

SPACES FOR THE FUTURE

A Companion to Philosophy of Technology

EDITED BY JOSEPH C. PITT
AND ASHLEY SHEW

First published 2018
by Routledge
711 Third Avenue, New York, NY 10017

and by Routledge
2 Park Square, Milton Park, Abingdon, Oxon, OX14 4RN

Routledge is an imprint of the Taylor & Francis Group, an informa business

© 2018 Taylor & Francis

The right of Joseph C. Pitt and Ashley Shew to be identified as the authors of the editorial material, and of the authors for their individual chapters, has been asserted in accordance with sections 77 and 78 of the Copyright, Designs and Patents Act 1988.

All rights reserved. No part of this book may be reprinted or reproduced or utilised in any form or by any electronic, mechanical, or other means, now known or hereafter invented, including photocopying and recording, or in any information storage or retrieval system, without permission in writing from the publishers.

Trademark notice: Product or corporate names may be trademarks or registered trademarks, and are used only for identification and explanation without intent to infringe.

Library of Congress Cataloging-in-Publication Data
A catalog record for this book has been requested

ISBN: 978-0-415-84296-9 (hbk)

ISBN: 978-0-203-73565-7 (ebk)

Typeset in Times New Roman
by Apex CoVantage, LLC

Visit the companion website: <http://spacesforthefuture.com>

Data, Technology, and Gender

Thinking About (and From) Trans Lives

Anna Lauren Hoffmann

Introduction

For scholars and students interested in topics of gender identity, data, and information technology, the current historical moment is a curious one. The proliferation of personal computing devices—from laptops to mobile phones to “smart” watches—combined with widespread internet access, means that people are producing unprecedented amounts of digital data, leading some scholars and technology evangelists to declare a “big data” revolution. At the same time, issues of sexism and gender inequality have taken on new urgency as women face increasing levels of harassment online, especially on large social networking sites like Twitter. The blame for this falls, in part, on platform owners and developers that fail to thoroughly consider role of design in promoting safety for the most vulnerable users. Finally, the emergence of high-profile transgender activists, performers, and celebrities—from Laverne Cox to Caitlyn Jenner—has brought attention to a minority population of trans, nonbinary, and gender-nonconforming people and communities that have been (until now, at least) largely overlooked, often to the detriment of the health and safety of these populations.

Of course, some would view these three trends as mostly unrelated: at a quick glance, big data, gender and sexism online, and the health and needs of transgender people seem to have little to do with one another. Against this easy assumption, however, this chapter suggests that—while not wholly reducible to one another—these three issues intersect in important ways and, in particular, they shine a light on the ongoing struggles minority identities and lives face in our increasingly data-driven world. The ‘big data revolution’ cannot be divorced from the technologies and systems that support it—technologies and systems that have long struggled to account for diverse and nonnormative lives.

In the following, these three trends are woven together to further our thinking about gender, identity, and technology. The first section attends to the biases and assumptions that underwrite the idea of ‘big data.’ It argues that big data and the quantitative insights into human behavior they stand to provide are not given but, rather, they are something we make and remake in practice. The second section traces key strands of thinking about the relationship between gender and technology, offering deeper insight into the ways in which gendered biases or stereotypes are built into the practice of scientific and technological development. Finally, the third section takes these lessons and extends them to thinking about the lives and identities of gender minorities, such as transgender individuals. I should note, however, that the discussions of relevant literature throughout this chapter are not intended to be comprehensive (indeed, a fully comprehensive literature review of any section’s topic would fall outside the scope of this chapter). Rather, I mean only to hit on the most salient trends and points as they relate to and help to discuss issues of data, technology, information systems, and gender identity.

Confronting the Mythology of Big Data

The term *big data* represents many things. As Rob Kitchin (2014a) describes, the term often refers to data sets and databases that are ‘big’ along three lines: volume, velocity, and variety (the 3Vs) (67–68; see also: Zikopoulos and Eaton 2011). Under this definition, big data are unique because of their massive size (petabytes or even zettabytes), the rapidity of their production (sometimes near real time, as with data generated by social networking sites), and their diversity (they are expansive, contain data and metadata, and they can be both structured and unstructured) (Kitchin 2014b: 1). Big data are also sometimes marked by other features, like scalability (Mayer-Schönberger and Cukier 2013), the ease by which they are combined with other data (Kitchin and McArdle 2016), and their often fine-grained or detailed nature (Dodge and Kitchin 2005). Beyond technical features, big data also represent a kind of mythology. As boyd and Crawford (2012) put it, big data simultaneously are produced and thrive on a “widespread belief that large data sets offer a higher form of intelligence and knowledge that can generate insights that were previously impossible, with the aura of truth, objectivity, and accuracy” (663).

Although the technical features of big data may raise their own practical and philosophical issues, the focus of this section is the mythology of big data. This myth—the idea that more and bigger data equals more and greater truth—is a seductive one; it suggests that the social world can be explained from a value-neutral, objective point in much the same way that the physical universe is understood through measurable and mathematically quantifiable features (Jurgenson 2014). Instead of filtering our data through the ideas and theories that make up various branches of the social sciences (like sociology, linguistics, or psychology) we can simply harness the power of today’s computers to perform automated statistical analyses on massive data sets that capture traces of human behavior. Computers can find patterns and identify correlations that humans cannot, patterns that—while not proof of causation—are basically good enough to do the job of predicting (rather than explaining) future behavior. As Geoffrey Bowker (2014) describes, such an approach seems—at least superficially—to “[avoid] funneling our findings through vapid stereotypes” (1796). Amazon, for example, deploys an online recommender system that

work[s] through correlation of purchases without passing through the vapid categories of the marketers—you don’t need to know whether someone is male or female, queer or straight, you just need to know his or her patterns of purchases and find similar clusters.

(Bowker 2014: 1796)

The seductiveness of this idea has led some big data evangelists to proclaim that we have reached the “end of theory,” a point in time where knowledge production is simply a matter of “[throwing] numbers into the biggest computing clusters the world has ever seen and [letting] statistical algorithms find patterns where science cannot” (Anderson 2008: n.p.). As Caroline Basset (2015) summarizes the idea, “Big Data ushers in new forms of expertise and promises to render various forms of human expertise increasingly necessary” through “automation of forms of data capture, information gathering, data analysis and ultimately knowledge production” (549). In Robert W. Gehl’s (2015) words, “a common refrain . . . is that we are in for a revolution, but only if we recognize the problem of too much data and accept the impartial findings of data science for the good of us all” (420). In short, big data appear to make “human expertise seem increasingly beside the point” (Bassett 2015: 549).

But one can only admit the “end of theory” if one also accepts uncritically the mythology of big data. But many scholars—including those cited earlier—warn that this myth is dangerous,

as it overlooks the ways in which our very ideas about what constitutes ‘data’ are themselves framed by theoretical perspectives and assumptions. At a fundamental level, the mere act of calling some things data (and disregarding other things as ‘not data’) represents a kind of theory itself: even unstructured data rely on categories of chronological time or textual sources that have already been shaped by assumptions about the world enforced by data collection instruments. Any given data set is, by necessity, limited by its sources or its aims—no single data set, even the most massive ones, can contain all conceivable data points because not everyone or everything is conceived of as ‘data.’ Consequently, big data continue to suffer from “blind spots and problems of representativeness, precisely because [they] cannot account for those who participate in the social world in way that do not register as digital signals” (Crawford et al. 2014: 1667).

Assumptions about what constitute ‘data’ are built into the instruments and tools we use to collect, analyze, and understand the data itself. These tools “have their own inbuilt limitations and restrictions”—for example, data available through social networking sites like Twitter and Facebook are constrained by the poor archiving and search functions of those sites, making it easy for researchers to look at events or conversations in the present and immediate past but also difficult to track older events or conversations (boyd and Crawford 2012: 666). As a consequence, research conducted on or through these sites often inherits a temporal bias, and given the constraints of these social platforms, researchers prioritize immediacy over more reflective or temporally distant analyses. The mythology of big data—its appeal to automated, technologically sophisticated systems and claims to objectivity—works to obscure these biases and their limits for accounting for certain kinds of people or communities (Crawford et al. 2014: 1667) As Bowker (2014) puts it: “just because we have big (or very big, or massive) data does not mean that our databases are not theoretically structured in ways that enable certain perspectives and disable others” (1797).

To be critical scholars and students of big data we must be vigilant against a mythology. It is imperative that we pierce the veil of technological wonder and readily scrutinize big data’s claims to impartiality or neutrality and recognize that data and knowledge are made legible and valuable not in a vacuum, but in context. As Tom Boellstorff (2013) rightfully asserts: “There is a great need for theorization precisely when emerging configurations of data might seem to make concepts superfluous—to underscore that there is no Archimedean point of pure data outside conceptual worlds” (n.p.). To be sure, these limits and biases do not automatically mean that large-scale, data-intensive research is necessarily bad or unimportant. Rather, they simply underscore the continued relevance of theoretical and other types of inquiry even in the midst of a big data ‘revolution.’ As Crawford et al. (2014) argue,

the already tired binary of big data—is it good or bad?—neglects a far more complex reality that is developing. There is a multitude of different—sometimes completely opposed—disciplinary settings, techniques, and practices that still assemble (albeit uncomfortably) under the banner of big data.

(1665)

Surfacing the Role of Gender in the Design and Production of Science and Technology

The previous section challenged the seeming neutrality and objectivity of big data by reasserting the importance of paying critical attention to the social, political, and technological biases that underlie processes of collecting, analyzing, and making sense of data. This section builds on this idea by zeroing in on one particular kind of social and political bias: gender bias. It

focuses on the work of scholars and commentators that show how scientific and technological practices (and the knowledge they produce) are shaped and constrained by considerations of gender.

Early work on gender and technology focused almost exclusively on highlighting the overlooked contributions of women to the history and development of science and technology. Work in this vein sometimes focuses on women's contributions to sites conventionally associated with men—such as industry, engineering, or scientific research—and demonstrates how the narratives that have emerged around these sites have tended to privilege the work and ideas of men despite the presence and contributions of women. For example, a focus on the men who built the first electronic, all-purpose computer—the Electronic Numerical Integrator and Computer (ENIAC)—overlooks the fact that it was a team of women mathematicians that worked to program the machine and make it operational (Sydell 2014). These sorts of skewed narratives “have tended to make the very male world of invention and engineering look ‘normal,’ and thus even more exclusively male than is actually the case” (Lerman, Mohun, and Oldenziel 2003: 431). As Nathan Ensmenger (2010) summarizes, “the idea that many . . . computing professions were not only historically unusually accepting of women, but were in fact once considered ‘feminized’ occupations, seems . . . unbelievable” against a backdrop that so heavily associates computing with men and masculinity (120).

Other approaches work in a different direction, looking instead at activities and spaces historically associated with women but overlooked as significant sites of technological activity. Building on feminist critiques of Marxism that emphasized the role of unpaid and domestic labor (most often performed by women), work in this area examines the relationship between gender and technology outside of conventional sites of scientific or technological production. Cynthia Cockburn and Susan Ormrod (1993)—in their now-classic work *Gender and Technology in the Making*—examined the history and rise of the microwave oven not only in its design and development phase, but through to its dissemination into kitchens and the home. Cockburn and Ormrod (1993) show how a technology that starts out as a high-tech innovation ends up—through processes of marketing, retailing, and associations with ‘women’s work’ like household cooking—viewed as a rote household appliance, ultimately ignoring the ways that women’s specific technical knowledge (of cooking, for example) also contributed to the design, distribution, and use of a particular technology.

Despite progress in recognizing the contributions of women in the history of science and technology, however, biases still persist in our narratives about novel or innovative technologies. The story of the relatively recent and much-lauded Google Books project, for example, foregrounds the vision of Google’s founders Sergey Brin and Larry Page as well as the company’s (male-dominated) engineering teams that developed a novel way for quickly and effectively scanning, digitizing, and bringing entire library collections online (thus greatly expanding access to recorded knowledge). Lost in this narrative are the contributions of librarians (primarily women) who collected, organized, curated, and maintained the collections upon which Google Books is built (Hoffmann and Bloom, forthcoming) as well as the women and people of color who performed the manual labor of turning pages for Google’s scanning machines (Wen 2014).

Further approaches to gender and technology center not on the narratives that grow up around particular technologies, but instead on the ways in which gender biases influence the development and design of technology itself. Work in this vein seeks to uncover how sexist assumptions and stereotypes end up designed—or ‘baked’—into various systems and artifacts. For example, video games that offer only male avatars for players (or male and highly sexualized female avatars) implicitly encode the assumption that only (heterosexual) men play video games (Friedman 1996). More recently, commentators have pointed out how software

applications and personal tracking tools also fail to account for the specific needs of women. For example, the release of Apple's HealthKit for its popular mobile phones (iPhones) promised a set of comprehensive tools for tracking personal health and biometric information. However, HealthKit's first iteration failed to include a tool for tracking menstruation (Duhaime-Ross 2014). Studying the relationship between gender and technology in this way allows us to reveal and destabilize these seemingly 'natural' defaults by revealing the ways in which they actively construct biased or even harmful ideas about women. (For more thorough summaries of the state of gender and technology studies at different points in its development, see McGaw 1982; Lerman, Mohan, and Odenziel 2003; Wajcman 2009).

Finally, gender has also played an important role in normative analyses of science, helping to shed light on the moral and ethical consequences of scientific and technological progress. Sandra Harding's (1991) foundational work on feminist studies of science implored scholars to pay close attention to "the problematics, agendas, ethics, consequences, and status" of science-as-usual, that is, scientific practice and as we commonly (and uncritically) understand it (1). Doing so means going beyond simply harnessing the tools of science to explore overlooked questions or areas (like, for example, women's health needs); instead, it requires a thorough examination of the tools themselves—the methods, instruments, practices, and ethics that have come to typify scientific practice. For example, simply pointing the tools and technologies of science at issues relevant to women's lives reinforces the assumption that gender is binary and that men and women are categorically different, a problematic assumption that has historically undergirded research on sex difference (Fausto-Sterling 1985; Richardson 2013).

Against the ingrained biases and problematic assumptions of conventional scientific inquiry, many feminist researchers emphasize not one particular 'female' way of knowing, but—rather—advocate for a plurality of methods for gathering, analyzing, and making sense of the world. Regardless of method, feminist research should share—as Alison Wylie (2007) argues—at least four basic commitments: (1) research should be relevant to feminist aims of exposing and addressing questions of oppression, gendered or otherwise; (2) research should be grounded in the experiences of marginalized populations, especially women; (3) researchers should be accountable, in an ethical sense, to the persons and populations they study; and (4) researchers should be reflexive, that is, they should foreground (rather than obscure) the context and assumptions that underwrite their work. Combined, these four dimensions articulate a normative vision for science that rejects the sort of objectivity and neutrality by positivist and other understandings of science. (For a more thorough discussion of these commitments, see Crasnow et al. 2015.)

Data, Information Technology, and Transgender Lives

The preceding discussions of big data and gender, science, and technology share a careful attention to the ways in which biases, stereotypes, and problematic assumptions shape our understandings of the world. They resist any easy or uncomplicated claims to neutrality or objectivity, whether in science generally or in analyses of massive data sets specifically. For scholars critical of big data, this resistance means understanding what is admitted as 'data' in the first place (and what is left out) as well as being cognizant of the histories and politics that shape the categories we use to make sense of data. For feminist scholars of science and technology, it means bringing gender and oppression to the fore of our analyses and rejecting the supposed neutrality of scientific and technological production. Bringing these discussions together helps to open up a critical discussion of data, information technology, and the continued marginalization of gender minorities like transgender and gender nonconforming individuals.

At its simplest, the term *transgender* refers to “people who move away from the gender they were assigned at birth, people who cross over (trans-) the boundaries constructed by their culture to define and contain that gender” (Stryker 2009: 1). It is sometimes described as the opposite of *cisgender*, a term that refers to people who identify with the gender they were assigned at birth—most likely binary, either male or female (man or woman, boy or girl). Etymologically, the prefix *cis-* derives from the Latin term meaning “on this side of,” while the prefix *trans-* derives from the Latin term meaning “on the other side of.” It is important to note, however, that not all members of gender minority groups (those who are not either cisgender men or cisgender women) necessarily identify as transgender. A range of terms have emerged to describe a range of identities and lived experiences of gender—from genderqueer individuals who do not prescribe to any discrete gender category to nonbinary individuals who reject the binary categories of male/female altogether.

Going beyond this relatively straightforward definition, Megan Davidson (2007) explains that “the term *transgender* has no singular, fixed meaning but is instead . . . conceptualized by both scholars and activists as inclusive of the identities and experiences of some (or perhaps all) gender-variant, gender- or sex-changing, gender-blending, and gender-bending people” (Davidson 2007: 60). In some sense, then, ambiguity has long been integral to any conception of the term (Nataf 1996). It may, at times, include (or exclude)

transsexual people (of all operative statuses), cross-dressers, drag kings and queens, genderqueer people, gay men and lesbians who queer gender lines (such as butch lesbians), the partners of trans people, and any number of other people who transgress binary sex and gender in all sorts of named and yet unnamed ways.

(Davidson 2007: 61)

For the purposes of readability, however, this remainder of this section (following Haimson et al. 2015) uses the shorthand “trans” to refer to the transgender and broader gender nonconforming population.

Trans people are relevant to thinking about data and information systems in different ways. Contemporary practices of collecting, mining, analyzing, and otherwise making use of data represent new avenues for the exercise of social control (Andrejevic 2013). In addition, efforts to classify and categorize things are caught up in processes of power and control (Boellstorff 2013: n.p.; see also Bowker and Star 1999). As such, they represent new methods for defining and containing categories of gender—methods that may or may not account for the identities and needs of trans populations. For example, paper or online forms that offer only binary options—only male and female check boxes—pose problems for trans people trying to access health or other social services, online communities, or even dating sites. Trans women, for example, have had problems using the popular online dating application Tinder, a site that offers users only the option to identify by binary (and presumably cis) gender (i.e., man or woman). Men seeking women on the site have repeatedly reported the accounts of trans women as fraudulent based on the perceived failure of these women to meet the men’s normative standard of what a ‘real woman’ is or looks like (Vincent 2016). These reports often result in trans women’s accounts being suspended and trans users being kicked off the site.

Trans people’s struggles with information systems and biased categories also go beyond mere check boxes for gender. Many trans people, when socially transitioning genders, choose a new name for themselves—one that better reflects who they are. However, national and local policies may make it more or less difficult to legally change the name one was assigned at birth (also known as a “deadname”). As a result, trans people often find themselves being forced to

disclose information (like their deadname) through bureaucratic or administrative practices that do not account for or permit the use of chosen names that are not yet legally recognized. For example, trans people may wish to sign up to use a website like Facebook—a social networking site with more than one billion registered users—using an identity that is different from the one that appears on their birth certificate or other legal documents. However, because Facebook enforces a ‘real name’ policy, doing so is often not possible.

Beyond social networking sites, the administrative tensions generated by limited and inflexible data categories and information systems can inform all aspects of a trans individual’s life. Take, for example, the importance of name and gender information in a university context:

Because college officials use gender in assigning campus housing, determining which bathrooms and locker room students are permitted to use and deciding on which sports team students can compete, a gender marker that does not correspond to how a student identifies might mean that their institution will place them in unfair, uncomfortable, and potentially dangerous situations.

(Beemyn and Brauer 2015: 480)

More than just an administrative headache, being forced to reveal or go by the wrong gender or the wrong name can trigger feelings of dysphoria and humiliation. In some cases, it can also lead to harassment, abuse, and even death. As Dean Spade (2015) forcefully demonstrates in his book *Normal Life*, these sorts of conflicts—between prescribed categories and lived or actual identities—have severe consequences, often leading to trans people being denied housing, employment, medical or mental health care, and access to homeless or domestic violence shelters.

As discussed in the first section, the mythology of big data cannot be divorced from the systems and practices upon which the big data revolution relies—systems and practices that struggle to account for trans identities and lives. As Jeffrey Alan Johnson (2014) reiterates “it should be clear by now that, contrary to the common perception of data as an objective representation of reality, the content of data systems is an interpretation” (160). Nonetheless, making sense of data and navigating information systems, he argues, necessarily requires something like the illusion of objective representation—an illusion that “establish[es] certain state[s] of the world as within the realm of normalcy to the exclusion of others” (Johnson 2014: 162). Trans lives and identities challenge the normalized gender assumptions imposed by information systems in at least two ways: (1) categorically (through the rejection of binary gender) and (2) conceptually (through resistance to singular, fixed meanings). In doing so, they expose the limits of quantitative and big data–driven understandings of the world that rely on rigid and reductive categories in the face of fluid or shifting identities.

In addition, contemporary data science and information systems stand to further marginalize individuals (binary, trans, or otherwise) whose identities are coupled with other identities that entail other forms of oppression, such as racial or socioeconomic discrimination. Here, discussions of gender, identity, and data featured in the relatively new journal *Transgender Studies Quarterly* are instructive as they often emphasize not only gender in their analyses, but other sources of oppression—racial, ableist, classist, and beyond—as well. They embrace the idea of intersectional feminism, a concept that refers to a line of critique and activism rooted in multiracial feminist movements in the second half of the twentieth century and eventually concretized in the work of legal scholar Kimberlé Crenshaw (1989). Following Crenshaw’s (1991) powerful discussions of violence against women of color, embracing intersectional analyses means recognizing that the various sources that oppress marginalized groups—be they racism,

sexism, ableism, homophobia, classism, or beyond—cannot be understood independently of one another. Rather, they intersect in ways that generate unique experiences of oppression and marginalization. For example, “the intersection of racism and sexism factors into Black women’s lives in ways that cannot be captured wholly by looking at the race or gender dimensions of those experiences separately” (Crenshaw 1991: 1244).

Careful attention to the intersections of identity generates even richer and more diverse understandings of gender as not isolated features of identity, but as shaped and realized in complex webs of identity and social relations best understood intersectionally. Instead of an abstract category of ‘woman’ that attempts to account for otherwise disparate experiences, more complex categories emerge—suddenly, the distinct experiences of White women and Black women or cisgender women and transgender women (or Black cisgender women and Black transgender women, and so on) become available for analysis. Oftentimes, however, large-scale, data-intensive research and design fails to account for these local, context-dependent intersections and the specific experiences of violence and oppression they generate. For example, Safiya Noble (2013) has shown how the data, algorithms, and processes that produce Google search results for the term *Black girls* reduce the identities of Black women to stereotypical or hypersexualized representations only, demonstrating the unique confluence of racist and sexist oppressions faced by Black women online.

Achieving broad inclusivity in data and design is challenging even for those squarely concerned with problems of gender and technology. As Catharina Landström (2007) notes, even when “captur[ing] the ways in which technology is shaped by gender and gender is shaped by technology” (8) feminist scholars of science and technology reinforce normative standards that are constraining rather than emancipatory for some. For example, work discussed in the second section tends to “not question the definition of gender as a heterosexual coupling of opposites, female and male, masculine and feminine” (Landström 2007: 10). The conception of gender as binary (and further constrained by the heteronormative connotations of a male/female dichotomy) presents further challenges for feminist discussions of big data. As Elizabeth Losh (2015) notes in her reading of big data through the politics of the “selfie,” in certain approaches to studying big data, “gender is presented in strongly binary terms, with ‘female’ and ‘male’ as the main categories separated by a territory demarcated by a question mark” (1635). Even where online tools—and commercial models, such as Facebook’s expanded and open-ended gender identity options—make possible a diversity of representations “essential . . . for studying how under and sexuality are performed online,” defaults tend to emphasize an either/or logic (Losh 2015: 1653).

The tension between fixed, reductive categories and fluid, transitional identities is further reflected in the most progressive efforts to account for trans and other queer identities through data collection and design. In 2014, Facebook revised its gender options for users—going from two categories to fifty-eight (and eventually adding an open-ended option as well). Though this is lauded as an important move towards broad gender inclusivity, Rena Bivens (2015) has demonstrated how—at a deep level and despite the addition of expanded gender options—Facebook continues to enforce a binary logic encoded both in their business model and at the level of software. In a different example, Jack Harrison-Quintana, Jaime M. Grant, and Ignacio G. Rivera (2015) reflect on their experiences developing the National Transgender Discrimination Survey (NTDS) and note the challenges of developing “liberating versus limiting” boxes that capture identity in data in ways that do not “collapse and marginalize trans experience” but “expand and uncover the richness and complexities of trans lives” (167). Though not necessarily congenial to the production of efficient and data-intensive quantitative analyses, such diverse understandings are integral to a richer and more broad ranging understanding of human behavior and experience.

Conclusion

In her feminist account of big data, Elizabeth Losh (2015) reminds us that “individuals do not float free in a loose matrix of voluntary social relations” (1651). They are, rather, constrained by power structures or practices that impose their own meanings at different levels. As boyd and Crawford (2012) put it:

Data are not generic. There is value to analyzing data abstractions, yet retaining context remains critical, particularly for certain lines of inquiry. Context is hard to interpret at scale and even harder to maintain when data are reduced to fit into a model.

(671)

The experiences of trans people extend and challenge our understandings of big data and the relationship between gender and technology in important ways. They lay bare the limits of rigid or fixed data categories for capturing fluid or multifaceted identities and they urge further examination—both theoretical and empirical—into the ways data subjects are constrained (and impacted) by biases and assumptions in scientific and technological development.

While issues of identity, data, and information systems seem to be—on one level, at least—an interesting conceptual or philosophical problem to ponder, they also expose the urgency of recognizing the very real and lived challenges these tensions and the rapid rise and adoption of data-intensive technologies and platforms generate for already vulnerable trans and queer populations. The continued exclusion from or subjugation of these populations to information systems that do not represent their lives or needs represents a continuation of the “administrative violence” described by Dean Spade (2015)—a phenomenon that we might rightly call *data violence* in order to also capture the harm inflicted on trans and gender nonconforming people not only by government-run systems, but also the information systems that permeate our everyday social lives.

References

- Anderson, C. (2008). The End of Theory: The Data Deluge Makes the Scientific Method Obsolete. *Wired*. Available at: www.wired.com/2008/06/pb-theory/ [Accessed April 16, 2016].
- Andrejevic, M. (2013). *Infoglut: How Too Much Information Is Changing the Way We Think and Know*. New York: Routledge.
- Bassett, C. (2015). Plenty as a Response to Austerity? Big Data Expertise, Cultures and Communities. *European Journal of Cultural Studies*, 18(4–5), 548–563.
- Beemyn, G., and Brauer, D. (2015). Trans-Inclusive College Records Meeting the Needs of an Increasingly Diverse U.S. Student Population. *TSQ: Transgender Studies Quarterly*, 2(3), 478–487.
- Bivens, R. (2015). The Gender Binary Will Not Be Deprogrammed: Ten Years of Coding Gender on Facebook. *New Media & Society*, 1–19. doi:10.1177/1461444815621527.
- Boellstorff, T. (2013). Making Big Data, in Theory. *First Monday*, 18(10). doi:10.5210/fm.v18i10.4869
- Bowker, G. (2014). The Theory/Data Thing. *International Journal of Communication*, 8, 1795–1799.
- Bowker, G., and Star, S. L. (1999). *Sorting Things Out: Classification and Its Consequences*. Cambridge, MA: MIT Press.
- boyd, d., and Crawford, K. (2012). Critical Questions for Big Data. *Information, Communication and Society*, 15(5), 662–679.
- Cockburn, C., and Ormrod, S. (1993). *Gender and Technology in the Making*. Thousand Oaks, CA: Sage.
- Crasnow, S., Wylie, A., Bauchspies, W. K., and Potter, E. (2015). In Edward N. Zalta (ed.) *Feminist Perspectives on Science*. In *The Stanford Encyclopedia of Philosophy*. Stanford, CA: Metaphysics Research Lab, Stanford University.

- Crawford, K., Miltner, K., and Gray, M. L. (2014). Critiquing Big Data: Politics, Ethics, Epistemologies. *International Journal of Communication*, 8, 1663–1672.
- Crenshaw, K. (1989). Demarginalizing the Intersection of Race and Sex: A Black Feminist Critique of Antidiscrimination Doctrine, Feminist Theory and Antiracist Politics. *University of Chicago Legal Forum*, 1989(1), 139–167.
- Crenshaw, K. (1991). Mapping the Margins: Intersectionality, Identity Politics, and Violence Against Women of Color. *Stanford Law Review*, 43(6), 1241–1299.
- Davidson, M. (2007). Seeking Refuge Under the Umbrella: Inclusion, Exclusion, and Organizing Within the Category Transgender. *Sexuality Research & Social Policy: Journal of NSRC*, 4(4), 60–80.
- Dodge, M., and Kitchin, R. (2005). Codes of Life: Identification Codes and the Machine-Readable World. *Environment and Planning D: Society and Space*, 23(6), 851–881.
- Duhaime-Ross, A. (2014). Apple Promised an Expansive Health App, So Why Can't I Track Menstruation? *The Verge*. Available at: www.theverge.com/2014/9/25/6844021/apple-promised-an-expansive-health-app-so-why-cant-i-track [Accessed April 16, 2016].
- Ensmenger, N. (2010). Making Programming Masculine. In T. J. Misa (ed.) *Gender Codes: Why Women Are Leaving Computing*. Hoboken, NJ: Wiley, 115–142.
- Fausto-Sterling, A. (1985). *Sexing the Body: Gender Politics and the Construction of Sexuality*. New York: Basic Books.
- Friedman, B. (1996). Value-Sensitive Design. *Interactions*, 3(6), 16–23.
- Gehl, R. W. (2015). Sharing, Knowledge Management and Big Data: A Partial Genealogy of the Data Scientist. *European Journal of Cultural Studies*, 18(4–5), 413–428.
- Haimson, O. L., Brubaker, J. R., Dombrowski, L., and Hayes, G. R. (2015). Disclosure, Stress, and Support During Gender Transition on Facebook. In *CSCW '15*. Vancouver, BC, Canada: ACM, 1176–1190.
- Harding, S. (1991). *Whose Science? Whose Knowledge? Thinking From Women's Lives*. Ithaca, NY: Cornell University Press.
- Harrison-Quintana, J., Grant, J. M., and Rivera, I. G. (2015). Boxes of Our Own Creation: A Trans Data Collection Wo/Manifesto. *TSQ: Transgender Studies Quarterly*, 2(1), 166–174.
- Hoffmann, A. L., and Bloom, R. (forthcoming). Digitizing Books, Obscuring Women's Work: Google Books, Librarians, and Ideologies of Access. *Ada: A Journal of Gender, New Media, and Technology*, 9.
- Johnson, J. A. (2014). From Open Data to Information Justice. *Ethics and Information Technology*, 16(4), 263–274.
- Jurgenson, N. (2014). View From Nowhere. *The New Inquiry*. Available at: <http://thenewinquiry.com/essays/view-from-nowhere/> [Accessed April 16, 2016].
- Kitchin, R. (2014a). Big Data, New Epistemologies and Paradigm Shifts. *Big Data & Society*, 1(1), 1–12.
- Kitchin, R. (2014b). *The Data Revolution: Big Data, Open Data, Data Infrastructures and Their Consequence*. Thousand Oaks, CA: Sage.
- Kitchin, R., and McArdle, G. (2016). What Makes Big Data, Big Data? Exploring the Ontological Characteristics of 26 Datasets. *Big Data & Society*, 3(1), 1–10.
- Landström, C. (2007). Queering Feminist Technology Studies. *Feminist Theory*, 8(1), 7–26.
- Lerman, N. E., Mohun, A. P., and Oldenziel, R. (2003). The Shoulders We Stand On/The View From Here: Historiography and Directions for Research. In N. E. Lerman, R. Oldenziel, and A. P. Mohun (eds.) *Gender & Technology: A Reader*. Baltimore, MD: The Johns Hopkins University Press, 425–450.
- Losh, E. (2015). Feminism Reads Big Data: “Social Physics,” Atomism, and Selfiecity. *International Journal of Communication*, 9, 1647–1659.
- Mayer-Schönberger, V., and Cukier, K. (2013). *Big Data: A Revolution That Will Transform How We Live, Work, and Think*. London: John Murray.
- McGaw, J. A. (1982). Women and the History of American Technology. *Signs*, 7, 798–828.
- Nataf, Z. I. (1996). *Lesbians Talk: Transgender*. New York: Scarlet Press.
- Noble, S. (2013). Google Search: Hyper-Visibility as a Means of Rendering Black Women and Girls Invisible. *InVisible Culture*, 19. Available at: <http://ivc.lib.rochester.edu/google-search-hyper-visibility-as-a-means-of-rendering-black-women-and-girls-invisible/>.
- Richardson, S. (2013). *Sex Itself: The Search for Male and Female in the Human Genome*. Chicago: University of Chicago Press.

- Spade, D. (2015). *Normal Life: Administrative Violence, Critical Trans Politics, and the Limits of Law*. Durham, NC: Duke University Press.
- Stryker, S. (2009). *Transgender History*. Berkeley, CA: Seal Press.
- Sydell, L. (2014). The Forgotten Female Programmers Who Created Modern Tech. *NPR: All Tech Considered*. Available at: www.npr.org/sections/alltechconsidered/2014/10/06/345799830/the-forgotten-female-programmers-who-created-modern-tech [Accessed April 16, 2016].
- Vincent, A. R. (2016). Does Tinder Have a Transphobia Problem? *The Huffington Post*. Available at: www.huffingtonpost.com/addison-rose-vincent/does-tinder-have-a-transp_b_9528554.html [Accessed April 16, 2016].
- Wajcman, J. (2009). Feminist Theories of Technology. *Cambridge Journal of Economics*, 1–10.
- Wen, S. (2014). The Ladies Vanish. *The New Inquiry*. Available at: <http://thenewinquiry.com/essays/the-ladies-vanish/> [Accessed April 16, 2016]. doi:10.1093/cje/ben057.
- Wylie, A. (2007). The Feminism Question in Science: What Does It Mean to “Do Social Science as a Feminist”? In S. Hesse-Biber (ed.) *Handbook of Feminist Research*. Thousand Oaks, CA: Sage.
- Zikopoulos, P., and Eaton, C. (2011). *Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data*. New York: McGraw Hill.

Discrimination

D. E. Wittkower

Langdon Winner's famous article, "Do Artifacts Have Politics?" (1980), must be the first thing mentioned in any discussion of what philosophy of technology has contributed to our understanding of discrimination. The examples addressed, most of all the famous 'racist bridges' of Robert Moses—allegedly¹ built low in order to specifically exclude New York City buses, and the kind of person more likely to be using public transportation, from certain beaches—make clear that artifacts can be said at least to have political effects, including advancing racial discrimination.

Winner's work has been highly cited, and rightly so, but it is not a full theory of *discriminatory technologies*, and it is not grounded in multiple theoretical perspectives in order to maximize its applicability within the field. In the following, I will develop such a theory; connect it with Heideggerian, Latourian, and postphenomenological theoretical structures; and demonstrate its applicability to a wide and widening range of forms of normativity, exclusion, and discrimination. This analysis will be limited to an American cultural context, as cultural constructions of discriminatory norms, especially those of race, gender, and religion, are far too varied across regions and societies to be meaningfully addressed simultaneously, and my goal in this article is in-depth analysis rather than cross-cultural exploration. I hope that readers in Germany will be able to see parallel issues presented to Turks; that Israeli readers will see parallel problems in a different religious social normativity; that those from Brazil and India will see similarities in the way that their societies normativize 'whiteness' within more of a spectrum, but still resulting in significant discrimination; that Canadians and Swedes will see connections to the cultural erasure of their indigenous peoples; and so on.

First, it must be asked, what it would be to have a full theory of discriminatory technologies? Next, it must be asked, what we are to make of the idea of a 'discriminatory technology'? Following this, we may approach the three theoretical groundings described earlier in order to provide support to the theory and to provide direction in seeing what kinds of artifacts it can help to identify and understand as technologies of discrimination.

What Would Be a Full Theory of Discriminatory Technologies? The Ontology of a Band-Aid

Using a brilliant illustration from Preston Wilcox's *White Is*, Richard Dyer (1997: 41) prompts us to consider the Band-Aid as a paradigmatic example of normative whiteness. His work in this famous book, *White*, seems to me among the finest examples of the field of cultural studies one could find. What philosophy of technology can add to this is a movement from reading the artifact as a text to looking at the way the object is concretely active in the construction of exclusionary normativity.

Band-Aids come in a variety of shapes and sizes, showing their responsiveness to a variety of contexts of use. In philosopher Luciano Floridi's language (2014), it needs to have the right protocol to fit its prompter—in this case, the minor cut in the skin. This is why it is made to minimize infection, with a mesh to discourage adhesion to the healing flesh, and available in different sizes in order to match up right with the naturally occurring diversity of bleeding gashes.

There are limits to the diversity of adhesive bandage sizes and shapes, however. Three sizes to a pack is good enough to cover most cases satisfactorily well, and we recognize it would be unreasonable to expect just the right bandage for each particular wound. Having only a single size is not responsive enough to the relevant cases, while having a dozen different sizes in every box is far more responsive than is necessary and would likely result in a bunch of odd shapes and sizes—which would pile up in half-empty boxes accumulating in the corners of our medicine cabinets, eventually to be discarded.

The invariance of the color of adhesive bandages, until relatively recently, places significant variance from 'White' skin in this same category of irrelevance. Dark skin is apparently a prompter to which it is not necessary to design a protocol to respond. This may be an effect of 'color-blindness': the (White) product designers failed to consider that 'flesh colored' might not be the same thing for everyone. Although exceedingly unlikely in this particular case, this could be an effect of conscious discrimination akin to Moses's bridges, where the designers specifically chose to design a Whites-only product. This could simply reflect the reality of the market, where a color is chosen that will match best for the largest set of similarly colored consumers. In any case, the ontology established by the object is the same: the function of the bandage's color is to match the skin; when it fails to do so, it implicitly claims that *this* flesh is not 'flesh colored.' The proper function of the technology contains within it an ontology that may define some persons as normative and others as lesser or deviant Others.

A full theory of technologies of discrimination should engage with technologies at this level—not by reading them as texts, not by producing analyses of particular effects or even kinds of effects of technology, but by theorizing how those technologies embody, transmit, and produce ontologies of normativity that result in privilege and discrimination.

What Is a Discriminatory Technology?

Without saying anything too contentious about a proper definition of 'technology,' we can perhaps say that a common-sense description might be that a technology is a way to get something done. By speaking of a 'discriminatory technology' we must mean a way of getting something done which produces a discriminatory effect.

By speaking of 'discrimination' we clearly do not intend the word in the sense in which a gourmand has 'discriminating taste,' although the two senses are related. Discrimination in the political sense has to mean something like *when a morally irrelevant characteristic is allowed undue influence in a determination of individual or distributive justice*. For discrimination of this political kind to take place, there must first be discrimination in the amoral sense of drawing distinctions—in this case, distinctions among persons.

This may seem to be a trivial conceptual point: of course a distinction must be first made before it can be given undue influence. But this point is of deep and historical consequence, for, arguably at least, the most prominent way that discrimination has been overcome is not by equalizing the judgments made about one group who has been distinguished from another, but instead by ceasing to make the distinction between these groups to begin with.

We see this in the history of the meaning of 'White' in a racial sense. In the colonial period, we find records of Blacks and Irish rising up against Whites, although today we consider the

Irish to be White. The Polish have similarly and recently disappeared as a category distinguished from 'Whites.' Hungarians and Bulgarians, in the mid-twentieth century, were subject to racial slurs (*bohunk, hunky*) largely unrecognizable today to the people that these words were meant to Other and to denigrate.

Religious and language differences play at least as much of a difference as more distinctively race-related in determining who counts as White. In European history, Spaniards and Italians have not always been considered White, especially those of Muslim faith. As Dyer points out (1997: 42), Jews seem to have been considered Black for some time, and became only White in the latter part of the twentieth century. Semitic persons, especially when Muslim or immigrants, are Caucasian but nonetheless are often not White—the same is true of Latina/os, especially when English is a second language.

What then is it to be White? The approximate answer from critical race theory is that being 'White' just means that it is not noted in any consequential way that you are raced at all. If you are encountered in the context of a racial identification, you are a person of color (PoC); if you are not, you are White. In this way we see that identification as White is a lack of judgment rather than a concrete claim: that you are White means nothing besides that you have not been identified as something else.

This judgment requires training—just as does having a discriminating palate. The way in which formerly non-White persons become White involves a decrease in the weight placed upon prejudicial claims against the minority in question, but it also involves a decrease in the amount of training people receive in identifying those persons as a group in the first place. The Nazis produced materials specifically designed to help Whites to identify and out Jews, but much more innocuous racial caricatures, as in political cartoons, play a similar role.

This is why status as White or PoC is a matter more of how we are interpreted rather than a matter of fact, although matters of fact form the basis of any interpretation, and certainly can limit the range of interpretation available. Someone of mixed race may pass as White and identify as White, and have no idea that they have non-White ancestors. A person of European descent with curly hair may be darker skinned than a person of African descent with straight hair, but we have been trained to interpret racial cues in such consistent and nuanced ways that there may be little or no controversy about the whiteness of the former and the blackness of the latter. Many people, including myself, are raced differently in different contexts or when wearing clothes or hairstyles with or without ethnic markers. Few people today are raised in environments in which they are trained to recognize my features or my surname as racial markers—but some are. To most, I am White, but I have been threatened with violence by White racists for my non-White identity.

This is what we mean when we say that race or gender are socially constructed: they are the product of human labor, manufactured using some physical basis, genetic and phenotypic, but reducible to or determined by that basis in only the same kind of limited sense that other manufactured goods are reducible to or determined by their raw materials.

An invisible starting point in our encounter with one another, prior to the construction of difference, was described by Martin Heidegger (1927/1996) as *das Man* ("the One," or "the they"). By "the One" he means only to indicate the approach to others named by the word *one* in phrases like "one doesn't do that." The "One" who does this or doesn't do that is no person in particular, or even a description of a variety or totality of actually existing persons, but is instead a set of expectations we are trained to have, on the basis of which we judge others and ourselves. The One is normativity of all kinds: One is kind, One doesn't tell lies, and One sets the table with the fork on the left of the plate and the knife on the right. And one is called to account when one doesn't do what One does!

Heidegger describes the normativity of the one in terms of an “average everydayness” that requires a “leveling down” on our parts (1927/1996: §27). It is, in his account, easy enough for us to fall into the One—to live our lives as One does and to believe what One believes and remain free from having to come up with our own values, judgments, beliefs, etc. Our care and anxiety before our own death may shake us loose from our fallenness into and entanglement with the One, because what One does and what One believes offers us no consolation before or explanation of the necessity of our own death. The need to come to terms with our own death forces us to try to make sense of our lives, and that, in turn, forces us to try actually to develop some idea of what we should do with our lives and why any of it matters. This is what Heidegger means by authenticity: to figure out for ourselves what to do and why (or die trying) rather than remaining lost in the One.

Heidegger fails to recognize that the One is constructed in ways that are directly exclusionary of many or most people, making the worry about falling into the One and failing to confront one’s individuality much more relevant to straight, White, cisgendered, affluent, Christian men than to the rest of us, who are reminded more or less regularly of our nonconformity with the One. W.E.B. Du Bois expressed this phenomenologically in the famous opening of *The Souls of Black Folks*:

[T]he negro is a sort of seventh son, born with a veil, and gifted with a second sight in this American world,—a world which yields him no true self-consciousness, but only lets him see himself through the revelation of the other world. It is a peculiar sensation, this double consciousness, this sense of always looking at one’s self through the eyes of others, of measuring one’s soul by the tape of a world that looks on him in amused contempt and pity. One ever feels his two-ness,—an American, a Negro; two souls, two thoughts, two reconciled strivings; two warring ideals in one dark body, whose dogged strength alone keeps in from being torn asunder.

(1903/1994: 2)

Why is double consciousness part of the Black experience, but not part of the White experience? It is tempting to say that the White experience is relevant for everybody to consider because of the wealth, power, and majority status of Whites, but this is incoherent. There is no ‘White experience,’ just as there is no ‘whiteness,’ only a lack of being raced. We must say instead that those who are regularly and predictably raced must consider themselves both as persons (as One) and as persons who One identifies as Other—as subject to normativity, but also as always already deviating from norms. One is not Black; One is not a woman; One is not gay; One is not transgender; One is not poor; etc.

Now, unlike “One should pursue a career” or “One ought to get married,” no one would ever actually say or even think “One isn’t Black” or “One isn’t a woman,” but the ‘average everydayness’ of White/male/straight/etc. normativity can be seen at work quickly enough in countless ordinary examples. The German term *das Man* is clearly enough gendered, and parallels long-standing English cognate usages, such as using *man* or *mankind* to refer to all humans. Here, of course, we can’t say that the view of male as ‘normal’ and female as ‘different’ can be accounted for by majority status, since women comprise approximately the same proportion of the species as do men. Regarding sexual orientation, we might consider the question, “when did you choose to be straight?” This question, of course, is never asked because our images and stories establish heterosexuality as a default condition. The effect is perhaps most striking when the population matching the One is clearly a minority, as in the body shapes and sizes that are treated as representative of femininity and masculinity in our fashion magazines and films.

As the hammer disappears in our experience of the work, integrated with its system of objects to which its affordances are tailored, so too does a normative embodiment appear to us as ready-to-hand. Only when the hammer is broken, in Heidegger's famous analogy (1927/1996: §15–16), does the artifact become present-at-hand as an object to be perceived. So long as the hammer is working, we have questions only about our projects and purposes along with it; once it is broken, we need to ask how it's supposed to work, and why it had been put together this way rather than some other way.

The normativity of the One is found in the obtrusiveness of persons rather than artifacts when there is a mismatch—to find oneself as Other rather than One is to have this mismatch attributed to one's own brokenness rather than the object's. The native English speaker, in countries where One speaks English, can wonder why One has to “Press 1 for English.” The ‘overweight’ airplane passenger, however, is more likely to blame themselves rather than the seat when it cannot accommodate their bulk. To return, now, to the Band-Aid, it is because One is White that the dark-skinned user doesn't simply say “They made this the wrong color,” but feels instead that they are the wrong color. The presence-at-hand of the artifact indicates a brokenness, a mismatch between the object and its application; the normativity of the One informs us of on which side of the relation the fault lies.

With this, we can now offer a definition of *privilege*: Privilege is the invisibility of our attributes caused by their fallenness into the One, which invisibility prevents these attributes from being perceived as meaningful. To have privilege means that the starting assumption, when something goes wrong, is that it is the world rather than the self that is broken; to lack privilege means that this, at a minimum, is not assumed.

This is why Peggy McIntosh's (1989) influential account of privilege as tools in an “invisible knapsack” is often off-putting to those who are most privileged: the tools of privilege disappear entirely to those for whom they are ready-to-hand. These aspects of privileged persons are not well-designed hammers or properly colored adhesive bandages, but are so integrated with the One that they do not appear as tools at all. For this reason and within this Heideggerian theoretical context it is more useful to think of privileges not as tools for getting things done, but instead as the failure of our attributes to appear at all; as our predetermined belonging to the One.

Now, to bring this together, we have seen that a precondition to discrimination is the drawing of distinctions. Privilege is when these distinctions do not appear, and the invisibility of whiteness and masculinity and Christian faith and so on is produced by their averageness, their fallenness into the One. Where these distinctions do appear, when they are present-at-hand rather than ready-to-hand. They are subject to being treated as having explanatory power, leading to discrimination in a political sense.

Let us now answer the question: What is a discriminatory technology? A discriminatory technology, so long as we understand technology in its broadest sense as a way of getting something done, is a method by which we background some set of attributes and foreground others, causing some attributes to disappear and become transparent and others, by contrast, to stand out. These technologies—or, techniques, if you prefer a narrower definition of ‘technology’—may include language, images, stories, policies, and objects.

Philosophy of technology is concerned with techniques, or technology in its broadest sense—but it is also and especially concerned with artifacts, or technology in a narrower sense. Having established a general theory, we can now go on to look at discriminatory artifacts.

Discriminatory Artifacts

We do well to listen to the knowledge of objects. The subtleties of the traditional size and shape of the hammer's handle contain within it a knowledge of how best to hold it, and weights it well

so that the artifact disappears into the user's experience of control and precision, even when that shape is transmitted through manufacturers who merely imitate its form while unknowing of its function. But objects can contain and transmit prejudice as well as knowledge, and the hammer—which, through its generations of traditional manufacturing, has come to conform itself to a man's hand—may, just as unknowingly, bring a feeling of awkwardness rather than authority to users with smaller hands and lithe fingers.

This occurs not only through artifacts that have discriminatory outcomes, as in Winner's case of Moses's racist bridges, but through artifacts that establish exclusionary norms. Technologies can embody discriminatory presumptions through a Latourian delegation (1992, 1999), where social values are enforced through material implication, surviving through replication of design long after their designers unthinkingly built their discriminatory values into the objects. Carpenters' tools were built for men's hands because men were carpenters. Those tools, though, have become discriminatory because our tools, unlike us, continue to act as if they believe that One does not build houses if one is a woman; they make the job easier for men than women, rendering to (most, larger-handed) male carpenters an unearned privilege and to (most, smaller-handed) female carpenters an undeserved disadvantage.

Embodiment Technics

This represents a discriminatory effect delegated to artifacts in an embodiment relation to the world, in Don Ihde's sense (1990). Embodiment technologies allow the user to access or affect the world by withdrawing into the user's experience of self. Perhaps the clearest example is corrective lenses: a good pair of prescription glasses should reveal the world while themselves disappearing from our experience; a pair of glasses that we notice constantly isn't a good pair of glasses for us. Another example is clothing, which should allow us to experience our environment in a pleasant manner, making the experience of the clothing disappear. Ill-fitting shoes or clothes that are too heavy or too light for the weather fail to disappear from our experience in the way they should.

This withdrawal from experience produces an 'enigma position' between the user and the technology. Because users experience the world as part of a human-technology hybrid, when something goes wrong, user must decouple themselves from the technology in order to ascertain where the breakdown has occurred. When our vision is blurry, we take our glasses off and clean them; when the blurriness remains, we remove our glasses again, but try rubbing our eyes instead.

The hammer that fails to withdraw into the practice of carpentry indicates a problem. It feels too heavy, or badly weighted. It is awkward. But if it is a standard design, and seems to be a good design for One to work with, we are likely to think that the fault lies with us rather than the object. And so the woman using such a tool is more likely to think that she's not good at what she's doing rather than that the tool isn't good for her.

The adhesive bandage is another example of discriminatory object in an embodiment relation: it is designed to be the color of One's skin, but fails to withdraw from the dark-skinned user's perception.

Strollers enforce regressive gender norms through a breakdown in embodiment relations as well. They are made for their average (female) user, being uncomfortable and obtrusive to most men and to tall women. In my experience, I found that not only were stroller handles too low for me to use comfortably, but the brakes on the rear wheels of our stroller were placed so that I had to train myself to take smallish steps—my natural stride made me step on the brakes by mistake whenever I started pushing the stroller at a moderate pace.

Kitchen counters are similarly designed for the average woman's height. By placing these average gender differences into design, these activities are made more difficult for men, and so

tend towards remaining women's work. Our attitudes change with the times, but the attitude written into our objects continue to make regressive claims about what One ought and ought not to be doing.

Imaging technologies provide a series of illuminating examples of discriminatory embodiment technologies. In the realm of three-dimensional imaging, new media theorist danah boyd (2014) has pointed out that constructing an immersive virtual environment through motion parallax depth cues works well for most men, but poorly for most women, because of differences in how most women's and most men's brains process visual information. The reliance of most virtual reality systems on motion parallax systems thus produces a sexist effect, where most men are able to be virtually embodied in virtual worlds (through, e.g., *Oculus Rift*), but most women are excluded, unable to allow their bodies to disappear into virtual embodiment due to the nausea that motion parallax imaging often produces in their physical bodies.

Lorna Roth (2009) has written an excellent media history of the Shirley Card—a standard photograph used to calibrate photographic printing equipment. Until the 1990s, the standard Shirley Card depicted a White woman, and photo labs calibrated to print her face with good clarity and contrast, leading to generations of poor photographic representations of dark-skinned persons, where Black faces and bodies sometimes appeared as shadows or blots with few distinguishing features other than White teeth and eyes—not just in the media, but in family snapshots. Compounding this is that even the film formulations were directed toward accurate reproduction of White faces, to the extent that Polaroid produced a specific camera for the apartheid South African government in order to produce identifiable ID card photographs of Black citizens, featuring a “boost button” that would increase the lumens of the flash by 42%; the average increased amount of light absorption of Black African skin (Smith 2013).

Roth describes this as “dysconscious racism” through a “technological unconscious” in which “a global assumption of ‘Whiteness’ [was] embedded within [photographers] architectures and expected ensemble[s] of practices” (2009: 117). A substantial change in producing less-discriminatory photographic formulation was the 1995 commercial release of Kodak Gold Max, which was referred to as being able “to photograph the details of a dark horse in low light” (Richard Wien, Executive, Kodak, Rochester, NY, personal communication, August 18, 1995, quoted in Roth 2009: 121–122).

In these cases, the embodiment relation of the photograph—where the photograph allows us to see an image as if we had been there in the place of the camera—contains a racist overlay delegated into its technological unconscious, making Black people appear darker and more indistinguishable or interchangeable, which is a racist way of seeing strongly resonant of the conscious racist depictions of Black people through minstrel shows and the Little Black Sambo and Mammy stereotypes. Through a technological version of DuBois's double consciousness, this racist representation was even reflected back to dark-skinned persons, with family and self-portraits becoming a distorted funhouse mirror in which they saw themselves not as they would appear when stretched tall or squashed short, but as they would appear to a White racist gaze. It is thus unsurprising that many PoCs view selfies in an age of Instagram and digital filters as liberatory and empowering in a way that may not be apparent to Whites. Our technological assemblages have long been oriented in order to reflect Whites' faces back to them as they see themselves, but the new level of control and authorship in digital photography has allowed PoCs to appear before any viewer of their selfie in accord with their own self-perception. Prior photographic technologies made the One's gaze racist; the digital selfie can allow One to gaze upon the PoC's selfie without the racist filters of the past.

But the One formed through delegation into the technological unconsciousness still embodies a racist gaze in other ways. Facial recognition software is still sometimes, perhaps often,

programmed to work according to contrast recognition algorithms that are calibrated to White faces and fail to recognize Blacks as persons, as demonstrated in one viral video entitled “HP computers are racist” (2009). In classroom discussion, a student shared a similar experience with me: he worked in a grocery store where employees clocked in and out using fingerprint recognition scanners that, he said, regularly failed to recognize his Black co-workers. In another similar algorithmic misrecognition, Google Photo’s image recognition software—presumably not properly primed with enough images of PoCs and not programmed properly to recognize humanity through universal human rather than White human attributes—automatically tagged Black people as gorillas (Mullen 2015). The effect of the technology is to construct Black persons as nonpersons: in some sense it is obviously right, despite the anthropomorphism of the claim, to describe such technologies as racist, for they fail even to notice the existence or the humanity of some persons on the basis of skin color.

To avoid creating discriminatory technology, it is insufficient to ensure that we do not build in racist/sexist/etc. values, for the One that we design for places statistical regularities into the architectures through which we act in the world, and so enforces those regularities upon those minorities to whom they do not apply. To have a technological unconscious that does not exhibit bias, we must take affirmative action to include minority bodies in our design spaces so that embodiment technologies fit with the diversity of user bodies. Nondiscriminatory technologies require not only designers who are not bigots, but also designers who are actively anti-racist, anti-sexist, anti-ableist, anti-transexclusionary, anti-heterosexist, and so on, because the averageness of the One will always be exclusionary of difference.

While this in no way exhausts or systematically covers ways in which embodiment technologies can be discriminatory, the most I can hope to accomplish in a chapter of this length—or even of ten times its length—is to address patterns and kinds of discriminatory artifacts. Ihde’s division of kinds of human-technics relation provides a useful structure in ensuring that I cover different sorts of such artifacts, and so, incomplete as my coverage of embodiment technologies must be, I will move forward into what he addresses as “hermeneutic technics” (1990: 80).

Hermeneutic Technics

Hermeneutic technics represent a part of a world to a user in such a way that the world is represented by rather than seen through the technology. Ihde’s phenomenological variation regarding the thermometer provides a useful contrast between embodiment and hermeneutic technics (1990: 84–85). An embodiment-based thermometer can be imagined: a metal strip going through a wall that would transfer heat efficiently, so that one’s hand could be placed on it in order to feel temperature, hot or cold, as if one’s hand were outside rather than inside. The thermometer as we know it, though, does not transfer an experience to the user, but instead translates information about the world into a different nonisomorphic format, where it can be ‘read.’ The ‘what-it’s-like’ of 30 degrees is phenomenally nonobvious and must be learned by rote, just like the ‘treeness’ of the written word *tree*—and, indeed, Ihde identifies written language as another hermeneutic technology.

In hermeneutic technologies, it is not the technology that disappears into the user’s experience of the world, but rather the world that disappears into the user’s experience of the technology, forming an enigma position between the technology and the world rather than one between the user and the technology. When the “check engine” light comes on, for example, we know that there is either something wrong with the engine or something wrong with the “check engine” indicator itself, but we don’t know which until the engine is decoupled from its representation and each is investigated separately.

Hermeneutic artifacts can become discriminatory when they fail to properly represent a person, or when they represent a nonhuman part of the world in a way that systematically excludes minority ways of understanding the world.

In the former case, we can think simply of the common understanding of the words *woman* and *man* as attached to biological sex markers, such as genetics. Insofar as we feel the need to identify a transgender woman, for example, as a trans woman, we assert that if One is a woman, one is cisgendered, and thus that a trans woman is both woman and not-woman, and another form of dual consciousness is constructed. This is made clear by the need for the term *cis woman*: if *woman* is the general term, and *trans woman* is taken to be a subset of women, then we need another word for the remainder of the set of women—otherwise transgendered women are conceptualized as not ‘really’ women, for they are not in the subset of women₁ (in the general sense) who are women₂ (in the sense of not being trans women).

The seeming objectivity of technical artifacts creates the normativity that makes this failure to capture difference discriminatory. Consider for example the résumé as a hermeneutic technology. A résumé represents a person through a well-defined set of filters, through which much of one’s life is excluded in order to provide efficient evaluation of candidates based (ideally) on relevant characteristics only. But what the same qualifications and years and kinds of experience represent in lives as they are lived can vary widely. Gaps in employment are often viewed unfavorably, as they are often taken to mean that a candidate has difficulty holding down a job. These gaps may indicate that a potential employee is unreliable, but they may instead indicate that the applicant left the labor pool for some time in order to raise or even simply to bear children—and this more favorable possibility applies more often to female rather than male applicants. Similarly, much stock may be placed in the reputation and name recognition of an applicant’s degree-granting institution, disadvantaging applicants who attended historically Black colleges and universities (HBCUs) that may be less well-known to White managers than similarly distinguished and high-quality non-HBCU institutions. In these ways and many others, the seeming-objectivity of the hermeneutic artifact—in this case, the résumé—conceals the White/male/cis/ableist normativity of the applicant whom it is designed to objectively represent.

Hermeneutic artifacts may also interpret parts of the world other than persons in a way that has discriminatory effects. The standard school and business calendars are obviously discriminatory in the way that they are organized around Christian holidays in majority-Christian-faith contexts. While it is a matter of practicality to plan around those days that most employees, managers, teachers, and students will wish to have off, the effect is to construct a set of holidays that One celebrates. Calendars are then invisible to Christians and opaque to those of other faiths, with barriers constantly and annually placed in between their organizationally provided schedules and the schedule of their faith practices. Non-Christians of faith must out themselves and request allowances to live their life in accord with their interpretation of the world as a place of religious observance; Christians need only decide whether to practice or not, for their world is largely organized to provide the opportunity. It is striking that ‘Spring Break’ for many public schools in the secular United States is moved year to year to correspond with Easter.

The discriminatory nature of the artifact of the calendar is clearest with Christmas, where it takes on additional complications. When non-Christians reject the dual consciousness of being expected to celebrate holidays that they do not celebrate—objecting to ‘Christmas parties’ at work and not smiling and saying “you too” when wished a “Merry Christmas”—this is described as an attack in the ‘War on Christmas.’ Amazingly, there is an entire genre of ‘entertainment’ dedicated to naming and shaming as ‘Grinches’ and ‘Scrooges’ those who fail to be appropriately enthusiastic about a religious holiday that One celebrates, but which a very large and diverse portion of the population of secular nations do not celebrate. At the same time as

pressure is exerted on all persons to participate in Christmas as a universal holiday, religious minorities' inclusion is disallowed by the fight to 'keep the Christ in Christmas'—to maintain its character as a religious holiday, even as those who are not Christians are expected to celebrate it.

Hermeneutic technics construct reality as One lives it as reality itself, leaving many to live in the world of their own experience with an overlay of life as lived by the One from which they are excluded, a part of a social reality that consistently fails to recognize and reflect their world.

Alterity Relations

Ihde's category of alterity relations (1990) with technology are of a different kind than embodiment and hermeneutic technics: here, the artifact does not mediate a relation between a user and the world, but instead the user interacts with the technology as such, and the relation of the technology to the world is not of central importance to that interaction. To some extent, any media representation of persons is an alterity relation: for example, consider the disproportionate representation of minorities as criminals in television programming. We don't take this representation to be representative, and its function is entertainment rather than truthful and accurate representation of reality. There is, however, an obvious spillover effect: it would be wrong to criticize any particular story for choosing a PoC as antagonist, since it is just a story and makes no reality claim, and yet a society in which Black people are seen regularly on the screen with weapons is a society in which police officers are more likely to think, in the heat of the moment, that the thing a Black citizen is holding is a gun rather than a cell phone.

These cases having to do with media representation are, however, already well covered in other fields, and particular media objects don't clearly fit a common-sense definition of technology as a way of getting something done. A crossover case might be the rightly controversial sometime use of mugshots for police target practice, which reinforces racial disparities in assumption of criminality and use of deadly force against minorities already subject to disproportional police attention and aggression. But the widest range of alterity technics that affect how we think of ourselves and others is in gaming, where we interact with virtual persons in complex and rich ways.

In games, female characters often have exaggerated secondary sex characteristics, are otherwise slim, and wear revealing and impractical outfits. But the form of interaction that gamers have with and through them establishes a deeper set of troubling norms as well. Female characters are often in support rather than lead roles, cast as magic users, healers, rogues, and archers. Exceptions abound, but women are more often heroes insofar as they allow the predominantly male characters to succeed, and do not as often succeed on their own or with support from male characters. When male characters act as support, it is often as "tanks" whose physical toughness allows for frail "glass cannon" characters to survive long enough to be effective. Women, then, who choose to play female characters must often enact the idea that women are secondary to men, whose excellence comes from their ability to allow men to triumph—and women who play primary roles, being supported rather than supporting, often do so in drag through male avatars. Male gamers, of course, play as female avatars as well, and role-play reinforces the same message to them: being a woman usually means being a helper, and being a helper usually means being a woman.

It's worth emphasizing that the point is not that this is how these characters are depicted, but how they are enacted. Female support characters may be strong and confident and have their own stories, and male lead characters may be muscled and scantily clad cardboard cutouts, but the mechanics of play often contain a clear script of male primacy, and success in the game requires adopting and acting out this view of gender roles.

This constitutes an alterity relation insofar as we are interacting with avatars on their own terms. These dynamics are present whether or not male lead and female support characters are played by male or female gamers, and very often the gender identity of other players is not known, or the game is played with the gamer controlling a team of variously gendered avatars on her own. Although here we interact with avatars through an alterity relation, gaming also represents a kind of embodiment relation insofar as we enact our purpose in the game through the avatars, and skillful masculine and skillful feminine action is encoded in a way that reinforces gender bias.

Background Relations

We can address a final category in human-technics relations from Ihde (1990)—background relations—in which the technology forms an environment to other interactions but disappears entirely from the user experience. Air conditioning, controlled by a thermostat, is a clear and paradigmatic example. Here, already, we have a good example for our consideration as well! Air conditioning is designed to disappear from our experience, but is foregrounded much more for women than men. Expected business attire for men—long sleeves, long pants, layers—breathes less and is less drafty than women’s skirts and blouses. This is all the more true when we look at more traditional business attire, as was expected of men working in offices when air conditioning first came to be standard equipment. This, even without considering biological differences (Byrne et al. 2005)! It should not be surprising then that the expectation of what an office feels like would be tailored to men’s embodiment and clothing, as a recent study found (Kingma and Lichtenbelt 2015)—although it may be quite surprising to consider how frequently we fail to recognize that this constitutes an unearned advantage, instead simply thinking that it seems like women are always cold.

To make this clear through phenomenological variation, consider men’s experience of a workplace thermoneutral for the majority of women’s clothing and metabolic rates: many men would be sweaty and unkempt, unbuttoned and unprofessional. Instead, it is women who are subjected to a meteorologically hostile work environment, and we have for the most part accepted that it’s women’s responsibility, individually, to bring sweaters and space heaters rather than our collective responsibility to provide an office environment hospitable—or failing that, equally uncomfortable—for all employees.

Innumerable sorts of online algorithms also present background relations that have discriminatory effects. These algorithms determine what we see online in a way that is entirely inaccessible to user knowledge or control—and, further, most users are not even aware that what they see is different in an important way from what others see.

Eli Pariser (2012) has written about the “filter bubble” as a way of understanding the customized internet; Cass Sunstein (2009) has addressed similar effects through his idea of the “Daily We,” in which we seek out information that fits with our existing views, leading to “ideological echo chambers” (Pew Research Center 2014) and “information cocoons” (Sunstein 2009: 44), resulting in an online environment that Pariser calls “a city of ghettos” (2012)—all largely without the user’s awareness. For the most part, and in spite of the racial analogy of the ‘ghetto,’ this discussion has mostly focused on the way that political opinions have become retrenched and insularized rather than the way that it creates insularity within groups subject to discrimination and creates blindness to those groups in ‘average,’ normatively privileged users.

Trackers on webpages follow our IP addresses and create profiles that are used by advertising firms in real-time bidding to determine which ads are served to us. To see the action of these trackers, go to Amazon and search for something you’re not interested in—sump pumps, homeopathic remedies, or blouses, perhaps—and watch how related ads follow you around

the internet in the next few days. These ad buys are informed not only by browsing history, but also by other data obtainable through your IP address: for example, your zip code, and the median house price and voting record for your zip code. The background to what we search for and read becomes tailored to not only the online environment we create but to the offline environment as well. These have racial and gendered aspects, of course, creating an invisible online ghettoization of women and minorities and an invisibly White and male internet for White male users.

Google search results are similarly customized using IP address and browsing history—with search history as well, if the user is signed in and allows Google to do so. The purpose of this customization of results is to deliver the information that users will find most relevant to their interests, but this clearly threatens to create racialized and gendered distortions, strongly compounded by the trust that users place in Google to provide relevant and objective information.

The extent and impact of the customized internet is difficult to study due to the complexity of these information ecosystems and their unavailability to public view, but it is clear that the impact can be significant. One study found that users identified algorithmically as female received “fewer instances of an ad related to high paying jobs” (Datta et al. 2015); another found “statistically significant discrimination in ad delivery based on searches of 2184 racially associated personal names,” where searches for statistically Black names such as DeShawn rather than statistically White names such as Geoffrey resulted in a greater proportion of ads suggesting criminal arrest records (Sweeney 2013). An invisible return of redlining also seems to be implied by this process, where those living in minority-majority zip codes may have an online environment that emphasizes e.g., payday loan services over mortgage services and educational opportunities. A patent acquired by Facebook even allows for assessment of a loan applicant through the Facebook Graph API:

When an individual applies for a loan, the lender examines the credit ratings of members of the individual’s social network who are connected to the individual through authorized nodes. If the average credit rating of these members is at least a minimum credit score, the lender continues to process the loan application. Otherwise, the loan application is rejected.
(Lunt 2014)

It is not hard to imagine how this and other applications of social networking site APIs could have discriminatory results, given that online associations tend to emphasize in-group connections by race, sexual orientation, transgender status, and so on. Further, as the Internet of Things continues to expand, identity markers of increasing variety and specificity will be available to these algorithms.

What Should Be Done?

We are all subject to various microaggressions at the hands of our tools—nearly every artifact designed to interface with persons must make significant assumptions about that person’s attributes in order to withdraw into their experience. These rise to the level of discrimination only when they are persistent and significant in effect, or when they play into and reinforce existing discriminatory structures or attitudes. While One is not 6’4”, microaggressions to someone of that height amount to little aside from bumping into the occasional beam or chandelier, and having to crouch down or lean over to wash one’s hair in the shower. Left-handedness makes many things more difficult and uncomfortable, and accommodating artifacts, like left-handed scissors and guitars, are manufactured in order to address these difficulties. The persistence of

these microaggressions and the seriousness of the difficulties they present is, however, incomparably greater in the case of someone who moves around on wheels rather than legs, and these microaggressions would produce a discriminatory effect even in the absence of ableist prejudice.

In most cases, we can't design to be responsive to every person, body, identity, and circumstance, and most of the time designing mostly for most people is good enough. It is clear that adhesive bandages available in only a single version of a 'flesh' color is insufficient, and that ten different shades is probably more than necessary to avoid the negative discriminatory effect—but it's difficult to say how or even whether this should be applied to kitchen countertop design. What counts as a reasonable accommodation also likely depends strongly on individual applications, what's at stake, and what cost and effort accommodations will demand. A strong effort has been made to accommodate people in wheelchairs in architecture, for example, and diaper changing tables—a cheap solution to a smaller problem—are increasingly common in men's bathrooms. Making virtual reality systems equally accessible to women is not currently recognized as so incumbent upon developers and companies, and insofar as such systems are used for entertainment only, it may well be sufficient for companies to say "we design for our target market," and to treat the exclusion of many women as a marketing choice rather than an issue of equity. When we look at the use of virtual reality in military treatment of posttraumatic stress disorder, however, it is more clear that providing unequal medical treatment to female veterans is a serious inequity, resulting in significant discrimination. We can imagine, similarly, that as customized pharmaceuticals and personalized medicine continue, the current research and development funding bias towards the diseases of the wealthy will result in increasing health care disadvantages for the poor—and, if such new forms of medicine attach to genetic differences across race or gender, other forms of health care discrimination may result as well. A further emerging set of issues is presented by a move to decentralized service provision under the 'sharing economy': services such as Uber and AirBnB do not well support persons with disabilities, with some reports of service animals being placed in trunks and blind persons being injured by drivers refusing them service (Heideman 2014), and business models that put provision of architectures of accommodation upon independent contractors are not well organized to ensure that all customers have equitable access.

In background relations, however, the problem isn't so much a lack of responsivity as it is an excess of 'accommodation' in the form of targeting and customization. In either kind of case, though, the problem results from the Latourian delegation where the technical system enforces a cultural norm in an inflexible way through a causal system.

So, no general policy can be recommended except that designers and programmers be aware of how these disparities arise, and design in a way which minimizes them as appropriate to the particular tool and task at hand. What is needed is a process of diversity impact assessment, akin to environmental impact assessments already regularly conducted in some areas of technological design and implementation. Having greater diversity in technology and engineering fields would help, of course—and would be desirable for its own sake—but this is not something that should be beyond the abilities of straight White able-bodied Christian cis men! A good number of these issues can be addressed by stepping back periodically and asking how design choices will differentially impact people and communities different from one's own.

A good number of other problems, however—such as personalized information spaces, social organization through calendars, and established gender roles—are so diffuse and multiply grounded in social norms and technical systems that they may be nearly insoluble. It is an existential rather than a technical problem that the One that forms the averageness with relation to which we live is something from which *all* of us deviate and are excluded from in one way or another.

Note

1 I use this example because it is the most famous of Winner's cases from this influential example, and it does illustrate his point effectively. Several authors, however, have presented strong arguments that the case is historically and factually erroneous, e.g., Joerges (1999a), Woolgar and Cooper (1999), and Joerges (1999b).

References

- boyd, d. (2014). Is the Oculus Rift Sexist? *Quartz*, March 28. Available at: <http://qz.com/192874/is-the-oculus-rift-designed-to-be-sexist/> [Accessed August 10, 2015].
- Byrne, N. M., Hills, A. P., Hunter, G. R., Weinsier, R. L., and Schutz, Y. (2005). Metabolic Equivalent: One Size Does Not Fit All. *Journal of Applied Physiology*, 99, 112–119.
- Datta, A., Tschantz, M. C., and Datta, A. (2015). Automated Experiments on Ad Privacy Settings: A Tale of Opacity, Choice, and Discrimination. *Proceedings on Privacy Enhancing Technologies*, 2015(1), 92–112.
- Du Bois, W. E. B. (1994). *The Souls of Black Folk*. New York: Dover Publications. (Original work published 1903)
- Dyer, R. (1997). *White*. London: Routledge.
- Floridi, L. (2014). *The Fourth Revolution*. Oxford: Oxford University Press.
- Heidegger, M. (1996). *Being and Time*, trans. J. Stambaugh. Albany: SUNY Press. (Original work published 1927)
- Heideman, E. (2014). Uber and Airbnb Leave Disabled People Behind. *The Daily Beast*, October 4. Available at: www.thedailybeast.com/articles/2014/10/04/uber-and-airbnb-leave-disabled-people-behind.html [Accessed August 10, 2015].
- HP Computers Are Racist* (2009). video, wzamen01, December 10. Available at: www.youtube.com/watch?v=t4DT3tQqgRM [Accessed August 10, 2015].
- Ihde, D. (1990). *Technology and the Lifeworld: From Garden to Earth*. Bloomington, IN: Indiana University Press.
- Joerges, B. (1999a). Do Politics Have Artefacts? *Social Studies of Science*, 29(3), 411–431.
- Joerges, B. (1999b). Scams Cannot Be Busted: Response to Steve Woolgar and Geoff Cooper, 'Do Artefacts Have Ambivalence? Moses' Bridges, Winner's Bridges and Other Urban Legends in STS. *Social Studies of Science*, 29(3), 450–457.
- Kingma, B., and Lichtenbelt, W. v. M. (2015). Energy Consumption in Buildings and Female Thermal Demand. *Nature Climate Change*, 5(9), 1054–1056.
- Latour, B. (1992). Where Are the Missing Masses? The Sociology of a Few Mundane Artifacts. In W. Bijker and J. Law (eds.) *Shaping Technology/Building Society: Studies in Sociotechnical Change*. Cambridge: Cambridge University Press.
- Latour, B. (1999). A Collective of Humans and Nonhumans: Following Daedalus's Labyrinth. In B. Latour (ed.) *Pandora's Hope: Essays on the Reality of Science Studies*. Cambridge, MA: Harvard University Press.
- Lunt, C. (2014). *Authorization and Authentication Based on an Individual's Social Network*. U.S. Patent 8782753 B2.
- McIntosh, P. (1989). White Privilege: Unpacking the Invisible Knapsack. *Peace and Freedom Magazine*, July/August.
- Mullen, J. (2015). Google Rushes to Fix Software That Tagged Photo With Racial Slur. *CNN*, July 2. Available at: www.cnn.com/2015/07/02/tech/google-image-recognition-gorillas-tag/. [Accessed August 10, 2015].
- Pariser, E. (2012). *The Filter Bubble: How the New Personalized Web Is Changing What We Read and How We Think*. New York: Penguin Books.
- Pew Research Center. (2014). *Political Polarization in the American Public: How Increasing Ideological Uniformity and Partisan Antipathy Affect Politics, Compromise and Everyday Life*, June 12. Available at: www.people-press.org/2014/06/12/political-polarization-in-the-american-public/ [Accessed August 10, 2015].

- Roth, L. (2009). Looking at Shirley, the Ultimate Norm: Colour Balance, Image Technologies, and Cognitive Equity. *Canadian Journal of Communication*, 34(1). Available at: <http://cjc-online.ca/index.php/journal/article/viewArticle/2196>
- Smith, D. (2013). 'Racism' of Early Colour Photography Explored in Art Exhibition. *The Guardian*, January 25. Available at: www.theguardian.com/artanddesign/2013/jan/25/racism-colour-photography-exhibition [Accessed August 10, 2015].
- Sunstein, C. (2009). *Republic.com 2.0*. Princeton, NJ: Princeton University Press.
- Sweeney, L. (2013). Discrimination in Online Ad Delivery. *ACM Queue*, 11(3). doi:10.1145/2460276.2460278.
- Wilcox, P. (1970). *White Is*. New York: Grove Press.
- Winner, L. (1980). Do Artifacts Have Politics? *Daedalus*, 109(1), 121–136.
- Woolgar, S., and Cooper, G. (1999). Do Artifacts Have Ambivalence? Moses' Bridges, Winner's Bridges and Other Urban Legends in S&TS. *Social Studies of Science*, 29(3), 433–449.
-