From Daguerreotypes to Algorithms

Machines, Expertise, and Three Forms of Objectivity

By Angèle Christin

What claims are made about the objectivity of machines versus that of human experts? Whereas most current debates focus on the growing impact of algorithms in the age of Big Data, I argue here in favor of taking a longer historical perspective on these developments. Drawing on Daston and Galison's analysis of scientific production since the eighteenth century, I show that their distinction among three forms of objectivity ("truth-to-nature," "mechanical objectivity," and "trained judgment") sheds light on existing discussions about algorithmic objectivity and accountability in expert fields.

Keywords: objectivity, algorithms, expertise, history of science
Categories: Socio-technical systems – sociology – history of computing
Corresponding Author: Angèle Christin
Email: christa@newschool.edu

Introduction

Periods of intense technological change are often accompanied by an array of unforeseen side effects. The age of Big Data is no exception. Not only are algorithms shaping the ways we think, feel, and live; the availability of massive amounts of digital data is also changing the production of scientific knowledge in profound ways[1]. Innovative methods, promising concepts, and new areas of inquiry are emerging in the study of algorithms and analytics. Yet some of this intellectual ebullience comes at a cost, at least in the social sciences: there is a relative amnesia about the continuities that exist between the Big Data revolution and historical precedents involving similar technological, economic, and political dilemmas.

I focus here on the reconfiguration of professional expertise taking place due to the development of algorithms; I argue that this process can usefully be compared to previous situations in which machines were mobilized to solve complex questions regarding knowledge, objectivity, and transparency. Drawing on Daston and Galison's study of the role of objectivity in the production of scientific atlases since the eighteenth

[1] Critical Questions for Big Data: Provocations for a Cultural, Technological, and Scholarly Phenomenon. danah boyd, Kate Crawford. *Information, Communication, & Society*, 15 (5): 662-679, 2012.

century[2], I argue that it is essential to better distinguish between different forms of "objectivity" when we praise or criticize the role of algorithms in expert fields.

Algorithms, expertise, and the problem of objectivity

Algorithms are currently transforming expert fields in multiple ways. In sectors as diverse as finance[3], healthcare[4], education[5], journalism[6], and criminal justice[7], algorithms are rapidly changing the work practices, norms, and identities of professional actors. From the development of online ratings systems measuring individual performance to the multiplication of predictive algorithms assessing the risk of future events, professionals now increasingly draw on analytics in their daily work.

In most of these fields, the practitioners advocating for technological change tend to describe algorithms as a rationalizing force[8]: digital technologies are said to help professionals make efficient decisions because they provide more reliable information based on sophisticated methods and large amounts of data. Another argument presented by advocates is that algorithms are value-neutral and thus will be better than humans at making decisions. In contrast to individuals, whose opinions are shaped by a variety of social factors including class, gender, race, politics, etc., algorithms would have no politics: their goal would be to analyze data in the most accurate way and maximize the amount of variance explained by their models. Therefore, Big Data analytics are often described as the cure for "broken" systems shaped by long histories of bias, inefficiency, and discrimination.

In reaction to this optimistic belief in the rationalizing force of Big Data, a critical research agenda is currently emerging. From the creation of unaccountable and little-understood algorithms (a process called "black boxing"[9]) to the critique of the "opacity"[10]

---

[2] *Objectivity*. Lorraine Daston, Peter Galison, Zone Books, 2007.
[3] From New Deal Institutions to Capital Markets: Commercial Consumer Risk Scores and the Making of Subprime Mortgage Finance. Martha Poon. *Accounting, Organizations and Society* 34(5): 654-674, 2009.
[4] Disciplined Doctors: The Electronic Medical Record and Physicians' Changing Relationship to Medical Knowledge. Adam Reich. *Social Science & Medicine* 74 (7): 1021–28, 2012.
[5] Rankings and Reactivity: How Public Measures Recreate Social Worlds. Wendy N. Espeland, Michael Sauder. *American Journal of Sociology* 113(1): 1-40, 2007.
[6] When it comes to chasing clicks, journalists say one thing but feel pressure to do another. Angèle Christin, *Nieman Journalism Lab*, 2014. http://www.niemanlab.org/2014/08/when-it-comes-to-chasing-clicks-journalists-say-one-thing-but-feel-pressure-to-do-another/. Accessed February 18, 2016.
[7] Using Big Data for Legal and Law Enforcement Decisions: Testing the New Tools. Lydia Bennett Moses, Janet Chan. *UNSW Law Journal* 37(2): 643-678, 2014.
[8] *Economy and Society: An Outline of Interpretative Sociology*. Max Weber. University of California Press. 1978 [1922].
[9] *The Black Box Society: The Secret Algorithms that Control Money and Information*. Frank Pasquale, Harvard University Press, 2015.
[10] How the Machine 'Thinks:' Understanding opacity in machine learning algorithms. Jenna Burrell. *Big*

or even the "tyranny"[11] of algorithms, scholars are examining how and why algorithms fail to improve accountability, objectivity, and transparency in expert fields. These studies have repeatedly demonstrated that algorithms tend to reproduce and even increase inequalities. In so doing, they have examined how specific values and ideologies become embedded in algorithmic calculations and how algorithms can create new forms of bias and secrecy.

These intellectual and political struggles about algorithms are important developments. Yet existing debates suffer from a relative lack of interest in the historical precedents of the digital age. Most of the social scientists and legal scholars studying Big Data care more about the present and the future than looking back at the past. Many historians in turn fail to pay close attention to the relatively new phenomenon of Big Data. This lack of dialogue is particularly damaging for questions that have already been explored in depth by historians of science and technology.

Learning from history of science

Objectivity is a case in point. Many social scientists take the meaning of the word "objectivity" for granted. For most of us, objectivity entails several clear features, such as emotional detachment (or the absence of subjectivity); procedural correctness (or the meticulous respect of certified methods); and the production of reliable empirical results. Yet, as the historians of science Lorraine Daston and Peter Galison show in their work about the making of scientific atlases, the meanings associated with the concept of objectivity have significantly fluctuated over the past two centuries.

For most of the eighteenth and nineteenth century, natural scientists understood the production of scientific knowledge to be close to a form of art. Scientists then attempted to capture "Nature" in its ideal form. When they prepared their atlases, they made informed decisions about which individual plant or animal to depict as the most "representative" of this ideal. If no single individual perfectly represented it, scientists would mix several items in their drawings in order to best capture the essence of the object they strove to represent. Thus, objectivity was defined by its connection to realism – what Daston and Galison call the "truth-to-nature" perspective.

Over the course of the nineteenth century, however, scientists began to question this approach. They had growing doubts about the effects of human intervention: were they unknowingly tampering with the data, gathering and interpreting them subjectively in the

---

Data & Society 216: 1-12, 2016.

[11] Tyranny of the Algorithm ? Predictive Analytics & Human Rights. Conference, New York University. http://www.law.nyu.edu/bernstein-institute/conference-2016. Accessed February 18, 2016.

light of existing conventions and individual idiosyncrasies? Scientists emphasized the strong discipline, moral qualities, and meticulous attention to detail necessary for "good" scientific practice; they also searched for "unmediated" ways of gathering and bringing data to the public. Scientists soon realized that they could draw on new technological developments in order to minimize their intervention. Mechanical reproductions such as daguerreotypes, photographs, and X-rays afforded an unmediated representation of natural phenomena.

This increased use of technology in scientific production came in turn with a moralized understanding of the epistemic qualities of machines. As noted by Daston and Galison, "machines were paragons of certain human virtues. Chief among these virtues were those associated with work: patient, indefatigable, ever-alert machines would relieve human workers whose attention wandered, whose pace slackened, whose hand trembled. (…) If the machine was ignorant of theory and incapable of judgment, so much the better, for theory and judgment were the first steps down the primrose path to intervention."[12] Daston and Galison analyze this widespread belief in the superior objectivity and qualities of machines as a paradigm of "mechanical objectivity."

Yet natural scientists gradually realized that mechanical representation came with its own sets of issues. Machines such as cameras and X-rays only recorded some of the natural phenomena that the scientists wanted to capture; they also created traces of their own that could not be found in the objects being represented. In addition, the photograph, printout, or X-ray provided by the machine often turned out to be confusing and misleading for the readers, mostly because it included too much information, most of it irrelevant or inconclusive. Over the course of the twentieth century, a new paradigm of "trained judgment" emerged, in which scientists started relying again on their expertise and experience to supplement the data provided by the machine with their own interpretation, for instance by adding complex color schemes or mixing different images in order to obtain composite results.

Algorithms and the three forms of objectivity

This detour through the practices and representations of nineteenth and twentieth century scientists allows us to come back to the topic of expertise, objectivity, and algorithms. Modern-day debates about algorithms and objectivity bear similarities with all three paradigms offered by Daston and Galison.

Until the late 1980s, the dominant representation of professionals strongly resembled the "truth-to-nature" model. Professionals were then described as making decisions based on

[12] The image of objectivity. Lorraine Daston, Peter Galison. *Representations* 40: 81-128, 1992, p. 83.

abstract forms of knowledge, tacit understandings of procedural norms, and skillful diagnoses.[13] Popular and scholarly representations described experts as possessing an almost sacred form of artistry that justified and legitimized their power and privileged social position.

In contrast, most of the current debates reveal strong suspicions about the role of experts in society, not unlike the doubts and self-criticism that characterized the beginning of the "mechanical objectivity" paradigm. Experts are increasingly under attack for their biases and prejudices; they are blamed for the opaqueness and unfairness of "broken" systems in fields as diverse as education, criminal justice, and healthcare. Thus, algorithms now play a similar role as the daguerreotypes and X-rays of the late nineteenth century: only machines can "cure" experts from their own subjective weaknesses. Several mythical virtues now applied to algorithms are similar to the ones assigned to daguerreotypes and cameras. Algorithms are hard working; they are patient and alert; they follow their own rules and cannot be influenced, which is both reassuring and troubling. Experts are increasingly asked to follow the "rule" of algorithms. This understanding comes with a strong moral view of machines, humans, and their relations.

Last, the scholarly reaction to this simplistic view of the "mechanical" connection between algorithms and objectivity relies, of course, on the paradigm of "trained judgment." Drawing mainly on Science and Technology Studies, recent work highlights the creation of hybrid entanglements of human and machine expertise. Like the twentieth century scientists who drew on their experience and judgment to create complex composite images, experts and algorithms would be creating new networks of accountability and forms of interactions.[14] In this view, "objectivity" should be understood as a complex process involving both social and technological agents. Algorithms would benefit from the input of experts; experts in turn would constantly analyze, interpret, and supplement algorithmic results, thus using Big Data as a new resource in the construction of professional knowledge.

Conclusion

In this piece, I argue that the relation between expertise, objectivity, and technology can take different forms; it tends to vary depending on the period and epistemic community under consideration. Specifically, I draw on Daston and Galison's distinction among the paradigms of "truth-to-nature," "mechanical objectivity," and "trained judgment" in order

[13] *The System of Professions: An Essay on the Division of Expert Labor*. Andrew D. Abbott, University of Chicago Press, 1988; *Trust in Numbers. The Pursuit of Objectivity in Science and Public Life.* Theodore M. Porter. Princeton University Press, 1996.
[14] Toward an ethics of algorithms: Convening, observation, probability, and timeliness. Mike Ananny. *Science, Technology, & Human Values*, 41(1): 93-117, 2016.

to make sense of current debates about algorithmic objectivity and accountability in expert fields. Of course, such clear-cut distinctions between the different meanings of objectivity fail to adequately account for the complexity of real-world situations: in most discussions of algorithms, "messiness" prevails.[15] Looking at the past, however, can help us make sense of the messiness of the present.

[15] Governing algorithms : Myth, Mess, and Methods. Malte Ziewitz. *Science, Technology, & Human Values*, 41(1): 3-16, 2016.