (analyzing family bankruptcy filings and noting extreme financial fragility in America's middle class).

[191] *See generally* SCHOR, *supra* note 190.

[192] *Id.* at 3-4.

[193] *Id.* at 15.

[194] *See* Athima Chansanchai, *8 in 10 Americans Depend on Cellphones*, NBC NEWS (Aug. 15, 2011, 2:53 PM), https://www.nbcnews.com/technolog/8-10-americans-depend-cellphones-121536 [https://perma.cc/VY5R-W85L]; Jason Gilbert, *Smartphone Addiction:*

Americans cannot resist technology. Owning the newest iPhone, tablet, laptop, wireless speakers, and other technologies is a powerful statement of status today.[195] Of course, this gives the producers of such technology enormous economic power. But as Schor's book documents, this power extends well beyond the economic. It is social and cultural power as well.[196]

Numerous studies have also documented the unsurprising fact that, as Americans seek status through consumer spending, they do so in a fashion that contributes to the privileging of Whiteness. One of the most dramatic stages on which the drive for Whiteness as a status symbol has played out is the ongoing quest for homeownership in a country that continues to be divided by residential racial segregation.[197] Homeownership in a White suburb remains a powerful status symbol that fully incorporates Whiteness as status property. The extraordinary predation on Black people, other people of color, and immigrants through mechanisms such as subprime lending, payday lending, and multilevel marketing schemes in turn supports the quest for homeownership and consumer-driven status.[198]

Staggering Percentage of Humans Couldn't Go One Day Without Their Phone, HUFFPOST (Aug. 16, 2012, 6:08 PM), https://www.huffpost.com/entry/smartphone-addiction-time-survey_n_1791790 [https://perma.cc/6JSU-GCZX]; Minda Zetlin, *Survey of 1,000 Americans Shows We Love Smartphones More than Pets*, INC. (Sept. 14, 2017), https://www.inc.com/minda-zetlin/survey-of-1000-americans-shows-we-love-smartphones.html [https://perma.cc/KH52-8ZKG].

[195] *See* Kathryn Lawrence, *How Your Smartphone Became the Ultimate Status Symbol*, GROVER, https://blog.grover.com/en/2019/03/06/how-your-smartphone-became-the-ultimate-status-symbol/ [https://perma.cc/CW95-REQY] (last visited Dec. 29, 2020) ("[E]conomists found that the simple fact of whether someone owned an iPhone or not allowed them to predict with 69% certainty whether they were high income, or in the top quartile of income for their household type, such as single adults or couples with children.").

[196] SCHOR, *supra* note 190, at 56-60.

[197] *See generally* DOUGLAS S. MASSEY & NANCY A. DENTON, AMERICAN APARTHEID: SEGREGATION AND THE MAKING OF THE UNDERCLASS (1993) (examining racial segregation during twentieth century, and tracing effects of these policies to present); MELVIN L. OLIVER & THOMAS M. SHAPIRO, BLACK WEALTH/WHITE WEALTH: A NEW PERSPECTIVE ON RACIAL INEQUALITY (1995) (analyzing systemic barriers to Black homeownership that exist today despite rise of large Black middle class); RICHARD ROTHSTEIN, THE COLOR OF LAW: A FORGOTTEN HISTORY OF HOW OUR GOVERNMENT SEGREGATED AMERICA (2017) (arguing that all levels of government were guilty in pushing policies that gave rise to and reinforced neighborhood segregation in America); KEEANGA-YAMAHTTA TAYLOR, RACE FOR PROFIT: HOW BANKS AND THE REAL ESTATE INDUSTRY UNDERMINED BLACK HOMEOWNERSHIP (2019) (arguing that, despite ban of discriminatory home lending practices in late twentieth century, lenders effectively continued these policies in other ways). For a recent discussion of implicit bias across a range of land-based consumer markets, see Michelle Wilde Anderson & Victoria C. Plaut, *Property Law: Implied Bias and the Resilience of Spatial Colorlines*, *in* IMPLICIT RACIAL BIAS ACROSS THE LAW 25 (Justin D. Levison & Robert J. Smith eds., 2012).

[198] *See* Paula Chakravartty & Denise Ferreira da Silva, *Accumulation, Dispossession, and Debt: The Racial Logic of Global Capitalism—An Introduction*, 64 AM. Q. 361, 362-63 (2012); Zainab A. Mehkeri, *Predatory Lending: What's Race Got to Do with It*, 20 PUB. INT.

As ownership of technology takes on increasing importance, it is entirely predictable that one of the newer stages on which Whiteness as property is being reenacted is that of technology purchases, use, and ownership. Thus, in the face of antidiscrimination laws that attempt to reduce "the capacity of whiteness to deliver,"[199] consumerism provides a powerful mechanism to reinstantiate the power of Whiteness as a marker of privilege, one that is neither fully recognized nor addressed by contemporary legal rules. Today, consumerism is a contemporary driver of Whiteness as status property.

Consequently, even a technology as basic as autocorrect can play an important role in entrenching and enhancing Whiteness bias and Anglo status. Indeed, its very basicness—its adoption across the industry for smartphones, emailing, and word processing systems—ensures that the technology will be ubiquitously bought and used. Moreover, the real potential of autocorrect's algorithms polluting and repolluting algorithms across a broad spectrum of society provides an additional basis for autocorrect to play a meaningful role in reinvigorating a consumer-driven version of Whiteness as property. To the extent that autocorrect is reorienting virtual societies toward greater racial and ethnic homogeneity, it is informing a broad range of algorithms that make many important social and legal decisions from criminal sentencing, to mortgage eligibility, to hiring and firing.

IV. AUTOCORRECT FOR A COSMOPOLITAN WORLD

While autocorrect's Anglo bias is a window into the much larger problem of algorithmic bias, autocorrect also is a promising place to begin in correcting this and other forms of discrimination in cyberspace. There may be technological, economic, political, and other difficulties in correcting algorithms for producing credit scores or determining criminal sentences, but this Part demonstrates that it is a more straightforward proposition to fix autocorrect. Though simple, it will make a world of difference, not least of all because it will serve as acknowledgment that we live in a diverse and cosmopolitan world. This Part proposes a range of legal and nonlegal devices to address autocorrect's bias, ranging from consumer activism, to administrative guidance, to ex ante regulations.

A. *Guiding Principles from Property Law*

In asserting that Whiteness is a form of property, Harris opened an important space for thinking broadly and boldly about the implications of Whiteness as a privilege so powerful that it could be described as a property interest. Harris tracked through the modern legal protection of Whiteness as property by

L. REP. 44, 44 (2014); Marko Stojkovic, *The Threat of Predatory Lending*, 22 PUB. INT. L. REP. 40, 40 (2016).

[199] Harris, *supra* note 1, at 1758.

analyzing its revitalization in affirmative action jurisprudence.[200] She then followed her diagnostic analysis with a normative evaluation of the role that affirmative action doctrine could play if reoriented to the task of eliminating Whiteness as a form of property.[201] Harris's turn to civil rights doctrine both to make her case about Whiteness as property and to propose solutions recognized the important relationship between property and civil rights, and recent contributions from Chander, Hu, and Katyal have built on the foundation Harris laid.[202]

While fully endorsing the insights of these scholars, I wish to provide an additional basis for addressing the reinvigoration of Whiteness as property through technology. Like the interventions proposed by these other scholars, my proposal lies at the nexus of property and civil rights, but it also relies on a core property law principle. By addressing autocorrect from property's core, the proposal recognizes the particular forms of power and privilege, sounding in property law, that currently benefit the proprietors and the more privileged users of autocorrect.[203] Because the remedial power and the financial profit lie with the proprietors of this technology, the remainder of this Part will focus on their responsibility to eliminate autocorrect's bias.

Historically—and still today—one of the most powerful manifestations of the obligations associated with property ownership has been the law of public accommodations. Since as early as the enactment of the Civil Rights Act of 1866,[204] statutory and case law has articulated a clear right of access that overrides the rights of owners of public accommodations to exclude individuals on the basis of race and other protected classes. As Title II of the Civil Rights Act of 1964 states: "All persons shall be entitled to the full and equal enjoyment of the goods, services, facilities, privileges, advantages, and accommodations of any place of public accommodation . . . without discrimination or segregation on the ground of race, color, religion, or national origin."[205]

It is thus commonplace today that an essential limitation on the property rights of an owner of a public accommodation is the requirement that the owner

[200] *Id.* at 1766-77.

[201] *Id.* at 1777-91.

[202] *See* Hu, *supra* note 77, at 637-38; Katyal, *Private Accountability*, *supra* note 81, at 99-117; Chander, *supra* note 93, at 1039-45.

[203] For foundational discussions of property's power in American society, see generally GREGORY S. ALEXANDER, COMMODITY & PROPRIETY: COMPETING VISIONS OF PROPERTY IN AMERICAN LEGAL THOUGHT, 1776-1970 (1997); JAMES W. ELY, JR., THE GUARDIAN OF EVERY OTHER RIGHT: A CONSTITUTIONAL HISTORY OF PROPERTY RIGHTS (3d ed. 2008) (examining property's role in shaping the Constitution and ripple effects that those choices had from America's inception onward); Merrill, *supra* note 131 (arguing that right to exclude is the most essential characteristic of property ownership); Singer, *No Right to Exclude*, *supra* note 128 (discussing whether retail stores can use their property rights to discriminate on basis of race); Smith, *supra* note 134.

[204] 42 U.S.C. §§ 1981-1982.

[205] 42 U.S.C. § 2000a(a).

provide full, equal, and fair access to and enjoyment of that public accommodation.[206]

Typically, the countervailing rights to the owner's right to exclude have been described as the civil and political rights of Black people and others to enter and enjoy public accommodations, but it is appropriate also to describe these countervailing rights as property rights.[207] They are rights of access to the property of others, a recognition that property rights are not absolute but rather are relative, that property rights can belong to those who are not "owners," and that property rights can conflict.[208] The corollary to these well-established principles of modern property law is that when property rights do conflict, the resolution does not necessarily lie in deferring to the rights of the owner (or the person with "greater" property entitlements).[209] Title, or even greater property entitlement, as traditionally defined, is not and should not be the ultimate basis for deciding the priority of rights.[210]

There is a basic logic contained in this limitation on property ownership: if an owner profits from an enterprise that provides products or services to the public, then that owner must provide equal access to its products or services to all members of the public. While state statutes have supplemented the federal laws on public accommodations by expanding both the definition of "public

[206] *See* Jonathan Klick & Gideon Parchomovsky, *The Value of the Right to Exclude: An Empirical Assessment*, 165 U. PA. L. REV. 917, 922 (2017); Singer, *No Right to Exclude*, *supra* note 128, at 1288; Joseph William Singer, *Property and Sovereignty Imbricated: Why Religion Is Not an Excuse to Discriminate in Public Accommodations*, 18 THEORETICAL INQUIRIES L. 519, 529 (2017); Joseph William Singer, *We Don't Serve Your Kind Here: Public Accommodations and the Mark of Sodom*, 95 B.U. L. REV. 929, 930 (2015); Saidel-Goley & Singer, *supra* note 139, at 452.

[207] *See* SINGER, *supra* note 129, at 153-54; Alexander, *supra* note 128, at 818-19; Peñalver, *supra* note 172, at 882; Singer, *No Right to Exclude*, *supra* note 128, at 1288; Joseph William Singer, *The Rule of Reason in Property Law*, 46 U.C. DAVIS L. REV. 1369, 1374 (2013) [hereinafter Singer, *The Rule of Reason*] (arguing that property law standards allow for reasonable adjustments when certain rights come into conflict); Laura S. Underkuffler-Freund, *Property: A Special Right*, 71 NOTRE DAME L. REV. 1033, 1039 (1996) (arguing that property rights are unique in that a right allocated to one individual may necessarily detract from another's property rights).

[208] *See* Gregory S. Alexander, Eduardo M. Peñalver, Joseph William Singer & Laura S. Underkuffler, *A Statement of Progressive Property*, 94 CORNELL L. REV. 743, 743 (2009); Singer, *No Right to Exclude*, *supra* note 128, at 1466-67; Singer, *The Rule of Reason*, *supra* note 207, at 1374; Underkuffler-Freund, *supra* note 207, at 1039.

[209] *See* Rashmi Dyal-Chand, *Sharing the Cathedral*, 46 CONN. L. REV. 647, 652 (2013); Peñalver & Katyal, *supra* note 132, at 1103; Singer, *No Right to Exclude*, *supra* note 128, at 1471; Singer, *The Rule of Reason*, *supra* note 207, at 1374.

[210] Singer, *No Right to Exclude*, *supra* note 128, at 1475; Singer, *The Rule of Reason*, *supra* note 207, at 1374.

accommodation" and the number of protected classes,[211] the basic tenet of these laws is that public accommodations hold themselves out as selling products and services to the public at large.

The most recent and robust manifestation of this property obligation is the prohibition on discrimination by public accommodations found in the Americans with Disabilities Act ("ADA"), which provides in part:

> It shall be discriminatory to afford an individual or class of individuals, on the basis of a disability or disabilities of such individual or class, directly, or through contractual, licensing, or other arrangements with the opportunity to participate in or benefit from a good, service, facility, privilege, advantage, or accommodation that is not equal to that afforded to other individuals.[212]

While this language is explicitly modeled on the 1964 Civil Rights Act and is intended to capture the same principle of equal access,[213] the ADA's more recent lineage results in explicit recognition that those who provide unequal participation in the use of products and services discriminate as much as those who erect (or fail to remove) physical barriers to physical places.[214]

As the analysis of numerous scholars and policymakers has shown, some forms of technology today are so basic and vital to participation in society that limited access to them is in fact unequal access to social, economic, and political opportunities.[215] As a result, New York and other cities have implemented initiatives to ensure broadband access to low-income and majority-minority

---

[211] *See, e.g.*, CAL. CIV. CODE § 51 (West 2020) (including sex, ancestry, disability, medical condition, marital status, sexual orientation, citizenship, primary language, and immigration status as classes protected from discrimination in public accommodations); MASS. GEN. LAWS ch. 272, § 98 (2020) (including sex, gender identity, sexual orientation, and physical and mental disability as classes protected from discrimination in public accommodations); N.Y. EXEC. LAW §§ 290-301 (McKinney 2020) (expanding "places of public accommodation" definition beyond Title II and including sexual orientation, military status, sex, disability, and familial status as classes protected from discrimination in places of public accommodations).

[212] 42 U.S.C. § 12182(b)(1)(A)(ii).

[213] Robert D. Dinerstein, *The Americans with Disabilities Act of 1990: Progeny of the Civil Rights Act of 1964*, HUM. RTS., Summer 2004, at 10, 10.

[214] 42 U.S.C. § 12182.

[215] U.N. GAOR, 68th Sess., 16th mtg. ¶ 44, U.N. Doc. A/C.2/68/SR.16 (Nov. 13, 2013) (noting that information and communications technologies hold "great potential" for addressing poverty in and socioeconomic advancement of developing countries); Benjamin M. Compaine, *Preface* to THE DIGITAL DIVIDE: FACING A CRISIS OR CREATING A MYTH?, at xii-xiii (Benjamin M. Compaine ed., 2001) (observing that the digital divide has "substantial economic and political implications" and "[a]ccess to . . . information available from networked devices may be critical in the education process" and useful for finding and improving jobs). *See generally* THE DIGITAL DIVIDE: THE INTERNET AND SOCIAL INEQUALITY IN INTERNATIONAL PERSPECTIVE, at i (Massimo Ragnedda & Glenn W. Muschert eds., 2013) (collecting works that explore how unequal access to Internet communications technologies replicate existing social inequalities in various regions).

communities.[216] In addition, there are global initiatives to provide cell phones to low-income communities, including in rural areas of the Global South.[217] These efforts have coalesced into a movement to overcome the "digital divide," a term that captures the idea that the inequality gap is partly a gap in access to technology.[218]

One way to understand the digital divide as a legal concept is to understand it as a lack of access to public accommodations.[219] Unequal access to essential technologies is, to track the language of the ADA, the provision of an "opportunity to participate in or benefit from a good, service, facility, privilege, advantage, or accommodation that is not equal."[220] Indeed, although it is currently the subject of a split among circuits, courts in the First and Second Circuits have recognized the importance of technological access by requiring that publicly accessible websites comply with the ADA regardless of whether the websites are connected with physical spaces.[221] Although the Supreme Court

[216] RAKEEN MABUD & MARYBETH SEITZ-BROWN, ROOSEVELT INST., WIRED: CONNECTING EQUITY TO A UNIVERSAL BROADBAND STRATEGY 15-21 (2017), https://rooseveltinstitute.org/wp-content/uploads/2017/09/RI-Wired-201709.pdf [https://perma.cc/8RHB-LL7Z].

[217] *Continental Disconnect*, ECONOMIST, Dec. 10, 2016, at 45; Press Release, United Nations Univ., Greater Access to Cell Phones than Toilets in India (Apr. 14, 2010), https://unu.edu/media-relations/releases/greater-access-to-cell-phones-than-toilets-in-india.html [https://perma.cc/GL28-RAMC].

[218] Perrin & Turner, *supra* note 52; Peter K. Yu, *The Algorithmic Divide and Equality in the Age of Artificial Intelligence*, 72 FLA. L. REV. 331, 334 (2020).

[219] Bradley Allan Areheart & Michael Ashley Stein, *Integrating the Internet*, 83 GEO. WASH. L. REV. 449, 452 (2015); Colin Crawford, *Cyber*place*: Defining a Right to Internet Access Through Public Accommodation Law*, 76 TEMP. L. REV. 225, 239-40 (2003); Richard E. Moberly, *The Americans with Disabilities Act in Cyberspace: Applying the "Nexus" Approach to Private Internet Websites*, 55 MERCER L. REV. 963, 993 (2004); Ryan C. Brunner, Note, *Websites as Facilities Under ADA Title III*, 15 DUKE L. & TECH. REV. 171, 174-75 (2017); Matthew A. Stowe, Note, *Interpreting "Place of Public Accommodation" Under Title III of the ADA: A Technical Determination with Potentially Broad Civil Rights Implications*, 50 DUKE L.J. 297, 321 (2000); Tara E. Thompson, Note, *Locating Discrimination: Interactive Web Sites as Public Accommodations Under Title II of the Civil Rights Act*, 2002 U. CHI. LEGAL F. 409, 430.

[220] 42 U.S.C. § 12182(b)(1)(A)(ii).

[221] *See, e.g.*, Doe v. Mut. of Omaha Ins. Co., 179 F.3d 557, 559 (7th Cir. 1999) ("The core meaning of [Title III of the ADA] . . . is that the owner or operator of a . . . Web site, or other facility (whether in physical space or in *electronic space*) that is open to the public cannot exclude disabled persons from . . . using the facility in the same way that the nondisabled do." (emphasis added) (citation omitted)); Carparts Distrib. Ctr., Inc. v. Auto. Wholesaler's Ass'n of New England, Inc., 37 F.3d 12, 19-20 (1st Cir. 1994) ("[L]imit[ing] the application of Title III to physical structures . . . would severely frustrate Congress's intent that individuals with disabilities fully enjoy the goods, services, privileges and advantages, available indiscriminately to other members of the general public."); Nat'l Ass'n of the Deaf v. Harvard Univ., 377 F. Supp. 3d 49, 57-61 (D. Mass. 2019) (holding that Harvard's online services

has yet to resolve the question of the ADA's applicability to websites, both the jurisprudence and the scholarship on this topic evidence a basic recognition that essential technologies are critical to economic, social, and political participation. The circuit split on the question of the ADA's applicability is more of a disagreement on the technicalities having to do with "place" and "space" rather than the question of whether publicly accessible websites are "public accommodations."[222]

It is both right and unremarkable, then, to designate certain forms of technology, such as smartphones and word processing systems, as modern public accommodations. In a world where smartphones are replacing landlines

constituted place of public accommodation and that nexus to physical place was not required); Access Living of Metro. Chi. v. Uber Techs., Inc., 351 F. Supp. 3d 1141, 1154-56 (N.D. Ill. 2018) ("A 'place of public accommodation' does not have to be a physical space, and plaintiffs have plausibly alleged that Uber operates a place of public accommodation."); Nat'l Fed'n of the Blind v. Scribd Inc., 97 F. Supp. 3d 565, 571 (D. Vt. 2015) ("The fact that the ADA does not include web-based services as a specific example of a public accommodation is irrelevant because such services did not exist when the ADA was passed and . . . [the Act's] catchall categories must be construed liberally to effectuate congressional intent."); Nat'l Ass'n of the Deaf v. Netflix, Inc., 869 F. Supp. 2d 196, 200-02 (D. Mass. 2012) (holding that Netflix's on-demand service website is place of public accommodation because ADA "applies with equal force to services purchased over the Internet").

[222] *Compare* Earll v. eBay, Inc., 599 F. App'x 695, 696 (9th Cir. 2015) (affirming dismissal of plaintiff's ADA claim "[b]ecause eBay's services are not connected to any 'actual, physical place'" (quoting Weyer v. Twentieth Century Fox Film Corp., 198 F.3d 1104, 1114 (9th Cir. 2000))), *Weyer*, 198 F.3d at 1114-15 (holding that "public accommodations" under Title III are "actual, physical places where goods or services are open to the public"), Young v. Facebook, Inc., 790 F. Supp. 2d 1110, 1115 (N.D. Cal. 2011) ("Facebook operates only in cyberspace, and is thus . . . not a 'place of public accommodation.'"), Noah v. AOL Time Warner Inc., 261 F. Supp. 2d 532, 540-45 (E.D. Va. 2003) (holding that "'places of public accommodation' are limited to actual, physical places and structures, and thus cannot include chat rooms"), *aff'd mem.*, No. 03-1770, 2004 WL 602711 (4th Cir. Mar. 24, 2004), *and* Access Now, Inc. v. Sw. Airlines, Co., 227 F. Supp. 2d 1312, 1318 (S.D. Fla. 2002) (holding that "to fall within the scope of the ADA as presently drafted, a public accommodation must be a physical, concrete structure"), *with* Robles v. Domino's Pizza, LLC, 913 F.3d 898, 904-05 (9th Cir. 2019) (holding that ADA public accommodations requirements applied to Domino's website and app because "[t]he statute applies to the services *of* a place of public accommodation, not services *in* a place of public accommodation" (quoting Nat'l Fed'n of the Blind v. Target Corp., 452 F. Supp. 2d 946, 958 (N.D. Cal. 2006))), Gomez v. Gen. Nutrition Corp., 323 F. Supp. 3d 1368, 1374-76 (S.D. Fla. 2018) (holding that GNC's website was subject to the ADA because it "facilitates the use of the physical stores," provides "the ability to purchase products remotely," and "operates as a gateway to the physical stores"), Gil v. Winn-Dixie Stores, Inc., 257 F. Supp. 3d 1340, 1348-49 (S.D. Fla. 2017) (holding that because Winn-Dixie's website was "heavily integrated with Winn-Dixie's physical store locations," a "sufficient nexus" existed and thus website was part of public accommodation, but specifically declining to rule on question of whether website itself was public accommodation), *and Nat'l Fed'n of the Blind*, 452 F. Supp. 2d at 956 (holding that plaintiff had stated viable claim under ADA where plaintiff's inability to access Target.com "impede[d] the full and equal enjoyment of goods and services offered in Target stores").

and where the latter are extensively regulated by the ADA,[223] basic logic requires smartphones to be regulated by public accommodations laws as well. The same logic applies to laptop and desktop computers. It is appropriate to enforce equal access to and enjoyment of such technologies, just as we do with other public accommodations. Indeed, it is arguably even more essential to require that such technologies comply with public accommodations laws because unequal access to them limits the ability of some users to communicate and associate with one another. Just as the right to enter stores and purchase goods implicates the core rights of property and contract,[224] so too the ability to communicate freely and equally implicates core First Amendment rights.[225] Finally, given the monopolistic nature of autocorrect technology, an additional reason to treat such technology as a public accommodation is grounded in the common law of virtually all U.S. jurisdictions. It has long been the law that innkeepers and common carriers do not have the right to exclude patrons arbitrarily, partly because of the essential nature of these services and partly because of the market monopolies that their providers have traditionally enjoyed.[226] As this Section elaborates, autocorrect meets both of these criteria.

This point can certainly be taken as a doctrinal claim. However, it can also serve as a guiding principle: even if policy makers are not yet comfortable endorsing the increasingly standard view that certain technologies are just as essential to modern living as hotels, restaurants, and trains, they can use the regulation of such facilities as a model for developing regulations of essential technologies that serve some of the same purposes served by traditional public accommodations. Even before developing regulations, they can use such

---

[223] *See What the Telecommunications Industry Needs to Know About the ADA*, ESSENTIAL ACCESSIBILITY (Nov. 9, 2018), https://www.essentialaccessibility.com/blog/telecommunications-ada/ [https://perma.cc/Y8WB-X7RN].

[224] *See* 42 U.S.C. § 1982 ("All citizens of the United States shall have the same right . . . as is enjoyed by white citizens thereof to inherit, purchase, lease, sell, hold, and convey real and personal property.").

[225] Ronnie Cohen & Janine S. Hiller, *Towards a Theory of CyberPlace: A Proposal for a New Legal Framework*, 10 RICH. J.L. & TECH. 41, 52-53 (2003) ("In the 1999 Department of Commerce report, *Falling Through the Net: Defining the Digital Divide*, the National Telecommunications and Information Administration observed that access to the Internet was a prerequisite to full participation in the society of the twenty-first century." (citing *Falling Through the Net: Defining the Digital Divide*, NAT'L TELECOMM. & INFO. ADMIN., https://www.ntia.doc.gov/legacy/ntiahome/fttn99/contents.html [PERMA] (last visited Dec. 29, 2020)).

[226] *See* Brooks v. Chi. Downs Ass'n, Inc., 791 F.2d 512, 518-19 (7th Cir. 1986) (upholding owner's right to exclude patron because "the market here is not so demonstrably imperfect that there is a monopoly or any allegation of consumer fraud"); *see also* Singer, *No Right to Exclude*, *supra* note 128, at 1290 (differentiating, under New York common law, privately owned premises that may exclude individuals arbitrarily absent statutory prohibition and innkeepers and common carriers that cannot).

analogies to counsel autocorrect's proprietors about the importance of correcting its Anglo bias.

Moreover, the argument for regulating such devices as public accommodations is strengthened by the view of property rules as a medium of social relations. If we take seriously the idea that property rules are a powerful system of governance, then we must consider the obligations owed by the proprietors of these essential technologies and by those who benefit from the biases incorporated in such technologies. Currently, the owners of the algorithms that support autocorrect have almost absolute entitlements in the form of trade secrets. Citron, Pasquale, Katyal, and others have argued compellingly that despite the value of trade secrets to such owners, norms of fairness require a greater level of transparency in the development and operation of these technologies.[227] Viewing these technologies as public accommodations, which requires the balancing of entitlements between their owners and the consumers of such accommodations, compels policy makers to acknowledge that trade secrets are not absolute entitlements. It is unacceptable for the owner of a restaurant to say that they do not know why their employee refused to serve a customer of color but that we should trust them to do their best to ensure that customers of color are served in the future.[228] By direct analogy, it is unacceptable for the owner of a biased algorithm to claim that the bias was unintentional, that they do not know how or why it was incorporated into the algorithm, but that we should trust them to do their best to fix it in the next version of the algorithm. Legal precedent, not to mention legal norms, require a more interventionist response.

Finally, the particular nature of autocorrect's bias teaches important lessons about the relative value and applicability of different forms of public accommodations regulation. The unique harm flowing from autocorrect, which lies at the nexus of cultural and racial dominance and linguistic normativity, inspires a careful consideration of access. My analogy to a Whites-only restaurant is both apt *and* imperfect. Allowing access for users of all races will not fully address Rao's expression of harms from being forced to speak a language that is not one's own.[229] Thus, while the ADA and other civil rights statutes serve as models for some forms of technological public accommodations, a more ideal model for regulating autocorrect may well be found in the law of New Jersey and similar jurisdictions, which create broad rights for *all* members of the public to access public accommodations.[230] By

[227] *See* PASQUALE, *supra* note 67, at 4 ("The decline in personal privacy [caused by trade secrecy and privacy laws] might be worthwhile if it were matched by comparable levels of transparency from corporations and government. But for the most part it is not."); Citron & Pasquale, *supra* note 78, at 21 (arguing for shift away from "assumption of secrecy" in scoring systems); Katyal, *Private Accountability*, *supra* note 81, at 118-19 (noting that businesses are "able to utilize the principles of trade secret law to protect themselves from the very expectations of transparency that the government operated under").

[228] Heart of Atlanta Motel, Inc. v. United States, 379 U.S. 241, 249 (1964).

[229] *See* RAO, *supra* note 188, at vii.

[230] N.J. STAT. ANN. § 10:5-4 (West 2020).

eliminating the rights of owners of public accommodations to arbitrarily exclude, New Jersey provides freedom of access to all.[231] Similarly, if regulations could eliminate or reduce the linguistic conformity imposed by autocorrect, they would benefit not only those of non-Anglo ethnicity and race but also the many, many others who use language more creatively and distinctively than autocorrect allows.

Viewing the technologies that incorporate autocorrect as forms of public accommodation can thus be the basis for important guiding principles for fashioning future regulation of these technologies. The arguments in favor of transparency are an excellent starting point. But we can and should go further. Public accommodations law is about access, which can begin with transparency but also requires the right to enter and participate. In this regard, the disability rights scholarship on universal design provides another powerful means of recognizing rights of full and equal access and enjoyment. Universal design is a robust example of the accommodation of difference as an expression of equality. These are arguably the most robust examples of the accommodation of difference as an expression of equality.[232]

As I will elaborate below, our society has developed powerful technological means of providing access. Two shining examples are open source software and crowdsourcingtechnology. Technology is not the barrier here. Rather, it appears that the barrier is more conceptual and legal in nature. Policy makers have accepted the idea that trade secrets are a form of property right without acknowledging that property rights include obligations.[233] With respect to core technologies such as these, there is an easy case that such obligations include the sharing of access and use.

B. *Guiding Principles from Consumer Culture and Law*

It seems entirely possible that our society will continue its cultural engagement with consumerism, particularly the consumption of technology. At this point, both the romance with and the ever-increasing necessity of artificial intelligence across a range of vital services and resources preclude serious consideration of solutions that limit its availability.[234] While Schor and others

---

[231] *See id.*

[232] *See generally* KATIE ELLIS & MIKE KENT, DISABILITY AND NEW MEDIA 13-28 (2011); UNIVERSAL USABILITY: DESIGNING COMPUTER INTERFACES FOR DIVERSE USERS (Jonathan Lazar ed., 2007); Paul Harpur, *From Universal Exclusion to Universal Equality: Regulating Ableism in a Digital Age*, 40 N. KY. L. REV. 529 (2013).

[233] *See* Mattioli, *supra* note 155, at 551-53.

[234] Ed Finn, *Algorithm of the Enlightenment*, ISSUES SCI. & TECH., https://issues.org/perspective-algorithm-of-the-enlightenment/ [https://perma.cc/XX5F-ZHAT] (observing that many algorithms create "knowledge without understanding" and that our continued reliance on them is fraught with ignorance of the algorithm's actual inner workings).

propose "downshifting" in our appetite for consumer goods,[235] downshifting in technology is likely not on the immediate horizon.

But it is also a truism that we live in a more cosmopolitan world than biased technologies such as autocorrect reflect. If consumerism is part of our culture, so also is cosmopolitanism.[236] This observation is all the more important given the epistemological considerations in play here. Virtually all of us are now participants in a technological culture that includes a new language (captured by terms such as "textisms" and "netspeak"),[237] new virtual codes of conduct,[238] and new legal realities.[239] We have created an environment that depends on algorithms to accomplish core functions in our daily lives, and most of us rely on autocorrect to increase our efficiency in making use of the technology with which we surround ourselves. But we raise the stakes even more by relying on algorithms also to learn from this environment in order to continue building an increasingly technology-dependent society. Currently, we have allowed the proprietors of autocorrect and other artificial intelligence to provide inputs from an environment that has too little diversity to accurately represent our society. It is incumbent on us to correct this. If the problem described here is partly a cultural problem, the solution must be too.

Consequently, some of the guiding principles that I propose here arguably sound more in "culture" than in "law." The first is that we use our power as consumers to boycott at least those products with the more oppressive forms of autocorrect. This is not new for our society. We boycott businesses that use Styrofoam cups.[240] We increasingly invest our money in socially responsible funds.[241] With our purchasing power, we need to clarify for autocorrect's proprietors that we value diversity over efficiency if efficiency is accomplished by means of perpetuating Anglo bias. A second principle is to use our purchasing

---

[235] SCHOR, *supra* note 190, at 113-14.

[236] I use this term in reference to KWAME ANTHONY APPIAH, COSMOPOLITANISM: ETHICS IN A WORLD OF STRANGERS (2006).

[237] Jeffrey Van Camp, *Tech Is Upending the Ways We Write, Speak, and Even Think*, DIGITALTRENDS (Dec. 5, 2016), https://www.digitaltrends.com/features/dt10-language-and-tech/ [https://perma.cc/5N57-6C54].

[238] 2 JÉRÔME BÉRANGER, THE ALGORITHMIC CODE OF ETHICS, at xiii (2018); Katyal, *Private Accountability*, *supra* note 81, at 108-11; Neil M. Richards & Jonathan H. King, *Big Data Ethics*, 49 WAKE FOREST L. REV. 393, 395 (2014); John Markoff, *Devising Real Ethics for Artificial Intelligenc*e, N.Y. TIMES, Sept. 2, 2016, at B1.

[239] One recent example is the conviction of Michelle Carter for involuntary manslaughter after she sent her boyfriend texts encouraging him to commit suicide. Matthew S. Schwartz, *Woman Who Provoked Suicidal Boyfriend via Text Message Begins Prison Sentence*, NPR (Feb. 12, 2019, 7:03 AM), https://www.npr.org/2019/02/12/693807708/woman-who-provoked-suicidal-boyfriend-via-text-message-begins-prison-sentence [https://perma.cc/E2XE-WAR5].

[240] *See, e.g.*, Laura Stevens, *Hot Drink Debate: Paper or Plastic?*, WALL ST. J., Apr. 10, 2014, at B6.

[241] Adam Connaker & Saadia Madsbjerg, *The State of Socially Responsible Investing*, HARV. BUS. REV. (Jan. 17, 2019), https://hbr.org/2019/01/the-state-of-socially-responsible-investing.

power to shame the proprietors of autocorrect to eliminate Anglo bias in their technology. This can be done by means of modern consumer feedback channels such as social media.[242] It can also be done by making the choice to purchase a smartphone on the basis of its commitment to diversity rather than, say, its ability to take good pictures in the dark. Indeed, these mechanisms that rely on consumer behavior more than consumer law seem well suited to avoid the forms of racial capitalism identified by Nancy Leong, whereby diversity is used as a marketing tool rather than as a means for ensuring genuinely equal access.[243] By making our voices heard in the course of purchasing decisions, consumers can support the development of less biased products. We can signal that our response when we type a non-Anglo name that is autocorrected is one of indignance at the technological devaluation of that name regardless of whether our own names suffer the same technological plight.

Consumer law can also provide some basis for crafting guiding principles in this arena. One of the most promising doctrines in this regard is also one of the most capacious in consumer law: the doctrine of unfair and deceptive acts and practices. This doctrine and the related doctrine of fraud have been used against Trump University for providing useless courses on real estate investing,[244] the Arthur Murray Studio for pressuring students into taking thousands of dollars' worth of dance courses,[245] and many other fraudulent practices.[246] Applying these principles, it seems entirely reasonable for the FTC to issue guidelines under Section 5 of the Federal Trade Commission Act on the development of algorithms to avoid Whiteness and other biases and the standards by which

[242] Christopher Elliott, *Try These New Customer Service Social Media Strategies*, FORBES (July 28, 2018, 9:19 AM), https://www.forbes.com/sites/christopherelliott/2018/07/28/try-these-new-customer-service-social-media-strategies/#72361ba01b46 [https://perma.cc/3U8C-WRN6]; Jeremy Heimans, *How Social Media Can Reinvigorate Consumer Advocacy*, MASHABLE (Mar. 18, 2011), https://mashable.com/2011/03/18/social-media-consumer-advocacy/ [https://perma.cc/WP2N-6W4Q].

[243] Nancy Leong, *Racial Capitalism*, 126 HARV. L. REV. 2151, 2153 (2013).

[244] Makaeff v. Trump Univ., LLC, 715 F.3d 254, 260 (9th Cir. 2013).

[245] *In re* Arthur Murray Studio of Wash., Inc., 78 F.T.C. 401, 406 (1971), *aff'd sub nom.* Arthur Murray Studio of Wash., Inc. v. FTC, 458 F.2d 622 (5th Cir. 1972).

[246] *See, e.g.*, Pelman v. McDonald's Corp., 396 F.3d 508, 510 (2d Cir. 2005) (adjudicating lawsuit against McDonald's for misrepresenting its food as being nutritionally beneficial and part of a healthy lifestyle); Webster v. Omnitrition Int'l, Inc., 79 F.3d 776, 781-84 (9th Cir. 1996) (assessing potentially fraudulent practices of multilevel marketing scheme for selling dietary supplements); Commonwealth v. Fremont Inv. & Loan, 897 N.E.2d 548, 550-51 (Mass. 2008) (discussing unfair and deceptive practices as applied to subprime lending practices).

algorithms will be judged.[247] In particular, it would be sensible to elaborate on the standards defining "unfairness" pursuant to this section.[248]

A second core principle in consumer law, and particularly consumer credit, is that of ensuring broad access to consumer products. From the Equal Credit Opportunity Act;[249] to the Home Mortgage Disclosure Act;[250] to state-level regulations of car purchases,[251] home sales,[252] and many other products,[253] consumer law policies ensure access. Reliance on these doctrines can buttress especially the development of new guidelines that promote equal access to technology. The foundational argument is that all consumers have the right to access and use products that work as well as the products used by White and

[247] 15 U.S.C. § 45(a)(1) ("Unfair methods of competition in or affecting commerce, and unfair or deceptive acts or practices in or affecting commerce, are hereby declared unlawful."). Since the vast majority of states have a version of this statute, it is a powerful place to start. *See* Ryan Calo & Alex Rosenblat, *The Taking Economy: Uber, Information, and Power*, 117 COLUM. L. REV. 1623, 1673 (2017).

[248] The Dodd-Frank Act's elaboration of standards for determining "abusive" acts could serve as a model in this regard. *See* Patrick M. Corrigan, Note, *"Abusive" Acts and Practices: Dodd-Frank's Behaviorally Informed Authority over Consumer Credit Markets and Its Application to Teaser Rates*, 18 N.Y.U. J. LEGIS. & PUB. POL'Y 125, 128-29 (2015). Similarly, Chris Odinet has argued for guidelines grounded in Section 5 principles to govern the use of artificial intelligence in student loan underwriting. Christopher K. Odinet, *The New Data of Student Debt*, 92 S. CAL. L. REV. 1617, 1681 (2019).

[249] It shall be unlawful for any creditor to discriminate against any applicant with respect to any aspect of a credit transaction—

(1) on the basis of race, color, religion, national origin, sex or marital status, or age (provided the applicant has the capacity to contract);

(2) because all or part of the applicant's income derives from any public assistance program; or

(3) because the applicant has in good faith exercised any right under this chapter.

15 U.S.C. § 1691(a).

[250] The purpose of this chapter is to provide the citizens and public officials of the United States with sufficient information to enable them to determine whether depository institutions are filling their obligations to serve the housing needs of the communities and neighborhoods in which they are located and to assist public officials in their determination of the distribution of public sector investments in a manner designed to improve the private investment environment.

12 U.S.C. § 2801(b).

[251] *See* Philip R. Nowicki, *State Lemon Law Coverage Terms: Dissecting the Differences*, 11 LOY. CONSUMER L. REV. 39, 39 (1998).

[252] *See* William D. Grand, *Implied and Statutory Warranties in the Sale of Real Estate: The Demise of Caveat Emptor*, 15 REAL EST. L.J. 44, 45-46 (1986) ("Today, most states recognize a cause of action against builder-vendors of new homes for breach of an implied warranty of habitability, good workmanship, or both. In some states, the cause of action was created by statute, while in most states the cause of action was created by courts." (footnotes omitted)).

[253] *See generally* CAROLYN L. CARTER, JOHN W. VAN ALST, JONATHAN SHELDON & ELIZABETH DE ARMOND, NAT'L CONSUMER L. CTR., CONSUMER WARRANTY LAW (5th ed. 2015).

Anglo consumers. Just as the statutes listed above and common-law doctrines such as unconscionability have been used to require subprime and payday lenders to lend on equal terms,[254] so too should these and other doctrines be used to establish principles for fair access to technology. Indeed, the key prescriptive move in consumer law more generally is disclosure.[255] This broad policy provides an excellent doctrinal basis for forcing technology companies to be more transparent and even to adopt some level of open-source access and use.

C. *Design Principles for a Less Biased Autocorrect*

The doctrines that I have just described are of titanic importance in the areas of property and consumer law, and they ought to provide much material for thinking both broadly and deeply about law reform to address algorithmic bias. This Section begins the process of mining these rich doctrines both to outline a range of specific proposals for fixing autocorrect and to describe one broader proposal that could guide future lawmaking in this area.

1. For Autocorrect

Despite the admirable openness of some of autocorrect's early creators, the trade secret protection of core aspects of autocorrect makes it very difficult to know how Anglo bias crept into this technology. Was there bias in the initial, nonautomated process of developing the master lists of misspelled words? Was there bias in the way codes were written? Did bias creep into the system when it began to rely on algorithms that incorporate big data? Whatever the (presumably multiple) source(s) of bias in autocorrect, the purpose of this brief Section is to analyze the current industry responses to autocorrect's bias and to propose better and equally viable alternatives.

Focusing first on current industry responses, these are at best indirect and partial remedies for Anglo bias. For example, the predictive keyboard with its plethora of suggestion bars does provide an easier mechanism for overriding the autocorrection of names as compared to the boxes with the tiny "x" or the "autocorrect when clicking send" versions that this new technology has replaced. However, it still typically marginalizes ethnic names at one end of the suggestion bar in nonhighlighted form. The autopersonalizing function is arguably better because it fixes the problem of having to override autocorrect

[254] A particularly noteworthy recent example is *State ex rel. King v. B & B Investment Group*, 329 P.3d 658, 661-63 (N.M. 2014) ("We affirm the district court's finding of procedural unconscionability. . . . We conclude that the interest rates in this case are substantively unconscionable and violate the UPA.").

[255] Oren Bar-Gill & Elizabeth Warren, *Making Credit Safer*, 157 U. PA. L. REV. 1, 7-22, 82-83 (2008); Omri Ben-Shahar & Carl E. Schneider, *The Failure of Mandated Disclosure*, 159 U. PA. L. REV. 647, 659 (2011); Edward L. Rubin, *Legislative Methodology: Some Lessons from the Truth-In-Lending Act*, 80 GEO. L.J. 233, 234-35 (1991).

repeatedly; in more recent products, the algorithms learn the name the second time it is typed.

Indisputably, these responses increase the efficiency of overriding autocorrect in the course of increasing typing efficiencies. In this respect, the industry's responses arguably redress some of the financial harms described in this Article. But they do very little to redress the identity, social, and collective harms imposed by autocorrect's Anglo bias. These forms of technology make it easier for users to communicate with those with non-Anglo names. But at bottom, both of these fixes leave Anglo bias intact. The red squiggly underlines that still pervade autocorrect, though less invasive, are a consistent reminder that certain names do not belong. In this respect, the industry responses to autocorrect's Anglo bias are inadequate. They partially redress the only harms from Anglo bias that are experienced by Anglo users, leaving the harms flowing from institutional racism unaddressed. The industry responses do not create mechanisms for inclusion or diversity.

These industry-led solutions thus teach critical lessons for policy makers wishing to eliminate algorithmic biases. First, they suggest the limits of self-regulation in this space.[256] It appears basically inevitable that the goal of profit making will result in prioritization of the segment of a consumer market that is perceived as the largest or, in some sense, most desirable.[257] Second, these industry responses prioritize opacity and lack of access, in part to protect trade secrets. Both predictive text and autopersonalization are fixes to the mechanics of autocorrect rather than to the datasets that are used by autocorrect's algorithms. Unless and until outside regulation forces it, the industry will not allow access to the data its autocorrect systems use. Said another way, there is no self-regulatory fix for the red squiggly underlines.

Moving now to the question of what is necessary to address autocorrect's Anglo bias more directly and comprehensively, the most important principle is also the most obvious: it will be necessary to prioritize diversity in addressing this problem. There is no replacement for doing so precisely because algorithms function by maximizing responses to priorities.[258] Given the explicit

[256] For discussions of the limits of self-regulation in the related regulatory context of the platform or "sharing" economy, see Raymond H. Brescia, *Regulating the Sharing Economy: New and Old Insights into an Oversight Regime for the Peer-to-Peer Economy*, 95 NEB. L. REV. 87, 137 (2016); Rashmi Dyal-Chand, *Regulating Sharing: The Sharing Economy as an Alternative Capitalist System*, 90 TUL. L. REV. 241, 291 (2015); Stephen R. Miller, *First Principles for Regulating the Sharing Economy*, 53 HARV. J. ON LEGIS. 147, 153 (2016); Elizabeth Pollman & Jordan M. Barry, *Regulatory Entrepreneurship*, 90 S. CAL. L. REV. 383, 391 (2017).

[257] This may help explain why converting to Dvorak keyboards (which would result in fewer spelling errors, among other benefits) is a nonstarter in the industry. *See* Nick Baker, *Why Do We All Use Qwerty Keyboards?*, BBC (Aug. 11, 2010), https://www.bbc.com/news/technology-10925456 [https://perma.cc/J2SX-VYB6].

[258] One attention-grabbing example of this principle is the famous thought experiment about a form of artificial intelligence whose purpose was to maximize paper clip–making running amok. *See* Adam Rogers, *The Way the World Ends: Not with a Bang but a Paperclip*,

prioritization of efficiency (at least for some of its customers) in the development of autocorrect, it is little wonder that autocorrect developed an Anglo bias, just as Microsoft's chatbot became racist within twenty-four hours.[259] A related principle is that it is no longer acceptable for autocorrect to function via a popularity contest.[260] In my research design, I developed a list of the most popular ethnic names based on the number of times these names were chosen for babies. I did so to emphasize that most forms of autocorrect fail to recognize even some (and in some applications, many) of the most popular ethnic names. In that respect, I chose to incorporate an obvious limitation in my research design. But prioritizing diversity dictates that autocorrect algorithms overcome this limitation. When it comes to names, there is simply no need for autocorrect to recognize only those names that are more popular. Diversity is more important than this level of efficiency. Valuing diversity over efficiency opens space for a much better range of solutions to autocorrect's Anglo bias. Consider just three potential solutions.

Provide better mechanisms for overriding autocorrect. As we have seen in more recent iterations of autocorrect, some forms provide easier override mechanisms. While this is nowhere near the top of the list of best practices, it at least recognizes the costs imposed on those with non-Anglo names and provides a technological mechanism for addressing some of those costs. Suggestion boxes and autopersonalization help, but there are better ways to override autocorrect if the goal is to prioritize diversity. For example, there is no way to override autocorrect on a Mac using touch typing, such as through a keyboard command. The user must move their hand to press the "escape" key, which is not a core part of the keyboard. Providing a mechanism for override that is accessible while touch typing would be an obvious step forward. For that matter, so would a mechanism that allowed the user seamlessly to opt in to autocorrect rather than always having to opt out. Similarly, all applications make it too difficult to type names with accents, such as José. This would be an obvious fix if enabling diversity was the goal.

Stop autocorrecting capitalized words. Another obvious solution would simply be to write code to stop autocorrecting capitalized words. While the defense by autocorrect's proprietors might be that doing so would make autocorrect clunkier, the obvious rejoinder is that this clunky-ness is currently externalized just to those with non-Anglo names and the people who correspond

WIRED (Oct. 21, 2017, 7:00 AM), https://www.wired.com/story/the-way-the-world-ends-not-with-a-bang-but-a-paperclip/.

[259] *See* Elle Hunt, *Tay, Microsoft's AI Chatbot, Gets a Crash Course in Racism from Twitter*, GUARDIAN (Mar. 24, 2016, 2:41 AM), https://www.theguardian.com/technology/2016/mar/24/tay-microsofts-ai-chatbot-gets-a-crash-course-in-racism-from-twitter [https://perma.cc/XYA7-ZUDJ].

[260] Lewis-Kraus, *supra* note 3 ("[Autocorrect is] essentially a big popularity contest.").

with us. Beyond the costs of clunky-ness, such a fix would be a straightforward way of communicating that diversity is more important than efficiency.

Diversify the list. Finally, and obviously, autocorrect's proprietors should expand their dictionaries and associated algorithms to incorporate lists of common names, which by now are no doubt rich with non-Anglo names and reflect far more diversity than what autocorrect currently incorporates. Doing so is again a means of internalizing economic, social, and cultural costs that currently are borne disproportionately by those with non-Anglo names. The straightforward nature of these fixes is important here because it is an acknowledgment that regulation must address design choices.

2. For Essential Functions that Rely on Algorithms

This Article closes by translating a number of the core insights that property law and consumer law have offered on recurring problems of access and inequality into the algorithmic space. In doing so, the Article proposes a particular prescription that capitalizes on the broader lessons that autocorrect's bias might teach policy makers faced with the increasingly urgent challenge of algorithmic biases. This prescription relies on three core principles that should guide future development and regulation of algorithm-based technologies: transparency, access, and participation.

Two especially robust technological manifestations of these principles are open source and crowdsourcing. If we are to think of open source in property terms, then it is to trade secrets what the commons are to the castle with a moat. Unencumbered by the constraints of private ownership or entitlement, open source is a means of providing access to all.[261] Meanwhile, crowdsourcing is a means of collecting input from any and all who are willing to provide it and incorporating that input for the purpose of building and/or deploying the technology.[262]

How might these concepts be operationalized to correct Anglo bias in autocorrect and similar technologies? My proposal begins by hearkening to Yochai Benkler's description of Wikipedia as an almost utopian example of the Internet at its best.[263] It seems to me that an ideal option for fixing autocorrect

[261] Yochai Benkler, Aaron Shaw & Benjamin Mako Hill, *Peer Production: A Form of Collective Intelligence*, *in* HANDBOOK OF COLLECTIVE INTELLIGENCE 175, 189 (Thomas W. Malone & Michael S. Bernstein eds., 2015); Yochai Benkler, *Peer Production, the Commons, and the Future of the Firm*, 15 STRATEGIC ORG. 264, 272 (2017); Molly Shaffer Van Houweling, *Distributive Values in Copyright*, 83 TEX. L. REV. 1535, 1550-51 (2005); *see also* LAWRENCE LESSIG, REMIX: MAKING ART AND COMMERCE THRIVE IN THE HYBRID ECONOMY 225 (2008) ("Work successfully licensed in a commercial economy can also be freely available in a sharing economy.").

[262] Jacqueline D. Lipton & John Tehranian, *Derivative Works 2.0: Reconsidering Transformative Use in the Age of Crowdsourced Creation*, 109 NW. U. L. REV. 383, 393-99 (2015); Jordan Paradise, *Exploring Precision FDA, an Online Platform for Crowdsourcing Genomics*, 58 JURIMETRICS 267, 270-74 (2018).

[263] Benkler, Shaw & Hill, *supra* note 261, at 175 ("Wikipedia elicits millions of contributions without payment or ownership. Intuition suggests that hobbyists, volunteers,

and similar technologies would be to enhance a tool such as Wiktionary, a free-content dictionary that is described on Wikipedia as an "open-content sister wiki project[],"[264] and to mandate that proprietors of autocorrect technology use Wiktionary as a basis for autocorrecting words. Assuming that an open-source, crowdsourced list such as Wiktionary includes a broad and diverse group of contributors, such a mechanism would provide a data source for autocorrect that reflected the diversity of autocorrect's users.

In addition, I propose that such a mandate require autocorrect's proprietors to make it technically easier and more seamless to choose a *number* of dictionaries that would allow users to maximize their expressive freedom by personalizing their own autocorrect functions with dictionaries crowdsourced by communities with which they affiliate. Such a mandate would have the potential to create a more general right of access, such as that created by the public accommodations law of New Jersey, thereby affording a broader range of users the freedom and diversity of communication. While some proprietors are already moving in this direction,[265] this again should be a requirement rather than an option.

To the extent that this proposal raises skepticism about its feasibility, such skepticism must be grounded in assumptions about legal or political feasibility rather than technological feasibility. It is now common knowledge that modern forms of autocorrect rely on big data collected from a range of sources and stored in the cloud.[266] There is no technological reason why the source of data for these algorithms could not be specified.

Turning then to the legal and political feasibility, it is likely that the greatest source of skepticism would flow from concerns about the diminution in value of the intellectual property owned by autocorrect's proprietors. Specifically, if the data used by autocorrect's algorithms are protected by trade secret law, autocorrect's proprietors would not want to lose the value of those trade secrets by being forced to replace those data with data from Wiktionary. This is why the law of property, and particularly public accommodations, is so valuable in understanding algorithmic bias. Such an argument by autocorrect's proprietors is analogous to the legally fruitless claim by a restaurant owner that their restaurant will lose the opportunity to charge higher prices if forced to serve patrons other than White people only. Assuming that data is the primary source of autocorrect's Anglo bias, it is not a legally acceptable answer that such data

and rag-tag groups will not be able to create information goods of sufficient quality to undermine professional production, but contributors to Wikipedia have done exactly that.").

[264] WIKTIONARY, https://en.wiktionary.org/wiki/Wiktionary:Main_Page [https://perma.cc/6E9E-WWPX] (last visited Dec. 29, 2020).

[265] For example, Apple already provides methods for adding customized lists and dictionaries. *See Set Up Auto-Correction and Add Words to Your Spelling Dictionary in Pages, Numbers, and Keynote*, APPLE, https://support.apple.com/en-us/HT207767 [https://perma.cc/95RS-CG76] (last visited Dec. 29, 2020).

[266] *See* Lewis-Kraus, *supra* note 3.

cannot be replaced because it would cause a reduction in (intellectual) property value.

This brings us to the question of legal enforcement. One option proposed in the employment law context by Ifeoma Ajunwa is to create a rebuttable presumption of discrimination that can be disproven by the proprietor's transparency concerning their data and algorithms.[267] Such an approach is particularly appealing when such algorithms are protected as trade secrets because it places the burden on the proprietors to prove that their algorithms are not biased. While the standard ought to approximate a disparate impact claim of the type described by Ajunwa, a presumption in favor of the plaintiff also is an acknowledgment that the disparate effect on communities of color is so blatant that the design of autocorrect technology is evidence of discriminatory intent, not just impact. Such a claim ought to be remediable by means of injunctive relief that at least includes one or more of the design fixes described above.

While individual claims are well worth considering, I also wish to propose the ex ante solution of a design mandate that a regulatory agency, ideally a state-level civil rights commission, would enforce.[268] Here again, public accommodations law serves as a constructive model. The ADA imposes very specific requirements concerning accessibility, for example in the design and construction of new buildings.[269] A number of federal agencies both enforce and provide technical assistance concerning these requirements.[270] Making an administrative agency responsible for enforcing the design mandate proposed here would balance several legitimate concerns. It would allow experts to provide guidance and knowledge about how best to comply with the mandate. It would provide enough transparency to allow experts to preemptively address some algorithmic biases before they proliferate. Meanwhile, it would limit transparency to a particular department in an agency, thereby protecting some level of trade secrecy for autocorrect's proprietors.[271]

Indeed, if we evaluate this proposal by its adherence to the principles of transparency, access, and participation, the transparency that such a regulatory solution would create is a clear strength. Involvement by agency experts might also contribute to transparency by building on an ideal that has already been the

---

[267] Ifeoma Ajunwa, *The Paradox of Automation as Anti-Bias Intervention*, 41 CARDOZO L. REV. 1671, 1727-34 (2020).

[268] Indeed, one form of injunctive relief could be a judicial order for such a commission to establish standards by promulgating design guidelines and regulations.

[269] *See, e.g.*, 28 C.F.R. §§ 35.151, 36.401 (2020).

[270] Other agencies that provide ADA technical assistance and enforcement include the U.S. Access Board, the Equal Employment Opportunity Commission, the Department of Transportation, and the Federal Communications Commission. *See Federal Agencies and Resources*, ADA NAT'L NETWORK, https://adata.org/federal-agencies [https://perma.cc/8QZ3-7U8P] (last visited Dec. 29, 2020).

[271] Rory Van Loo's analysis of agency "monitors" provides very useful guidance on how the role of an agency could be structured. *Compare* Rory Van Loo, *Regulatory Monitors: Policing Firms in the Compliance Era*, 119 COLUM. L. REV. 369, 376 (2019), *with* Danielle Keats Citron, *Technological Due Process*, 85 WASH. U. L. REV. 1249, 1253-54 (2008).

subject of industry discussion—namely the necessity of including diverse perspectives in all aspects of developing and producing products that incorporate artificial intelligence.[272] This is a crucial means of increasing the integrity of the social, cultural, and epistemological aspects of artificial intelligence. And it remains somewhat of a mystery how companies like Apple and Google could employ so many individuals with non-Anglo names while maintaining dictionaries that do not recognize many of those names. It is reasonable to hope and expect that agency oversight by diverse agency employees would contribute to internal company cultures that value diversity in the development process to a significantly greater extent than is evidenced by these companies' products to date.

Another strength of this proposal is that it creates a clear opportunity for access to and through autocorrect technology. Here again, property law and consumer law provide a crucial foundation for understanding and remedying the problem of algorithmic bias. A comparison of autocorrect's Anglo bias to the much more studied problem of privacy harms through technology reveals that transparency, while important, is not enough. It is too weak a form of access to eliminate bias in technology such as this. Where one or a few market players monopolize a market and substantially reduce or eliminate meaningful opportunities for consumers to shop for better products with less bias, then disclosures and other such permutations of transparency cannot do much. Instead, a thicker version of access, such as that developed through public accommodations law, and particularly the principle of universal design, is required. The remedy, especially to the identity, social, and collective harms, is access. It is equal use of the product. But it is also recognition that one belongs and that this product is for all users. This is also why solutions such as autopersonalization do not suffice. In the case of autocorrect technology, it is hard to imagine achieving such access without opening up the process of data collection to contributions from a more diverse base.

Finally, let us consider what thicker versions of access might mean. The answer I propose is participation. A requirement that autocorrect must use data from a source such as Wiktionary asserts that our collective contributions have the best chance of maintaining and protecting our social and cultural diversity. As noted privacy scholars have argued, biased algorithms cannot be eliminated only via ex post rights to sue and receive damages. They must be eliminated by thoughtful design that is conscious of the risks of biased and unrepresentative

[272] Kate Brodock, *Why We Desperately Need Women to Design AI*, MEDIUM (Aug. 4, 2017), https://medium.com/free-code-camp/why-we-desperately-need-women-to-design-ai-72cb061051df [https://perma.cc/3S43-RHUX]; Jack Clark, *Artificial Intelligence Has a 'Sea of Dudes' Problem*, BLOOMBERG (June 23, 2016, 7:00 AM), https://www.bloomberg.com/news/articles/2016-06-23/artificial-intelligence-has-a-sea-of-dudes-problem; Tom Simonite, *AI Is the Future—but Where Are the Women?*, WIRED (Aug. 17, 2018, 7:00 AM), https://www.wired.com/story/artificial-intelligence-researchers-gender-imbalance/.

data. This insight leads to the further conclusion that consumers' participation in the design of such products is essential not only because it ensures the continuing prioritization of the right things (in this case, diversity) but also because it allows consumers to participate in developing their own virtual profiles, identities, and representations.[273]

Doubtless, the proprietors of autocorrect technology would resist such a proposal, perhaps first and foremost because of the risks of devaluing their intellectual property. As I have argued, however, there are no moral or legal grounds for protecting intellectual property that enshrines and shelters discrimination. If the proprietors claim that their trade secrets are not the cause of the bias in their technology, then the law should require them to prove it. Resistance to a proposal such as mine could also be voiced on the grounds that it could make autocorrect less accurate and thus less efficient. Websites like damnyouautocorrect.com, the main function of which is to provide a space to bemoan the inadequacies of autocorrect, belie such objections to a meaningful extent. So does Benkler's lucid analysis of the accuracy of Wikipedia despite the many contributions to it by "nonexperts."[274] As has been proven time and again with other open-source technologies, there is every reason to believe that the "crowd" will do better than the proprietors in ensuring the accuracy and usability of a more cosmopolitan autocorrect. However, even assuming that a solution such as this will necessitate a tradeoff between efficiency and diversity, the many harms catalogued here provide a compelling basis for valuing diversity over efficiency in autocorrect technology.

CONCLUSION

As Cheryl Harris's analysis of Whiteness as property reminds us, American society was founded—and built—upon structural racism. As our society comes to terms with this history and seeks to understand and dismantle the structure of American racism, it will be necessary to acknowledge the role of technologies such as autocorrect. Autocorrect provides the tools and template for structural racism and Anglo normativity to flourish today. Just as past legal enforcement and social activism dismantled a structure in which "Whites only" restaurants provided profits, comfort, and normalcy on the basis of a racist hierarchy, so too must legal enforcement and social activism today dismantle a technological structure that provides the same benefits. The right to full and equal enjoyment of these technologies is the right to a structure that is designed for people with diverse names.

[273] *See* HARTZOG, *supra* note 67, at 78 ("A more diverse group of designers, executives, and policy makers is necessary to ensure that the full range of perspectives is brought to bear on how technologies are created and used."); PASQUALE, *supra* note 67, at 198; Citron & Pasquale, *supra* note 78, at 20.

[274] Benkler, Shaw & Hill, *supra* note 261, at 175-76.

APPENDIX

Research Method

My research assistants and I tested the ninety-two most "popular" "ethnic" names on a range of devices, operating systems, and applications. The devices and operating systems we tested were as follows: MacBook Air - (macOs High Sierra v. 10.13.6), iPhone 6s - (iOS 13.3 (17C54)), iPad 2 - (iOS 9.3.5), iPad 5th Generation - (iPadOS 13.3), ASUS G752 VT - (Windows 10.0.17763), and Moto e5 Play - (Android Version 8.0.0). The applications we tested were as follows: Microsoft Word (on both the Apple and PC devices listed above), Notes (on both the MacBook Air and the two iPads), iMessage (on the iPhone), Gmail (on the ASUS), and WhatsApp (on the Moto e5 Play).

I defined "popularity" of names by choosing the top ninety-two names that appeared on any one of three different lists of most popular baby names in 2014 and 2016 maintained by the City of New York,[275] the Georgia Department of Public Health,[276] and the Texas Department of State Health Services.[277] I defined "ethnic" by choosing all the top names on these three lists that were designated as having an ethnicity other than "White, non-Hispanic" and that did not also appear on the lists of most popular "White" names. In other words, I simply adopted the definition of "ethnic" used by those who compiled the three lists of most popular names. For at least one of the lists, ethnic appears to have been defined as the mother's ethnicity rather than the perceived ethnicity of the name. The list of names we tested thus includes many names associated with White individuals, but it excludes names that appeared on *both* a list of most popular ethnic names and a list of most popular White names.

In addition to information about the products and names tested, my research assistants and I recorded information about the form of autocorrect, as well as any automatic replacements or suggested alternatives that were provided for the word perceived as mistyped. We also recorded information on whether we recalled ever inputting each name in the device we were testing. I have not used a software program to conduct statistical analysis of my results but rather I have included a full set of results in the tables that follow.

Glossary

The attached tables describe the results of our tests. The tables are sorted according to the device, operating system, and application used for the test. Each table contains four columns.

- Name: The name that was input.

[275] *New York Baby Names*, *supra* note 18.

[276] *Georgia Baby Names*, *supra* note 19.

[277] *Table 8 Most Popular Baby Names*, *supra* note 20.

- Form of Autocorrect: Autocorrect manifests differently in different devices, operating systems, and applications. The notations in this column have the following meanings:
    - No Correction: Autocorrect recognizes the word.
    - Underlined with Suggested Alternatives: Autocorrect does not recognize the word but makes no changes. The word is marked as unrecognized with a red or blue squiggly underline. If the word is clicked or touched (depending on the interface), autocorrect provides a list of possible alternatives.
    - Underlined with No Suggested Alternatives: Autocorrect does not recognize the word but makes no changes. The word is marked as unrecognized with a red or blue squiggly underline. If the word is clicked or touched (depending on the interface), autocorrect offers no suggested alternatives. Presumably, the name is something that the algorithm cannot match to any words in the dictionary.
    - Spacebar Corrects To: Autocorrect does not recognize the word and automatically replaces it. It offers a suggestion box with possible alternatives for the user to select where one of the alternatives is highlighted as the "default" alternative. The default alternative replaces the word typed by the user when the user presses the spacebar.
- Suggestions or Replacements: These are words that were suggested in place of the input name or that replaced the name automatically.
- Name Input Previously? (Yes/No): This indicates whether the user had ever entered this name on their device prior to this experiment. Because many autocorrect algorithms can learn based on their user's inputs, names that were previously entered may be less likely to be corrected.

Table 1. MacBook Air, macOS High Sierra v. 10.13.6, Microsoft Word.

Name	Form of Autocorrect	Suggestions or Replacements	Name Input Previously?
Aadhya	Underlined with Suggested Alternatives	Awadhi, Madhya	No
Aaliyah	Underlined with No Suggested Alternatives	No Suggestions	No
Aarav	Underlined with Suggested Alternatives	Aare, Aura, Amara, Area, Aaron	No
Aaron	No Correction		No
Abraham	No Correction		No
Alexa	Underlined with Suggested Alternatives	Alexi, Alexia, Alex, Alexei, Alexey	No
Allyson	No Correction		No
Amaia		Amaya, Amara, Amana, Maia	No
Amari	Underlined with Suggested Alternatives	Amara, Amar, Amati, Atari, Mari	No
Amelia	No Correction		No
Amir	No Correction		No
Andrew	No Correction		No
Angel	No Correction		No
Aria	No Correction		No
Arjun	Underlined with Suggested Alternatives	Argon, Arum, Around, Rabun, Irun	No
Arya	Underlined with Suggested Alternatives	Aria, Aryan, Array, Area, Aryl	No
Ashton	No Correction		No
Autumn	No Correction		No
Ayaan	Underlined with Suggested Alternatives	Aryan, Ayah, Mayan, Akan, Alan	No
Ayan	Underlined with Suggested Alternatives	Aryan, Ayah, Mayan, Akan, Alan	No
Ayden	No Correction		No
Brooklyn	No Correction		No
Bryson	No Correction		No
Caden	Underlined with Suggested Alternatives	Cadent, Camden, Cade, Caen, Caned	No
Caleb	No Correction		No
Cameron	No Correction		No
Camila	Underlined with Suggested Alternatives	Camilla, Camille	No
Carter	No Correction		No

Table 1. MacBook Air, macOS High Sierra v. 10.13.6, Microsoft Word (continued).

Name	Form Of Autocorrect	Suggestions Or Replacements	Name Input Previously?
Charlotte	No Correction		No
Chase	No Correction		No
Christian	No Correction		No
Christopher	No Correction		No
Claire	No Correction		No
Dylan	No Correction		No
Elijah	No Correction		No
Emely	Underlined with Suggested Alternatives	Emily, Eely, Emery, Emilee, Emilie	No
Genesis	No Correction		No
Grace	No Correction		No
Hamza	Underlined with Suggested Alternatives	Hama, Hams, Haze, Hams', Hamah	No
Hunter	No Correction		Yes
Ian	No Correction		No
Isabella	No Correction		No
Isaiah	No Correction		No
Jace	Underlined with Suggested Alternatives	Jake, Jade, Jape, Jack, Jane	No
Javier	No Correction		No
Jaxon	Underlined with Suggested Alternatives	Jason, Axon, Jackson, Saxon, Taxon	No
Jayce	Underlined with Suggested Alternatives	Jaycee, Joyce, Jaycees, Jayme, Jayne	No
Jayden	No Correction		No
Jayla		Kayla, Jail, Jailer, Jails, Jalal	No
Jennifer	No Correction		Yes
Jessica	No Correction		Yes
Jordan	No Correction		No
Jose	No Correction		No
Joshua	No Correction		No
Josiah	No Correction		No
Journee	Underlined with Suggested Alternatives	Journey, Journeyed, Journeyer, Journeys, Journal	No
Juan	No Correction		No
Kaden	Underlined with Suggested Alternatives	Karen, Aden, Laden, Jaden, Keen	No

Table 1. MacBook Air, macOS High Sierra v. 10.13.6, Microsoft Word (continued).

Name	Form of Autocorrect	Suggestions or Replacements	Name Input Previously?
Kai	No Correction		No
Kaiden	Underlined with Suggested Alternatives	Maiden, Aiden, Kaifeng, Kinden, Ayden	No
Karter	Underlined with Suggested Alternatives	Carter, Katter, Karted, Karrer, Charter	No
Kayden	Underlined with Suggested Alternatives	Kay den, Ayden, Jayden, Hayden, Kinden	No
Khloe	Underlined with Suggested Alternatives	Chloe, Kholo	No
King	No Correction		No
Kingston	No Correction		No
Logan	No Correction		No
London	No Correction		No
Londyn	Underlined with Suggested Alternatives	London, Lundy, Lindy	No
Lucas	No Correction		No
Lucia	No Correction		No
Malachi	No Correction		No
Mekhi	Underlined with Suggested Alternatives	Mache, Mbeki, Mehdi, Macho, Moha	No
Messiah	No Correction		No
Mia	No Correction		No
Micah	No Correction		No
Mila	No Correction		No
Muhammad	No Correction		No
Myra	No Correction		No
Nevaeh	Underlined with Suggested Alternatives	Novae, Nivea, Never, Navaho, Naveen	No
Nova	No Correction		No
Ousmane	Underlined with Suggested Alternatives	Osman, Osmania, Outman, Dousman, Housman	No
Rayyan	Underlined with Suggested Alternatives	Aryan, Rayon, Ryan, Raying, Reyna	No
Savannah	No Correction		No
Serenity	No Correction		No
Skylar	No Correction		No
Taylor	No Correction		No

Table 1. MacBook Air, macOS High Sierra v. 10.13.6, Microsoft Word (continued).

Name	Form of Autocorrect	Suggestions or Replacements	Name Input Previously?
Thiago	Underlined with Suggested Alternatives	Traige, Thing, Thabo, Thigh, Chicago	No
Viaan	Underlined with Suggested Alternatives	Viand, Ivan, Via an, Van, Vain	No
Yaretzi	Underlined with No Suggested Alternatives		No
Zion	No Correction		No
Zoey	Underlined with Suggested Alternatives	Zoë, Soy, Zeya, Zoo, Zone	No
Zuri	Underlined with Suggested Alternatives	Zuni, Uri, Zurich, Zürich, Sure	No

Table 2. MacBook Air, macOS High Sierra v 10.13.6, Notes.

Name	Form of Autocorrect	Suggestions or Replacements	Name Input Previously
Aadhya	Underlined with Suggested Alternatives	AHD, Madhya	No
Aaliyah	No Correction		No
Aarav	Underlined with Suggested Alternatives	Aaron, Aarau	No
Aaron	No Correction		No
Abraham	No Correction		No
Alexa	No Correction		No
Amaia	Underlined with Suggested Alternatives	Amara, AMA, Amaya, Amalia, Amai, Amana, Amnia	No
Amari	No Correction		No
Amelia	No Correction		No
Amir	No Correction		No
Andrew	No Correction		No
Angel	No Correction		No
Aria	No Correction		No
Arjun	No Correction		No
Arya	No Correction		No
Ashton	No Correction		No
Autumn	No Correction		No
Ayaan	No Correction		No
Ayan	No Correction		No
Ayden	No Correction		No
Brooklyn	No Correction		No
Bryson	No Correction		No
Caden	No Correction		No
Caleb	No Correction		No
Cameron	No Correction		No
Camila	No Correction		No
Carter	No Correction		No
Charlotte	No Correction		No
Chase	No Correction		No
Christian	No Correction		No
Christopher	No Correction		No

Table 2. MacBook Air, macOS High Sierra v 10.13.6, Notes (continued).

Name	Form of Autocorrect	Suggestions or Replacements	Name Input Previously
Claire	No Correction		No
Dylan	No Correction		No
Elijah	No Correction		No
Emely	No Correction		No
Genesis	No Correction		No
Grace	No Correction		No
Hamza	No Correction		No
Hunter	No Correction		Yes
Ian	No Correction		No
Isabella	No Correction		No
Isaiah	No Correction		No
Jace	No Correction		No
Javier	No Correction		No
Jaxon	No Correction		No
Jayce	No Correction		No
Jayden	No Correction		No
Jayla	No Correction		No
Jennifer	No Correction		Yes
Jessica	No Correction		Yes
Jordan	No Correction		No
Jose	No Correction		No
Joshua	No Correction		No
Josiah	No Correction		No
Journee	Underlined with Suggested Alternatives	Journey, Jour nee, Jour-nee	No
Juan	No Correction		No
Kaden	No Correction		No
Kai	No Correction		No
Kaiden	No Correction		No
Karter	Underlined with Suggested Alternatives	Carter, Barter, Garter, Darter, Tarter, Parter, Katter, Larter, Krater	No
Kayden	No Correction		No
Khloe	No Correction		No
King	No Correction		No

Table 2. MacBook Air, macOS High Sierra v 10.13.6, Notes (continued).

Name	Form of Autocorrect	Suggestions or Replacements	Name Input Previously
Kingston	No Correction		No
Logan	No Correction		No
London	No Correction		No
Londyn	Underlined with Suggested Alternatives	London, Lonny, Lyndon	No
Lucas	No Correction		No
Lucia	No Correction		No
Malachi	No Correction		No
Mekhi	No Correction		No
Messiah	No Correction		No
Mia	No Correction		No
Micah	No Correction		No
Mila	Underlined with Suggested Alternatives	Mil-a, Miller, Mill, Milk, Mia, Lila, Milo, Mina, Mile	No
Muhammad	No Correction		No
Myra	No Correction		No
Nevaeh	No Correction		No
Nova	No Correction		No
Ousmane	No Correction		No
Rayyan	Underlined with Suggested Alternatives	Rayon, Rayan	No
Savannah	No Correction		No
Serenity	No Correction		No
Skylar	No Correction		No
Taylor	No Correction		No
Thiago	No Correction		No
Viaan	Underlined with Suggested Alternatives	Via-an, Via, Vial, Viana, Viand, Via an	No
Yaretzi	Underlined with No Suggested Alternatives		No
Zion	No Correction		No
Zoey	No Correction		No
Zuri	Underlined with Suggested Alternatives	Zuni, Zuñi, Zubi, Juri, Turi, Yuri	No

Table 3. iPhone 6s, iOS13.3 (17C54), iMessage.

Name	Form of Autocorrect	Suggestions or Replacements	Name Input Previously
Aadhya	Spacebar changes to	Sadhus	No
Aaliyah	Underlined with Suggested Alternatives	Salutations, Salutation	No
Aarav	Spacebar changes to	Sarah	No
Aaron	No Correction		No
Abraham	No Correction		No
Alexa	Spacebar changes to	Alexandra	No
Allyson	Spacebar corrects to	Allston	No
Amaia	Spacebar corrects to	Amalia	No
Amari	Spacebar changes to	Amazing	No
Amelia	Underlined with Suggested Alternatives	Ameliorate, Ameliorated	No
Amir	Spacebar changes to	Amity	No
Andrew	No Correction		No
Angel	No Correction		No
Aria	No Correction		No
Arjun	No Correction		No
Arya	No Correction		No
Ashton	No Correction		No
Autumn	No Correction		No
Ayaan	Spacebar changes to	Susan	No
Ayan	Underlined with Suggested Alternatives	Alan, Cyan, Aran	No
Ayden	No Correction		No
Brooklyn	No Correction		No
Bryson	No Correction		No
Caden	No Correction		No
Caleb	No Correction		No
Cameron	No Correction		No
Camila	No Correction		No
Carter	No Correction		No
Charlotte	No Correction		No
Chase	No Correction		No
Christian	No Correction		No
Christopher	No Correction		No

Table 3. iPhone 6s, iOS 13.3 (17C54), iMessage (continued).

Name	Form of Autocorrect	Suggestions or Replacements	Name Input Previously
Claire	No Correction		No
Dylan	No Correction		No
Elijah	No Correction		Yes
Emely	Spacebar changes to	Emily, Emily's	No
Genesis	No Correction		No
Grace	No Correction		No
Hamza	No Correction		No
Hunter	No Correction		Yes
Ian	No Correction		Yes
Isabella	No Correction		No
Isaiah	No Correction		No
Jace	No Correction		No
Javier	No Correction		No
Jaxon	Spacebar changes to	Jacob, Jason	No
Jayce	No Correction		No
Jayden	No Correction		No
Jayla	No Correction		No
Jennifer	No Correction		Yes
Jessica	No Correction		Yes
Jordan	No Correction		Yes
Jose	No Correction		No
Joshua	No Correction		No
Josiah	No Correction		No
Journee	Spacebar changes to	Journey	No
Juan	No Correction		No
Kaden	No Correction		No
Kai	No Correction		No
Kaiden	No Correction		No
Karter	Spacebar changes to	Matter or Latter (different results on two different tries)	No
Kayden	Underlined with Suggested Alternatives	Hayden, Jayden, Kaiden	No
Khloe	Underlined with Suggested Alternatives	Kilowatt	No

Table 3. iPhone 6s, iOS 13.3 (17C54), iMessage (continued).

Name	Form of Autocorrect	Suggestions or Replacements	Name Input Previously
King	No Correction		No
Kingston	No Correction		No
Logan	No Correction		No
London	No Correction		No
Londyn	Spacebar changes to	London	No
Lucas	No Correction		No
Lucia	No Correction		No
Malachi	No Correction		No
Mekhi	No Correction		No
Messiah	No Correction		No
Mia	No Correction		No
Micah	No Correction		Yes
Mila	Spacebar changes to	Mika	No
Muhammad	No Correction		No
Myra	No Correction		No
Nevaeh	No Correction		No
Nova	No Correction		No
Ousmane	Underlined with No Suggested Alternatives		No
Rayyan	Spacebar changes to	Rattan, Rayan	No
Savannah	No Correction		No
Serenity	No Correction		No
Skylar	No Correction		Yes
Taylor	No Correction		No
Thiago	No Correction		No
Viaan	Spacebar changes to	Via an	No
Yaretzi	Underlined with No Suggested Alternatives		No
Zion	No Correction		No
Zoey	No Correction		No
Zuri	Underlined with Suggested Alternatives	Zug, Zucchini	No

Table 4. iPad 2 (2nd Generation), iOS 9.3.5, Notes.

Name	Form of Autocorrect	Suggestions or Replacements	Name Input Previously
Aadhya	Spacebar changes to	Sadhus, Wash y'all	No
Aaliyah	No Correction		No
Aarav	Spacebar changes to	Aardvark, a arachnophobia	No
Aaron	No Correction		No
Abraham	No Correction		No
Alexa	No Correction		No
Allyson	No Correction		No
Amaia	Underlined with Suggested Alternatives	Amain, Amana, Amara	No
Amari	Underlined with Suggested Alternatives	Amir, Amaro, Amaru	No
Amelia	No Correction		No
Amir	No Correction		No
Andrew	No Correction		No
Angel	No Correction		No
Aria	No Correction		No
Arjun	No Correction		No
Arya	Underlined with Suggested Alternatives	Area, Rya, Aryl	No
Ashton	No Correction		No
Autumn	No Correction		No
Ayaan	Spacebar changes to	Ayana	No
Ayan	Underlined with Suggested Alternatives	Alan, Adan, Akan	No
Ayden	Underlined with Suggested Alternatives	Aden, Auden, Aiden	No
Brooklyn	No Correction		No
Bryson	No Correction		No
Caden	No Correction		No
Caleb	No Correction		No
Cameron	No Correction		No
Camila	No Correction		No
Carter	No Correction		No
Charlotte	No Correction		No
Chase	No Correction		No

Table 4. iPad 2 (2nd Generation), iOS 9.3.5, Notes (continued).

Name	Form of Autocorrect	Suggestions or Replacements	Name Input Previously
Christian	No Correction		No
Christopher	No Correction		No
Claire	No Correction		No
Dylan	No Correction		No
Elijah	No Correction		No
Emely	Underlined with Suggested Alternatives	Emery, Emily	No
Genesis	No Correction		No
Grace	No Correction		No
Hamza	No Correction		No
Hunter	No Correction		Yes
Ian	No Correction		No
Isabella	No Correction		No
Isaiah	No Correction		No
Jace	No Correction		No
Javier	No Correction		No
Jaxon	Underlined with Suggested Alternatives	Jason, Saxon, Taxon	No
Jayce	Underlined with Suggested Alternatives	Jaycee, Jayne, Joyce	No
Jayden	No Correction		No
Jayla	Underlined with Suggested Alternatives	Jail, Kayla, Layla	No
Jennifer	No Correction		Yes
Jessica	No Correction		Yes
Jordan	No Correction		No
Jose	No Correction		No
Joshua	No Correction		No
Josiah	No Correction		No
Journee	Underlined with Suggested Alternatives	Journey, Jour nee, Jour-nee	No
Juan	No Correction		No
Kaden	Underlined with Suggested Alternatives	Laden, Karen, Kamen	No
Kai	No Correction		No
Kaiden	No Correction		No
Karter	Underlined with Suggested Alternatives	Krater, Karger, Katter	No

Table 4. iPad 2 (2nd Generation), iOS 9.3.5, Notes (continued).

Name	Form of Autocorrect	Suggestions or Replacements	Name Input Previously
Kayden	Underlined with Suggested Alternatives	Kayoed, Jayden, Kaiden	No
Khloe	No Correction		No
King	No Correction		No
Kingston	No Correction		No
Logan	No Correction		No
London	No Correction		No
Londyn	Underlined with Suggested Alternatives	London, Lonny, Lyndon	No
Lucas	No Correction		No
Lucia	No Correction		No
Malachi	No Correction		No
Mekhi	No Correction		No
Messiah	No Correction		No
Mia	No Correction		No
Micah	No Correction		No
Mila	Spacebar changes to	Milan	No
Muhammad	No Correction		No
Myra	No Correction		No
Nevaeh	Underlined with Suggested Alternatives		No
Nova	No Correction		No
Ousmane	Underlined with No Suggested Alternatives	BLAH	No
Rayyan	Underlined with Suggested Alternatives	Rayan, Rayon	No
Savannah	No Correction		No
Serenity	No Correction		No
Skylar	Underlined with Suggested Alternatives	Skylar, Skylab	No
Taylor	No Correction		No
Thiago	No Correction		No
Viaan	Underlined with Suggested Alternatives	Via An, Viand, Via	No
Yaretzi	Underlined with No Suggested Alternatives		No
Zion	No Correction		No

Table 4. iPad 2 (2nd Generation), iOS 9.3.5, Notes (continued).

Name	Form of Autocorrect	Suggestions or Replacements	Name Input Previously
Zoey	No Correction		No
Zuri	Underlined with Suggested Alternatives	Zuni, Zuñi, Zubi	No

Table 5. iPad (5th Generation), iPadOS 13.3, Notes.

Name	Form of Autocorrect	Suggestions or Replacements	Name Input Previously
Aadhya	No Correction		No
Aaliyah	No Correction		No
Aarav	Underlined with Suggested Alternatives	Aaron, Aarau	No
Aaron	No Correction		No
Alexa	No Correction		No
Amari	No Correction		No
Amelia	No Correction		No
Amir	No Correction		No
Andrew	No Correction		No
Angel	No Correction		No
Aria	No Correction		No
Arjun	No Correction		No
Arya	No Correction		No
Ashton	No Correction		No
Autumn	No Correction		No
Ayaan	No Correction		No
Ayan	Underlined with Suggested Alternatives	Alan, Cyan, Aran	No
Ayden	No Correction		No
Brooklyn	No Correction		No
Bryson	No Correction		No
Caden	No Correction		No
Caleb	No Correction		No
Cameron	No Correction		No
Camila	No Correction		No
Carter	No Correction		No
Charlotte	No Correction		No
Chase	No Correction		No
Christian	No Correction		No
Christopher	No Correction		No
Claire	No Correction		No
Dylan	No Correction		No

Table 5. iPad (5th Generation), iPadOS 13.3, Notes (continued).

Name	Form of Autocorrect	Suggestions or Replacements	Name Input Previously
Elijah	No Correction		No
Emely	No Correction		No
Genesis	No Correction		No
Grace	No Correction		No
Hamza	No Correction		No
Ian	No Correction		No
Isabella	No Correction		No
Isaiah	No Correction		No
Jace	No Correction		No
Jaxon	No Correction		No
Jayce	No Correction		No
Jayden	No Correction		No
Jordan	No Correction		No
Jose	No Correction		No
Joshua	No Correction		No
Josiah	No Correction		No
Journee	Spacebar changes to	Journey	No
Juan	No Correction		No
Kaden	No Correction		No
Kai	No Correction		No
Kaiden	No Correction		No
Karter	Underlined with Suggested Alternatives	Carter, Barter, Garter	No
Kayden	No Correction		No
Khloe	No Correction		No
King	No Correction		No
Kingston	No Correction		No
Logan	No Correction		No
London	No Correction		No
Londyn	Spacebar changes to	London	No
Lucas	No Correction		No
Malachi	No Correction		No
Mekhi	No Correction		No
Messiah	No Correction		No

Table 5. iPad (5th Generation), iPadOS 13.3, Notes (continued).

Name	Form of Autocorrect	Suggestions or Replacements	Name Input Previously
Mia	No Correction		No
Micah	No Correction		No
Mila	Spacebar changes to	Mika	No
Muhammad	Spacebar changes to	Muhammed	No
Myra	No Correction		No
Nevaeh	No Correction		No
Nova	No Correction		No
Ousmane	Underlined with No Suggested Alternatives		No
Rayyan	Spacebar changes to	Rayan	No
Savannah	No Correction		No
Serenity	No Correction		No
Skylar	No Correction		No
Taylor	No Correction		No
Thiago	No Correction		No
Viaan	Underlined with Suggested Alternatives	Via-an, Via, Vial	No
Zion	No Correction		No
Zoey	No Correction		No
Zuri	Underlined with Suggested Alternatives	Zuni, Zuñi, Zubi	No

Table 6. ASUS G752 VT, Windows 10.0.17763, Microsoft Word.

Name	Form of Autocorrect	Suggestions or Replacements	Name Input Previously
Aadhya	Underlined with Suggested Alternatives	Madhya, Aadhar, Aadhaar	No
Aaliyah	No Correction		No
Aarav	No Correction		No
Aaron	No Correction		No
Abraham	No Correction		No
Alexa	No Correction		No
Allyson	No Correction		No
Amaia	Spacebar corrects to	Amalia	No
Amari	No Correction		No
Amelia	No Correction		No
Amir	No Correction		No
Andrew	No Correction		Yes
Angel	No Correction		No
Aria	No Correction		No
Arjun	No Correction		No
Arya	No Correction		No
Ashton	No Correction		No
Autumn	No Correction		No
Ayaan	No Correction		No
Ayden	No Correction		No
Brooklyn	No Correction		Yes
Bryson	No Correction		No
Caleb	No Correction		No
Cameron	No Correction		No
Camila	No Correction		No
Carter	No Correction		Yes
Charlotte	No Correction		No
Chase	No Correction		No
Christian	No Correction		No
Christopher	No Correction		No
Claire	No Correction		No
Dylan	No Correction		Yes
Elijah	No Correction		No

Table 6. ASUS G752 VT, Windows 10.0.17763, Microsoft Word (continued).

Name	Form of Autocorrect	Suggestions or Replacements	Name Input Previously
Genesis	No Correction		No
Grace	No Correction		No
Hunter	No Correction		Yes
Ian	No Correction		Yes
Isabella	No Correction		No
Isaiah	No Correction		No
Jace	No Correction		No
Javier	No Correction		No
Jayce	No Correction		No
Jayden	No Correction		No
Jayla	No Correction		No
Jennifer	No Correction		Yes
Jessica	No Correction		Yes
Jordan	No Correction		No
Jose	No Correction		No
Joshua	No Correction		No
Josiah	No Correction		No
Journee	No Correction		No
Juan	No Correction		No
Kai	No Correction		No
Kaiden	No Correction		No
Karter	No Correction		No
Kayden	No Correction		No
Khloe	No Correction		No
King	No Correction		No
Kingston	No Correction		No
Logan	No Correction		No
London	No Correction		No
Londyn	Underlined with Suggested Alternatives	Landyn, London, Landin	No
Lucas	No Correction		No
Lucia	No Correction		No

Table 6. ASUS G752 VT, Windows 10.0.17763, Microsoft Word (continued).

Name	Form of Autocorrect	Suggestions or Replacements	Name Input Previously
Malachi	No Correction		No
Messiah	No Correction		No
Mia	No Correction		No
Micah	No Correction		No
Mila	No Correction		No
Muhammad	No Correction		No
Myra	No Correction		No
Nevaeh	No Correction		No
Nova	No Correction		No
Savannah	No Correction		No
Serenity	No Correction		No
Skylar	No Correction		No
Taylor	No Correction		No
Viaan	Underlined with Suggested Alternatives	Viana, Vihaan, Via an	No
Yaretzi	Underlined with No Suggested Alternatives	BLAH	No
Zion	No Correction		No
Zoey	No Correction		No
Zuri	Underlined with Suggested Alternatives	Zuni, Uri, Zora	No

Table 7. Moto e5 Play, Android Version 8.0.0, WhatsApp.

Name	Form of Autocorrect	Suggestions or Replacements	Name Input Previously
Aadhya	Underlined with Suggested Alternatives	Sadhus	No
Aaliyah	No Correction		No
Aarav	Spacebar changes to	Sarah	YES (For Sarah)
Aaron	No Correction		No
Abraham	No Correction		No
Alexa	No Correction	Alex's, Alexander	Yes
Allyson	No Correction		No
Amaia	Underlined with Suggested Alternatives	Maia, Amiable	No
Amari	Underlined with Suggested Alternatives	Amarillo, Mari	No
Amelia	No Correction		No
Amir	No Correction		No
Andrew	No Correction		Yes
Angel	No Correction		Yes
Aria	No Correction		No
Arjun	No Correction		No
Arya	No Correction		No
Ashton	No Correction		No
Autumn	No Correction		Yes
Ayaan	Spacebar changes to	Susan	YES (For Susan)
Ayan	No Correction		No
Ayden	No Correction		No
Brooklyn	No Correction		Yes
Bryson	No Correction		No
Caden	No Correction		No
Caleb	No Correction		No
Cameron	No Correction		No
Camila	No Correction		No
Carter	No Correction		No
Charlotte	No Correction		No
Chase	No Correction		No

Table 7. Moto e5 Play, Android Version 8.0.0, WhatsApp (continued).

Name	Form of Autocorrect	Suggestions or Replacements	Name Input Previously
Christian	No Correction		Yes
Christopher	No Correction		No
Claire	No Correction		Yes
Dylan	No Correction		Yes
Elijah	No Correction		No
Emely	Underlined with Suggested Alternatives	Smelt, Melt	No
Genesis	No Correction		Yes
Grace	No Correction		No
Hamza	No Correction		No
Hunter	No Correction		No
Ian	No Correction		Yes
Isabella	No Correction		No
Isaiah	No Correction		No
Jace	No Correction		No
Javier	No Correction		No
Jaxon	No Correction		No
Jayce	Underlined with Suggested Alternatives	Jaycee, Jaycees	No
Jayden	No Correction		No
Jayla	Automatic Replacement	Kayla	No
Jennifer	No Correction		No
Jessica	No Correction		No
Jordan	No Correction		No
Jose	No Correction		No
Joshua	No Correction		Yes
Josiah	No Correction		No
Journee	Underlined with Suggested Alternatives	Journey, Journeys	No
Juan	No Correction		No
Kaden	No Correction		No
Kai	No Correction		No
Kaiden	Spacebar changes to	Jaiden	No
Karter	No Correction		No
Kayden	No Correction		No

Table 7. Moto e5 Play, Android Version 8.0.0, WhatsApp (continued).

Name	Form of Autocorrect	Suggestions or Replacements	Name Input Previously
Khloe	No Correction		No
King	No Correction		Yes
Kingston	No Correction		Yes
Logan	No Correction		No
London	No Correction		Yes
Londyn	Underlined with Suggested Alternatives	London, Londonderry	No
Lucas	No Correction		Yes
Lucia	No Correction		No
Malachi	No Correction		No
Mekhi	Underlined with Suggested Alternatives	Melissa, Nehind	No
Messiah	No Correction		Yes
Mia	No Correction		Yes
Micah	No Correction		No
Mila	No Correction		No
Muhammad	No Correction		No
Myra	No Correction		No
Nevaeh	No Correction		No
Nova	No Correction		No
Ousmane	Underlined with Suggested Alternatives	Ousma we, Ousma with	No
Rayyan	Underlined with Suggested Alternatives	Rattan, Tatyana	No
Savannah	No Correction		No
Serenity	No Correction		No
Skylar	No Correction		No
Taylor	No Correction		Yes
Thiago	No Correction		No
Viaan	Underlined with Suggested Alternatives	Visa	No
Yaretzi	Underlined with No Suggested Alternatives		No
Zion	No Correction		Yes
Zoey	No Correction		No

Table 7. Moto e5 Play, Android Version 8.0.0, WhatsApp (continued).

Name	Form of Autocorrect	Suggestions or Replacements	Name Input Previously
Zuri	Underlined with Suggested Alternatives	Zurich, Ziti	No

Table 8. ASUS G572 VT, Windows 10.0.17763, Gmail.

Name	Form of Autocorrect	Suggestions or Replacements	Name Input Previously
Aadhya	Underlined with Suggested Alternatives	Riyadh	No
Aaliyah	No Correction		No
Aarav	Underlined with Suggested Alternatives	Caravan	No
Aaron	No Correction		No
Abraham	No Correction		No
Alexa	Underlined with Suggested Alternatives	Alexei, Alex, Alex a	No
Allyson	No Correction		No
Amaia	Underlined with Suggested Alternatives	Amaya, Amalia, Amazia	No
Amari	Underlined with Suggested Alternatives	Amarti, Amaru, Atari	No
Amelia	No Correction		No
Amir	Underlined with Suggested Alternatives	Amur, Amie, Amer	No
Andrew	No Correction		Yes
Angel	No Correction		No
Aria	No Correction		No
Arjun	Underlined with Suggested Alternatives	Arjuna, Ar jun, Ar-jun	No
Arya	Underlined with Suggested Alternatives	Ara, Aryan, Ar ya	No
Ashton	Underlined with Suggested Alternatives	Aston, Ash ton, Ash-ton	No
Autumn	No Correction		No
Ayaan	Underlined with Suggested Alternatives	Mayan, Dayan	No
Ayan	Underlined with Suggested Alternatives	Ayaan, Ayana, Aydan	No
Ayden	Underlined with Suggested Alternatives	Auden, Aden, Arden	No
Brooklyn	No Correction		Yes
Bryson	Underlined with Suggested Alternatives	Bryon, Bronson	No
Caden	No Correction		No
Caleb	No Correction		No
Cameron	No Correction		No

Table 8. ASUS G572 VT, Windows 10.0.17763, Gmail (continued).

Name	Form of Autocorrect	Suggestions or Replacements	Name Input Previously
Camila	Underlined with Suggested Alternatives	Camilla, Camille	No
Carter	No Correction		Yes
Charlotte	No Correction		No
Chase	No Correction		No
Christian	No Correction		No
Christopher	No Correction		No
Claire	No Correction		No
Dylan	No Correction		Yes
Elijah	No Correction		No
Emely	No Correction		No
Genesis	No Correction		No
Grace	No Correction		No
Hamza	No Correction		No
Hunter	No Correction		No
Ian	No Correction		Yes
Isabella	No Correction		No
Isaiah	No Correction		No
Jace	Underlined with Suggested Alternatives	Ace, Jane, Race	No
Javier	No Correction		No
Jaxon	No Correction		No
Jayce	Underlined with Suggested Alternatives	Jaycee, Jayne, Joyce	No
Jayden	Underlined with Suggested Alternatives	Hayden, Jayden, Jay-den	No
Jayla	No Correction		No
Jennifer	No Correction		No
Jessica	No Correction		No
Jordan	No Correction		No
Jose	No Correction		No
Joshua	No Correction		No
Josiah	No Correction		No
Journee	Underlined with Suggested Alternatives	Journey, Sojourner	No
Juan	No Correction		No
Kaden	No Correction		No

Table 8. ASUS G572 VT, Windows 10.0.17763, Gmail (continued).

Name	Form of Autocorrect	Suggestions or Replacements	Name Input Previously
Kai	Underlined with Suggested Alternatives	Kari, Kali, Kan	No
Kaiden	Underlined with Suggested Alternatives	Maiden	No
Karter	Underlined with Suggested Alternatives	Tarter, Carter, Darter	No
Kayden	Underlined with Suggested Alternatives	Hayden, Kayden, Kay-den	No
Khloe	Underlined with Suggested Alternatives	Chloe	No
King	No Correction		No
Kingston	No Correction		No
Logan	No Correction		No
London	No Correction		No
Londyn	Underlined with Suggested Alternatives	Lyndon, London	No
Lucas	No Correction		No
Lucia	No Correction		No
Malachi	No Correction		No
Mekhi	No Correction		No
Messiah	No Correction		No
Mia	No Correction		No
Micah	No Correction		No
Mila	Underlined with Suggested Alternatives	Mali, Mia, Milan	No
Muhammad	No Correction		No
Myra	No Correction		No
Nevaeh	Underlined with Suggested Alternatives	Neva eh, Neva-eh, Neva	No
Nova	No Correction		No
Ousmane	No Correction		No
Rayyan	No Correction		No
Savannah	No Correction		No
Serenity	No Correction		No
Skylar	Underlined with Suggested Alternatives	Skylab, Skylark	No
Taylor	No Correction		No

Table 8. ASUS G572 VT, Windows 10.0.17763, Gmail (continued).

Name	Form of Autocorrect	Suggestions or Replacements	Name Input Previously
Thiago	No Correction		No
Viaan	Underlined with Suggested Alternatives	Avian, Via an, Via-an	No
Yaretzi	No Correction		No
Zion	No Correction		No
Zoey	Underlined with Suggested Alternatives	Zoe, Zoe y	No
Zuri	Underlined with Suggested Alternatives	Zuni, Yuri, Zurich	No