Imperfect Models of the World: Gender Stereotypes and Assumptions in Covid-19 Responses

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Abstract

As the Covid-19 pandemic has unfolded, epidemiologists have been working to build and refine models of how the disease is spread through populations: at the same time, policy-makers around the world have been taking measures to try to stem the transmission of disease, which are based on models of how they think the world works. These models may be implicit, or made explicit including through the use of statistics and data science: frequently, though, they are based on stereotypes and assumptions about how individuals and systems operate.

This paper argues that it is crucial to understand to whom models are useful, and who they ignore. This paper looks at the gendered assumptions – and resulting gaps - in policy responses, which betray an understanding of the world that neglects the experiences of women and of trans and non-binary people. It examines how gendered assumptions, gender binaries and stereotypes weaken responses to the pandemic, and how they reinforce imperfect models of the world that have detrimental impacts on the people who are not included.

Keywords

Gender, data, policy, discrimination

I. Introduction

Covid-19 is a new disease, caused by a newly discovered virus.[1] We don't know how it will behave or what to expect: but as societies, we have to respond to a disease that has killed more than a third of a million people worldwide in a few months.[2] In this paper, I articulate how the way that we – individuals, authorities, scientists, or governments – respond to Covid-19 is based on how we model the world, and the assumptions that we make as we do this. I outline how these assumptions may be based on stereotypes, and how the

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[1] The virus is called severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2): the disease it causes is called coronavirus disease (Covid-19). For more information, see World Health Organization, 'Naming the Coronavirus Disease (Covid-19) and the Virus That Causes It', accessed 7 May 2020, https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/naming-the-coronavirus-disease-(covid-2019)-and-the-virus-that-causes-it.

[2] As of 10 June 2020, the WHO had reported 408,025 deaths. World Health Organization, 'Coronavirusdisease (Covid-19) Situation Report–142', 31 May 2020, https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200511-covid-19-sitrep-112.pdf?sfvrsn=813f2669_2.

inaccuracies caused by inaccurate models can lead to discrimination. Finally, I articulate two recommendations that could help alleviate the problems caused by these imperfect models: making the assumptions that underly them explicit; and centering the people who are already marginalised by building policy responses that foreground their experiences and expertise.

II. The Importance of Models

The experts in new diseases are epidemiologists. As with SARS, H1N1, and Ebola, they follow the spread of Covid-19. They look at data on positive tests, on infection rates, on hospitalisation and deaths. This data enables them to build *models* of the disease: expressed as diagrams or in computer programs, these models allow us to better *determine* what is happening now, and to *predict* what will happen next.

a) Models in epidemiology

Models can help us understand what was previously unknown: and to communicate ideas that might not have been previously accepted. In the UK in the 1850s, the prevailing model of cholera, as understood by doctors, was that it was spread by a "miasma": bad air.[3] Dr John Snow disagreed. He recorded the deaths from a cholera outbreak in Soho, London in 1854, marking the residences of those who died on a map: and because he thought that the disease might be spread by water, he also marked the location of neighbourhood pumps.

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[3] William F Bynum, 'On the Mode of Communication of Cholera', *Nature*, 14 March 2013, 169.
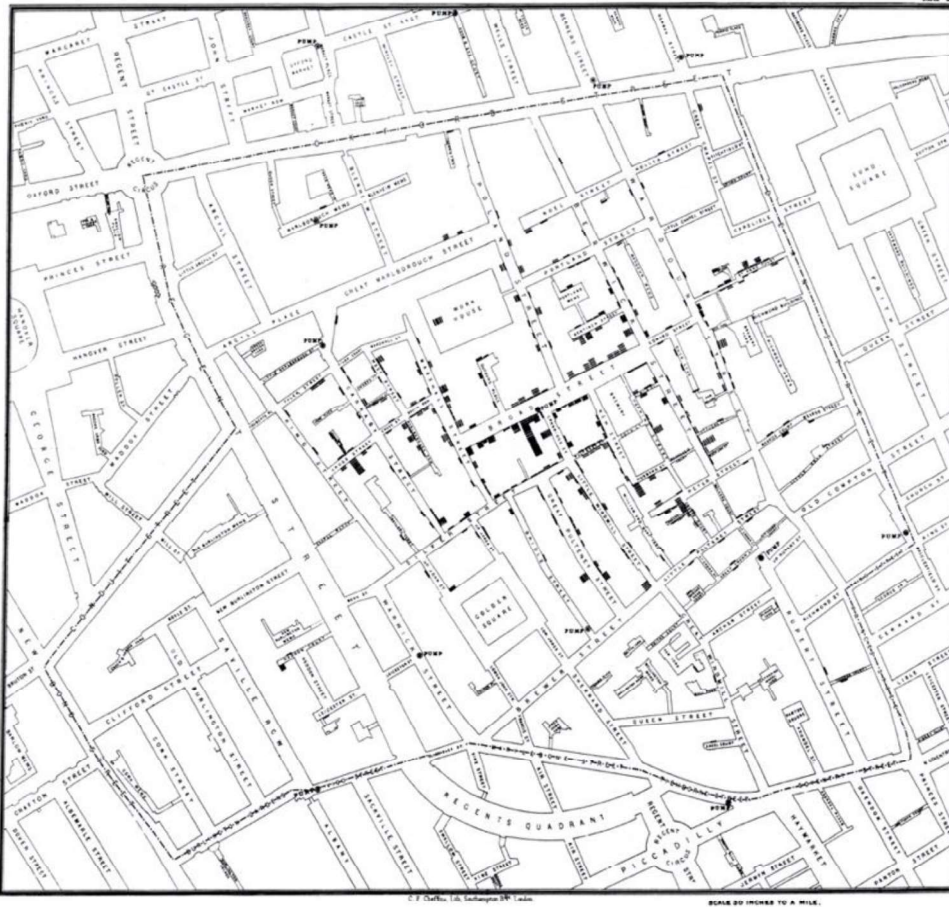
Figure 1: John Snow's map showing cholera cases in Soho in 1854.[4]

Snow's map – now often cited as an early example of data visualisation[5] – is shown in Figure 1. The largest cluster of deaths was around the pump on Broad Street. Snow demanded that the handle of the pump be removed, and the outbreak stopped.[6] More than 150 years later, modern-day epidemiologists are engaged in similar projects: understand how a disease spreads, and what actions need to be taken to save lives.

b) Models in the world

Of course, models are not solely the tool of epidemiologists. Models of how the world operates are familiar in all academic disciplines: from microeconomic graphs that plot price against demand, to legal theories that posit humans as rational actors, to sociological theories about the ways that we constitute ideas of 'disability'.

These models may be developed as theories, that are then tested empirically, or they may be developed through a 'grounded' observation of a situation, on top of which a model is

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[4] John Snow, *Map from 'On the Mode of Communication of Cholera'*, 1854, 1854, Originally published in 1854 by C.F. Cheffins, Lith, Southhampton Buildings, London, England, https://commons.wikimedia.org/wiki/File:Snow-cholera-map-1.jpg.

[5] See for example Edward R. Tufte, *The Visual Display of Quantitative Information* (Graphics Press, 1983), 24.

[6] Broad Street is now called Broadwick Street: it now hosts a commemorative replica of the original pump, just outside the (more traditionally British commemoration) John Snow pub.

built; they may make use of qualitative or quantitative research; they may be constructed as single static forms, or constantly updated. Written in academic papers and presented in the form of graphs, computer code or flowcharts, we are familiar with models of the world: and we understand that some models are better than others. We no longer accept the "miasma" theory of cholera transmission as a useful explanation, just as we no longer find geocentric models of the universe useful.[7]

Models are crucial for policy responses as well. In order to have some idea of how a policy will work, we need to have some understanding of how a complex system will respond to changes. This is a model, whether it's computational, theoretical, or ideological.

III. The Imperfections of Models

Statistician George Box wrote, 'all models are wrong, but some are useful.' [8] All models are wrong in the sense that they are inherently reductive. They reduce the complexities of the world down to a finite set of parts.

This reduction may be because not enough is known about all the components: Snow was able to advance the understanding of cholera through his work, but he died before the development of germ theory,[9] which argued that some diseases are caused by micro-organisms. His model of cholera, therefore, held that it was spread by sewage-contaminated water, but was not specific enough to identify the contamination: the bacterium *Vibrio cholerae*, which can be spread in human faeces.[10]

It may also be because assumptions are made that are not spelled out: Newton did not explicitly state that his laws were only valid up to a certain speed. While during his lifetime, he accepted the idea that light travelled at a very fast but finite speed,[11] he did not consider that the laws he developed to measure the world around him might not be universally applicable. Newtonian classical mechanics is accurate enough to send humans to the moon, but it fails for objects that are very small, or going very fast.[12]

This is just as true in the humanities as in the sciences. Liberal theories of society explicitly model society as being composed of individuals who are rational, autonomous, and equal before the law,[13] while international law institutions have rightly been criticised for their

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[7] In a geocentric model of the universe, everything — the Sun, the Moon, planets, and stars — orbits around the Earth. Geocentric models were known to be flawed from the 2nd century BC, and were superseded by heliocentric (orbiting around the Sun) models in the 16th century.

[8] An oft-quoted aphorism, it appears in print in for example George E P Box and Norman R Draper, *Empirical Model-Building and Response Surface* (USA: John Wiley & Sons, Inc., 1986), 424.

[9] Bynum, 'Cholera' (n. 3).

[10] World Health Organization, 'Cholera', 17 January 2019, https://www.who.int/news-room/fact-sheets/detail/cholera.

[11] Isaac Newton, *Opticks*, 1704, 77, https://gallica.bnf.fr/ark:/12148/bpt6k3362k.

[12] How small, or how fast, exactly? Smaller than atoms, or faster than around 10% the speed of light. In practice, the differences between Newton's predictions, and Einstein's Theory of General Relativity, were far smaller than the rounding errors in the computer systems used by NASA in the Apollo program. (Much) more information about the computer system is available from Ron Burkey, 'The Apollo Guidance Computer: A Kinder, Gentler Introduction', Virtual AGC — AGS — LVDC — Gemini, accessed 7 May 2020, http://www.ibiblio.org/apollo/ForDummies.html.

[13] Sandra Fredman, *Women and the Law*, Oxford Monographs on Labour Law (Oxford: Clarendon Press, 1997), 12–17.

'outmoded but nevertheless deeply entrenched attitudes concerning the roles and status of men and women in society.'[14]

Some models are useful: but only to some people. Newton's model of gravity was useful to NASA scientists, but not to quantum theorists. Snow's model of cholera was useful to future Londoners, but not to the residents of Soho who had already died – or fled – the outbreak of 1854.

Models of – and about – people may be useful for describing some lives, but less so for others. These include both theoretical models and grounded models, both qualitative and quantitative. Feminist legal scholars have argued, for example, that the assumptions of liberalism are masculine: they do not fit the realities of people's lives, particularly the lives of women, in their neglect of human bodies, social contexts and relationships.[15]

At the international level, the Convention on the Elimination of All Forms of Discrimination Against Women, and the CEDAW Committee which oversees its implementation has begun not only to identify that gender stereotyping is a problem,[16] but to name specific stereotypes and show how their application is harmful in judicial decisions.[17] Imperfect models of the world can lead to unexpected outcomes for people who don't fit – and sometimes discrimination.

IV. Imperfect Models and Covid-19

In crisis situations, things move fast. The people – whether they are epidemiologists or policy makers – are unlikely to have all the information they need to build accurate models at the best of time. In crises, this is exacerbated, and the model-makers also may not have time to interrogate all their assumptions.

Take, for example, collecting disaggregated data on Covid-19 cases and deaths. This is crucial in order to track potential disparities and inequities in health: it enables health care researchers to see how the virus is impacting different groups of people.[18] The USA has the highest number of Covid-19 cases in the world, but the disease is not hitting everyone equally. In order to understand which communities are being hit hardest, US states have started to collect data that is disaggregated by race. But at the time of writing, this data was available for only 35% of deaths.[19]

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[14] Elizabeth Evatt, 'Foreword', in *The Boundaries of International Law: A Feminist Analysis*, by Hilary Charlesworth and Christine Chinkin, Melland Schill Studies in International Law (Manchester: Manchester University Press, 2000), ix.

[15] Rosemary Hunter, 'Contesting the Dominant Paradigm: Feminist Critiques of Liberal Legalism', in *The Ashgate Research Companion to Feminist Legal Theory*, ed. Margaret Davies and Vanessa Munro, Ashgate Research Companion (Farnham: Ashgate, 2013), 21.

[16] As in for example *AT v Hungary*, UN Doc. CEDAW/C/32/D/2/2003, 26 January 2005.

[17] Simone Cusack, 'Building Momentum Towards Change: How the UN's Response to Stereotyping Is Evolving', in *Stereotypes and Human Rights Law*, ed. Eva Brems and Alexandra Timmer (Cambridge, United Kingdom: Intersentia, 2016), 28.

[18] PolicyLink, 'Counting a Diverse Nation: Disaggregating Data on Race and Ethnicity to Advance a Culture of Health', 2018, 5, https://www.policylink.org/sites/default/files/Counting_a_Diverse_Nation_08_15_18.pdf.

[19] Johns Hopkins University of Medicine, 'State Testing Data by Race', Johns Hopkins Coronavirus Resource Center, accessed 7 May 2020, https://coronavirus.jhu.edu/data/racial-data-transparency.

a) Who is 'other'?

Not all data on infection rates and deaths is disaggregated. In four of the ten states with the highest population of Native Americans, data about the case and fatality numbers for this population is not disaggregated, and is instead counted under 'other.' Without accurate data about Native populations – who are disproportionately likely to be living in poverty, and unable to access healthcare – it will not be possible to design policy responses that take into the account how they have been hit by the virus.

And it is likely that they have been hit hard. Where data has been collected, Native Americans are more likely to have been infected – as in New Mexico, where they are less than 10% of the population but more than a third of the cases – and to die – as in Arizona, where 6% of the population, but 16% of the deaths, are amongst Native populations.[20] In per capita cases, the Navajo Nation is third highest in the USA, behind only New York and New Jersey.[21]

b) Exactly two genders?

Policy responses, too, can rely on imperfect models of the world. In Panama, in order to minimise the number of people in public at one time, the government implemented a gendered curfew: women can leave their houses on Monday, Wednesday and Friday, while men can go out on Tuesday, Thursday and Sunday.[22] Violations are enforced by the police and quarantine officers. This presents a challenge for trans and non-conforming Panamanians, in a country where changing the gender marker on official documents requires undergoing costly gender confirmation surgery, and where transphobic discrimination is widespread.

For trans people whose gender doesn't match their legal documents, they risk arrest, humiliation and criminalisation: one woman was detained for three hours, despite being outside on a Wednesday, and as a health volunteer, exempt from the quarantine restrictions.[23] It took more than five weeks for the government of Panama to recognise that the enforcement of the quarantine was discriminatory against trans and gender non-conforming people, and to issue a communication to the security forces.[24]

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[20] Rebecca Nagle, 'Native Americans Being Left out of US Coronavirus Data and Labelled as "Other"', *The Guardian*, 24 April 2020.
[21] Delilah Friedler, 'Navajo Nation Is behind Only New York and New Jersey in Rates of COVID-19 Infection. What Happened?', *Mother Jones* (blog), 5 May 2020, https://www.motherjones.com/politics/2020/05/navajo-nation-covid-outbreak-deaths/.
[22] This was combined with specified hours for leaving the house, based on the last digit of a person's ID card or passport. República de Panamá Gobierno Nacional, 'Nuevas Medidas Para La Cuarentena Absoluta', 30 March 2020.
[23] Cristian González Cabrera, 'Panama's Gender-Based Quarantine Ensnares Trans Woman', *Human Rights Watch* (blog), 2 April 2020, https://www.hrw.org/news/2020/04/02/panamas-gender-based-quarantine-ensnares-trans-woman.
[24] Human Rights Watch, 'Panama: Government Takes Step to End Quarantine Gender Discrimination', Human Rights Watch, 18 May 2020, https://www.hrw.org/news/2020/05/18/panama-government-takes-step-end-quarantine-gender-discrimination.

c) Hitting the most marginalised hardest

Both of these outcomes result from a failure to model aspects of the world. In Panama, it is a failure to recognise that legal gender and gender expression are not the same for many people, and that policing the latter to enforce the former leaves an already marginalized group at risk of further oppression. In the USA, it is a failure to recognise in models that there is a population – Native Americans – who experienced consistently poor health outcomes (including lower life expectancy, and higher rates of death from preventable diseases) in general,[25] and who would therefore benefit from disaggregated data in order to understand the specific impact of Covid-19.

In both of these countries, this failure to model accurately, disproportionately impacts groups that are already marginalized. This might be the result of models – explicit or implicit models – suffering from what D'Ignazio and Klein call the 'privilege hazard': they are built by people who lack the tools to recognize the oppression that other people experience.[26] It might be the result of deliberate discrimination. Or it might be the result of hurried decision-making. Regardless of the motivation, the outcome is the same: inequalities are exacerbated, and marginalised people are pushed further into the margins.

Assumptions are not neutral. They may be made deliberately, in service of faster, more streamlined models. They may be made implicitly, because everyone in the room is working under the same set of assumptions and so no-one thinks to question if a different approach could be taken. But when modelling the world, the assumptions made are choices: about what to spell out in detail, and what to abstract. The choices are political: they determine what is counted, and what is ignored.

V. Building Better Models

Models must be reductive in some way: but the choices that are made in order to reduce the world to a model are political. They hit some people harder than others. In this final section, I offer two methods to mitigate against this disproportionate impact.

a) Make assumptions explicit

When developing a model – whether it is computational, diagrammatic, or theoretical – everyone involved could articulate the assumptions that they are making. The specific actors will be different for every model, but Wieringa's taxonomy of actors involved in computer algorithm development is a helpful illustration: she distinguishes between decision-makers, developers and users.[27] In complex systems, it is not always easy – or possible – to know the individual or individuals who fill each of these roles

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[25] Donald Warne, 'The State of Indigenous America Series: Ten Indian Health Policy Challenges for the New Administration in 2009', *Wicazo Sa Review* 24, no. 1 (10 May 2009): 7–23, https://doi.org/10.1353/wic.0.0023.

[26] Catherine D'Ignazio and Lauren F. Klein, *Data Feminism*, <Strong> Ideas Series (Cambridge, Massachusetts: The MIT Press, 2020), 29.

[27] Maranke Wieringa, 'What to Account for When Accounting for Algorithms: A Systematic Literature Review on Algorithmic Accountability', in *Proceedings of the 2020 Conference on Fairness, Accountability, and Transparency* (FAT* '20: Conference on Fairness, Accountability, and Transparency, Barcelona, Spain: ACM, 2020), 3–4, https://doi.org/10.1145/3351095.3372833.

'Decision-makers' are those who specify parameters for a model. In the example cited above, this could be the state- and federal-level public health bodies in the USA who decided that collecting data about Covid-19 cases and deaths was important, or the individuals or teams within the Government of Panama, who decided that they needed to impose a curfew.

'Developers' are those who make decisions about how to implement the model. These could be the civil servants tasked with dividing Panama's population into discrete groups, for the purposes of limiting the number of people in public. It could also be the representatives of Arizona Department of Health Services which included Native American as a category in their demographic data,[28] or those at the Texas Department of State Health Services, which did not.[29]

Finally, 'users' are the operators of a model: the health and social care workers tasked with recording demographic information about COVID-19 patients, or the police and security forces in Panama tasked with enforcing the curfew.

In Covid-19 data collected in Texas, for example, an unspoken assumption is that certain racial groups are worthy of special consideration, and others are not. Collecting data so that disproportionate impact on White people could be identified is deemed worthwhile by the Texas public health authorities: similarly, Black people. But Native Americans – despite a history of health inequities – were not necessarily considered a group worth of scrutiny. Implicitly, it was assumed that the impact on Native American populations was likely to be either small enough to be not worth scrutinising: or (possibly in addition), the virus was expected to hit those populations in the same way as other groups that are not counted separately in data, such as Arab-Americans.[30]

In the case of the Panama gendered quarantine, the policy makers assumed that gender could be determined by third parties: police and quarantine officers: they also assumed that gender expression and legal gender were the same for everyone. Neither of these assumptions hold, as trans activists and gender scholars have been arguing for many years.[31]

Articulating assumptions is not an easy task: it takes practice! It is easier to do when the people in the room are from diverse backgrounds – when everyone has the same assumptions, they often go unnoticed: and it is easier to do when there is a strong incentive to devote resources to this process Spelling out assumptions in the Panamanian and USA-ian examples above might have helped identify why – and for whom – they failed: which leads neatly into my second method.

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[28] Arizona Department of Health Services, 'COVID-19 Data Dashboard', Arizona Department of Health Services, accessed 27 May 2020, http://www.azdhs.gov/preparedness/epidemiology-disease-control/infectious-disease-epidemiology/covid-19/dashboards/index.php.

[29] Texas Department of State Health Services, 'Texas Case Counts: COVID-19', accessed 27 May 2020, https://txdshs.maps.arcgis.com/apps/opsdashboard/index.html#/ed483ecd702b4298ab01e8b9cafc8b83.

[30] For more information about advocacy for including 'Arab American' as a separate category in census and other data, see: PolicyLink, 'Counting a Diverse Nation'.

[31] See for example TGEU, 'Legal Gender Recognition', accessed 27 May 2020, https://tgeu.org/issues/legal-gender-recognition/; Amnesty International, 'The State Decides Who I Am: Lack of Legal Gender Recognition for Transgender People in Europe', 2014, https://www.amnesty.org/en/documents/document/?indexNumber=EUR01%2f001%2f2014&language=en.

b) Centre the impact on the people on the margins

Scholars like Donna Haraway have been arguing for 'strong objectivity' as a lens of analysis, which centres the perspectives of groups who are excluded from knowledge-making processes:[32] while standpoint theory, a common tool of feminist analysis, recognises that all knowledge is situated, partial and historically specific.[33] Black feminist scholar and activist bell hooks argued that it is not only important to recognise that the people on the margins have a specific perspective: it is crucial to building successful movements that the experiences of marginalised people are "understood, addressed and incorporated."[34]

Yet while scholars have been arguing for local knowledge, properly used, for decades: those in power remain, in many situations, prone to discount the impact of their decisions on marginalised people. Marginalised people are less likely to be in the room when decisions are made: and if they are in the room, they are less likely to have their voices heard, let alone have the power to influence the decisions that are made.

In the medium-to-long term, one way to resolve this is to have decision-makers with diverse identities, backgrounds and experiences. But this will take time. In the short-term – and particularly in crisis situations – it is crucial for those who hold power to think about the impact of their decisions – and the assumptions that underly them – on people who are marginalised. Centring marginalised people means, in hooks' analysis, bringing in their experiences, but also creating – and in some cases, ceding – space for them to participate as both 'makers of theory and of leaders of action.'[35]

In the USA, this would have meant including the experiences, perspectives and expertise of communities who are already known to have poorer health outcomes - including Native Americans – in the development of policy responses. It would have meant ensuring that the policy included responses centred on these communities, instead of keeping them at the margins. And to be effective, these policy responses needed data for evaluation. While there are legitimate concerns about collecting data on marginalized groups, ignoring them or subsuming them into 'other' was not effective here.

In Panama, this would have meant including trans people, and gender-non-conforming people – and their lived experiences - in the development of the quarantine measures. It would have meant considering how the measures would impact them, including how quarantine violations were to be policed. Trans people are already more likely to be targeted by police: quarantine measures that exacerbated this should not have been put into place.

Both of these responses require a broader view of the world: they require thought and reflection on the part of the designers and implementers, about the models of the world that they are using and the assumptions that underly them. Crisis situations are inherently fast-moving and individuals tasked with decision-making may feel they don't have time to think about these concerns: this is precisely why these are important. Not just in our current

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[32] D'Ignazio and Klein, *Data Feminism*, (n. 26) 83.
[33] Joey Sprague, *Feminist Methodologies for Critical Researchers: Bridging Differences*, The Gender Lens Series (Walnut Creek, CA: AltaMira Press, 2005), 41.
[34] bell hooks, *Feminist Theory from Margin to Center* (South End Press, 1984), 161.
[35] Ibid.

pandemic situation, but in every future crisis – and day-to-day – policy response. These two methods: making assumptions explicit, and centering the people who are already marginalized – should be paramount in all the models that we build of the world.

VI. Conclusion: Beyond Covid-19

As I have described, imperfect models of the world have the potential to have a detrimental impact on responses to Covid-19. But the harm of imperfect models does not stop there. The Covid-19 crisis will continue for months and years, but decision-making based on imperfect models did not begin with the virus, and it will not end with it.

Models of the world are in use in almost every sphere of life, but the proliferation of big data analytics and algorithmic decision-making has concretised these models into computer code. Without proper oversight, the decision-makers, developers and user of models risk using models with reductive views of the world based on assumptions and stereotypes. The two methods I have outlined here: spelling out assumptions, and centring the people at the margins, will be necessary – although perhaps a starting point, rather than a complete solution – to ensuring that these models are useful without being harmful.