Critique and quantitative methods in the case for reparations

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Harvard School of Public Health, Boston, Massachusetts
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Slides: https://www.MominMalik.com/fxb2023.pdf

Outline

1. The problem: Quant against justice

2. Walkthrough of and commentary on our *Social Science and Medicine* paper

3. What are critical quantitative methods? What *could* they be?

About me

- UG: DEPARTMENT OF THE **HISTORY OF SCIENCE** HARVARD UNIVERSITY

- MSc: OXFORD INTERNET INSTITUTE | UNIVERSITY OF OXFORD

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- Post-doc: **BERKMAN KLEIN CENTER** FOR INTERNET & SOCIETY AT HARVARD UNIVERSITY

- Previously: **AVANT-GARDE HEALTH**

- Currently: MAYO CLINIC | Center for Digital Health / **Penn** Social Policy & Practice UNIVERSITY *of* PENNSYLVANIA / **ICQCM** CRITICAL DATA SCIENCE FOR A DIVERSE WORLD

YOU KEEP ON USING THESE DATA
I DO NOT THINK THEY MEAN WHAT YOU THINK THEY MEAN

The problem: quant against justice

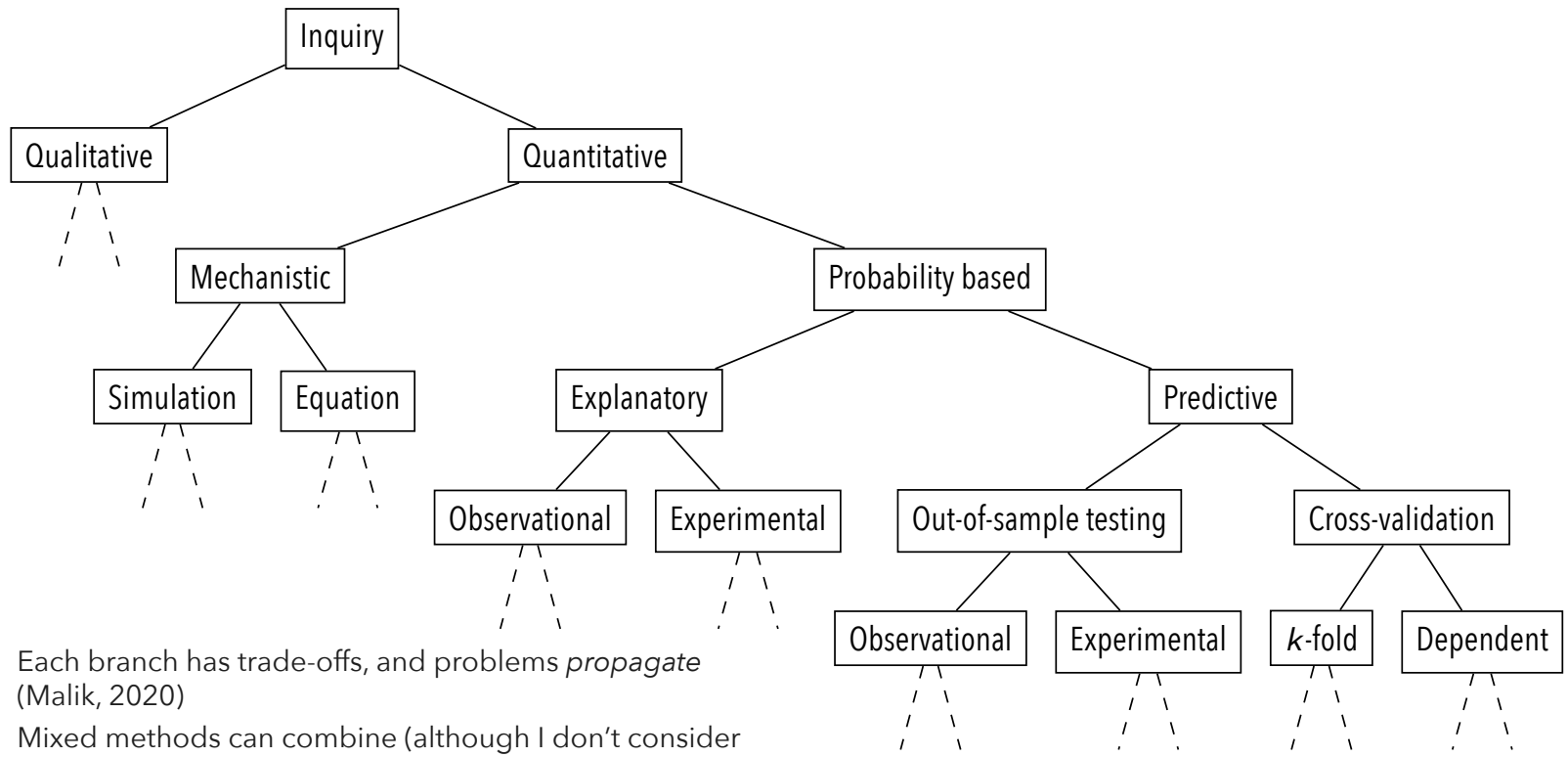# What do I mean by "quant"? A particular set of abstractions

Introduction

The problem: quant against justice

Walk through of and commentary on our *Social Science and Medicine* paper

What are critical quantitative methods? What *could* they be?

References

- Each branch has trade-offs, and problems *propagate* (Malik, 2020)
- Mixed methods can combine (although I don't consider this in the paper)

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at Harvard University

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The problem

- Quantitative methods are deeply complicit in anti-Blackness, particularly in the roots of statistics in eugenics and scientific racism, through to statistics being used to delegitimizing lived experience, and the effects of the insurance industry (Caley Horan), further "punishing" the victims of oppression (Deborah Hellman)

- Quantitative methods have NOT led to the humanization of Black people

  – Despite a long history of pioneering work (Du Bois, Well-Barnett), quantitative evidence has neither been *necessary* nor *sufficient* for change. What seems to have been necessary and sufficient is "narrative technologies" (Ruha Benjamin)

  – Quantitative evidence is theory-laden, and has infinite "regress" (Harry Collins on "experimenter's regress"): just look at Eduardo Bonilla-Silva and *White Logic, White Methods* (maybe Yanis Varoufakis?). Quantitative evidence that goes against what people believe can and will be questioned, so it is NOT a neutral or universal debate stage

What, then, are we doing using quant methods?

- Why, then, would we use quant methods to achieve justice?
  - Because it's "true"? But it's not
  - Because it's (currently) the language of power? But it has proven neither necessary nor sufficient for change

- Better arguments:
  - Qual has been, and can be, just as or even more oppressive (Linda Tuhiwai Smith, Kleinberg & Kleinberg)
  - These problems are inherent in the way the quant methods we have now are *conceived*, *justified*, and *imagined*: specifically, in positivism. It is hard to for the imagination to escape the path dependency, but not impossible, especially drawing from alternative histories (e.g., examples Rodrigo Ochigame is working on in *Remodeling Rationality*)
  - Neither necessary nor sufficient, but maybe it can be helpful (maybe more by acting through *perspective transformation*, rather than policy decisions)

"Paradigms of inquiry"

Issue	Positivism	Post-positivism	Critical theory et al.	Constructivism	Participatory
Ontology	Naïve realism: Reality independent of and prior to human conception of it, apprehensible	Critical realism: Reality independent of and prior to human conception, but imperfectly and approx. apprehensible	Disenchantment theory: reality is secret/hidden, shaped by power structures and solidified over time	Relativism: multiple realities, constructed in history through social processes	Participative: multiple realities, co-constructed through interactions between specific people and environments
Epistemology	Reality knowable. Findings are singular, neutral, perspective-independent, atemporal, universally true	Findings provisionally true; multiple descriptions can be valid but are probably equivalent; findings can be affected/distorted by social + cultural factors	How we come to know something, or who knows it, matters for how meaningful it is	Relativistic: no neutral perspective to adjudicate competing claims	We come to know things, create new understandings, & transform world by involving other people in process of inquiry
Methodology	Hypotheses can be verified as true. Quant methods, math.	Falsification of hypotheses; primacy of quant, but some qual and mixed methods	Dialogic (conversation + debate) or dialectical (thesis$_1$ → antithesis$_1$ → synthesis$_2$:= thesis$_2$…)	Dialetical, or exegetical (reading between the lines)	Collaborative, action-focused; flattening hierarchies; engaging in self- and collective reflection, action
Axiology	Quant knowledge-holders have access to truth, and responsibility from it	Quant knowledge valuable but can be distorted; qual can help find and correct	Marginaliz*ation* provides unique insights, knowledge of marginaliz*ed* valuable	Understanding construction is valuable; value relative to given perspective	Reflexivity, co-created knowledge, and non- western ways of knowing are valuable and combat erasure and dehumanization

Malik & Malik (2021), via Guba and Lincoln (2005)

More on "critical"

- Brian Fay (1987): "humanist variant of estrangement theory" (very rationalist formulation, but I've found it useful)
  - Estrangement theory: most people live in a manifest/ordinary sphere that keeps them trapped from what is best in life, which exists in a hidden/extraordinary sphere
  - Humanist variant: locates the hidden/extraordinary sphere in the social plane, not religious or spiritual
- Components:
  - Theory of false consciousness
  - Theory of crisis
  - Theory of education
  - Theory of transformative action
- Examples he gives: Critical race theory, feminist theory, Marxism
- Related to, but sometimes in conflict with, *constructivism*: the "hidden truth" may be how things were constructed in a critical framework, but also, there can be constructivism without transformative action (e.g., Bruno Latour: "Since ANT is often accused of being indifferent to morality, it's worth recalling that there are good deontological reasons in having at least as much freedom of movement as the actors we study")

Contrast with realism, positivism

- Realism: there is an underlying "true" reality that exists prior to and independent of our conception of it (for scientific realism, reality is mathematically characterized or even mathematical in nature)

- Positivism: the only meaningful knowledge is that which can be empirically verified and demonstrated in universal ways (which are quantitative)

- Both are "scientistic" (Payne and Payne 2004), insisting on the possibility and superiority of universal, objective, neutral knowledge, but differ in their metaphysical commitment

"Ways of understanding a person"

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What are critical quantitative methods? What *could* they be?

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	As a case (quant)	In narrative (qual)
Context/circumstance	Stripped away	Key
Mental states	Absent (for the most part)	Crucial; constitutive
Relevant features	Determined in advance	Emergent
Orientation to time	Atemporal	Chronological
Ordering of features	Unimportant	Meaningful
Other actors	Invisible	Often present
Causal logic	Mathematical	Theoretical
Boost predictive validity	Add cases	Know person better

Slide from Barbara Kiviat (work in progress), based on "Bowker and Star 2000; Bruner 1986; Desrosières 1998; Espeland 1998; Espeland and Stevens 1998, 2008; Fourcade and Healy 2017; Hacking 1990; Porter 1994, 1995; Ricouer 1998; White 1980, 1984". I would add: Abbott, 1988

Core incompatibility

"*...it is striking how absolutely these assumptions* [of linear models] *contradict those of the major theoretical traditions of sociology*. Symbolic interactionism rejects the assumption of fixed entities and makes the meaning of a given occurrence depend on its location… Both the Marxian and Weberian traditions deny explicitly that a given property of a social actor has one and only one set of causal implications… all approach social causality in terms of stories, rather than in terms of variable attributes." (Abbott 1988)

Note: quant lacks (is incapable of?) reflexivity, and can't account for itself

"The declared aim of modern science is to establish a strictly detached, objective knowledge. Any falling short of this ideal is accepted only as a temporary imperfection, which we must aim at eliminating. **But suppose that tacit thought forms an indispensable part of all knowledge, then the ideal of eliminating all personal elements of knowledge would, in effect, aim at the destruction of all knowledge.** The ideal of exact science would turn out to be fundamentally misleading and possibly a source of devastating fallacies." (Polanyi 1966)

Take-away

- If quant methods are conceived and justified via positivism, then they will be inextricable from legacies of and ongoing epistemicide
  - We risk reifying this when if we use quant "strategically"
- Quant (other than maybe geometry; definitely probability and statistics, calculus, functional analysis, and probably a good chunk of algebra) is hard to make collaborative insofar as it is novel and bizarre in human history and culture, and quant knowledge training is hostile for and systematically denied to marginalized people
- (I recently saw Nathan Alexander give a talk; what I saw of his work makes it perhaps the only example I've found of real reimagining)

Walkthrough of and commentary on our *Social Science and Medicine* paper

The paper

Reparations for Black American descendants of persons enslaved in the U.S. and their potential impact on SARS-CoV-2 transmission

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ARTICLE INFO

Keywords:
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Reparations
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Health disparities
Risk structure

ABSTRACT

Background: In the United States, Black Americans are suffering from a significantly disproportionate incidence of COVID-19. Going beyond mere epidemiological tallying, the potential for racial-justice interventions, including reparations payments, to ameliorate these disparities has not been adequately explored.

Methods: We compared the COVID-19 time-varying R_t curves of relatively disparate polities in terms of social equity (South Korea vs. Louisiana). Next, we considered a range of reproductive ratios to back-calculate the transmission rates $\beta_{i \to j}$ for 4 cells of the simplified next-generation matrix (from which R_0 is calculated for structured models) for the outbreak in Louisiana. Lastly, we considered the potential structural effects monetary payments as reparations for Black American descendants of persons enslaved in the U.S. would have had on pre-intervention $\beta_{i \to j}$ and consequently R_0.

Results: Once their respective epidemics begin to propagate, Louisiana displays R_t values with an absolute difference of 1.3–2.5 compared to South Korea. It also takes Louisiana more than twice as long to bring R_t below 1. Reasoning through the consequences of increased equity via matrix transmission models, we demonstrate how the benefits of a successful reparations program (reflected in the ratio $\beta_{b \to b}/\beta_{w \to w}$) could reduce R_0 by 31–68%.

Discussion: While there are compelling moral and historical arguments for racial-injustice interventions such as reparations, our study considers potential health benefits in the form of reduced SARS-CoV-2 transmission risk. A restitutive program targeted towards Black individuals would not only decrease COVID-19 risk for recipients of the wealth redistribution; the mitigating effects would also be distributed across racial groups, benefiting the population at large.

Reparations for slavery could have reduced Covid-19 transmission and deaths in the US, Harvard study says

By Scottie Andrew, CNN
Updated 3:42 PM EST, Tue February 16, 2021

Slides: https://www.MominMalik.com/fxb2023.pdf
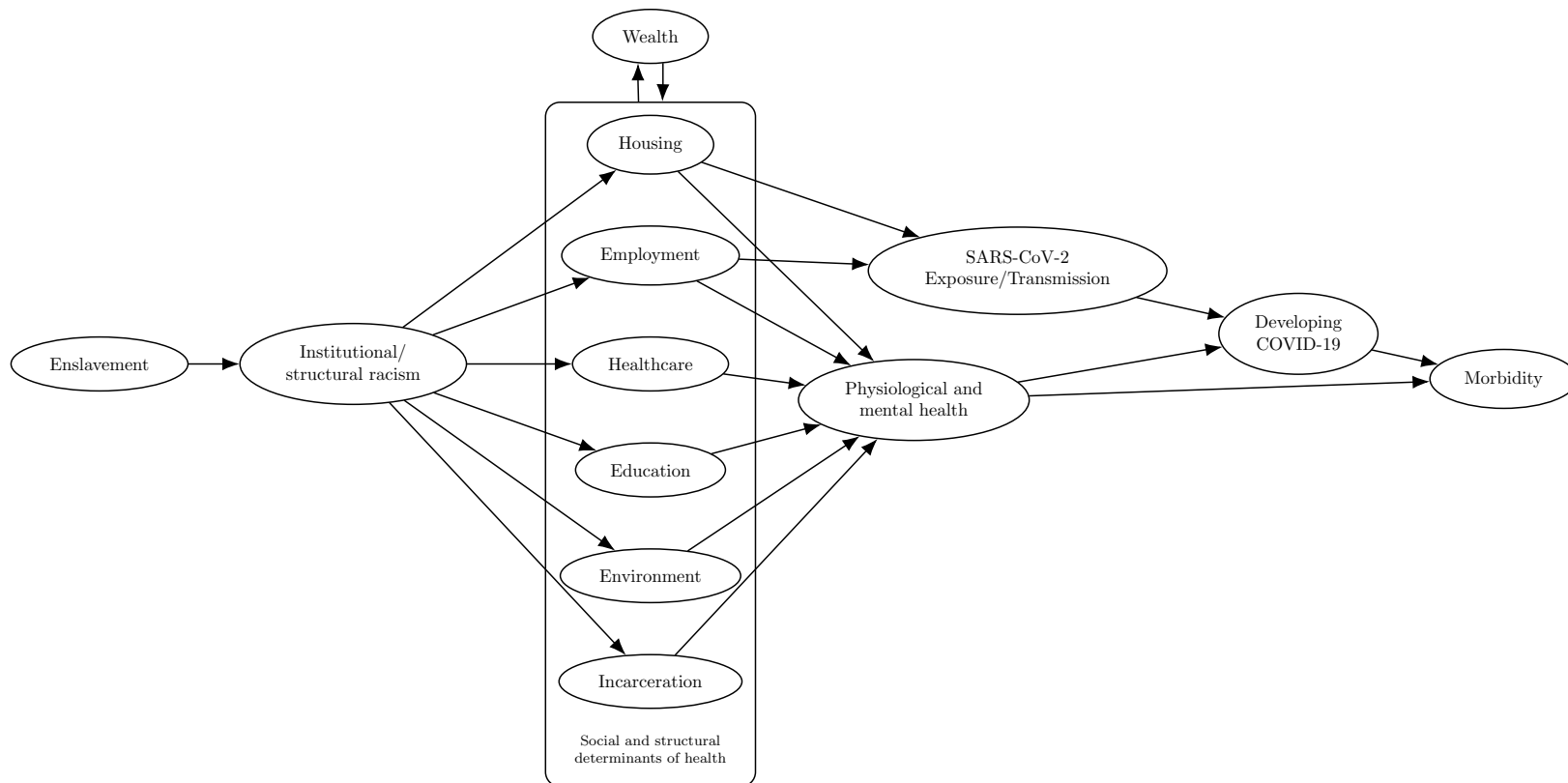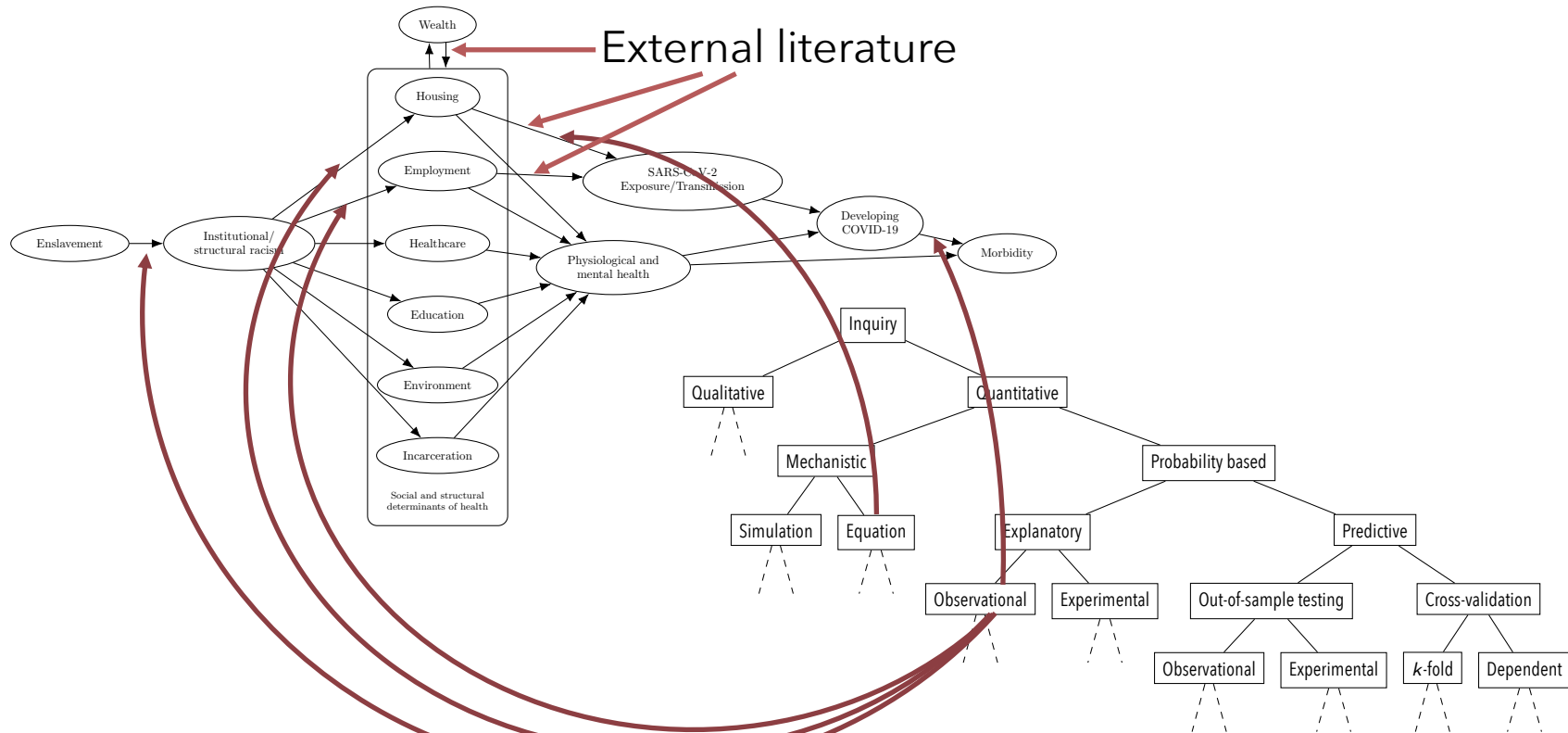
A massive structural argument

Introduction

The problem:
quant against
justice

**Walk through
of and
commentary
on our *Social
Science and
Medicine*
paper**

What are
critical
quantitative
methods?
What *could*
they be?

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Slides: https://www.MominMalik.com/fxb2023.pdf

Piecemeal mix, multiple types of argument

External literature

Slides: https://www.MominMalik.com/fxb2023.pdf

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Matrix population model (mechanistic)

- A transfer like the amount due for reparations (~$800K per household) has never happened before

- Bring it into public health (COVID-19), SIR modeling

$$\mathbf{G} = \begin{bmatrix} g_{b \to b} & g_{b \to w} \\ g_{w \to b} & g_{w \to w} \end{bmatrix} = \begin{bmatrix} \frac{\tau c_{b \to b} \pi_b}{\gamma} & \frac{\tau c_{b \to w} \pi_b}{\gamma} \\ \frac{\tau c_{w \to b} \pi_w}{\gamma} & \frac{\tau c_{w \to w} \pi_w}{\gamma} \end{bmatrix} = \begin{bmatrix} \frac{\beta_{b \to b} \pi_b}{\gamma} & \frac{\beta_{b \to w} \pi_b}{\gamma} \\ \frac{\beta_{w \to b} \pi_w}{\gamma} & \frac{\beta_{w \to w} \pi_w}{\gamma} \end{bmatrix}$$

- Segregation: off-diagonals would have a ratio of around 1:2

- Overcrowding: Higher transmission rate $\beta_{b \to b}$ than $\beta_{w \to w}$, in addition to other factors

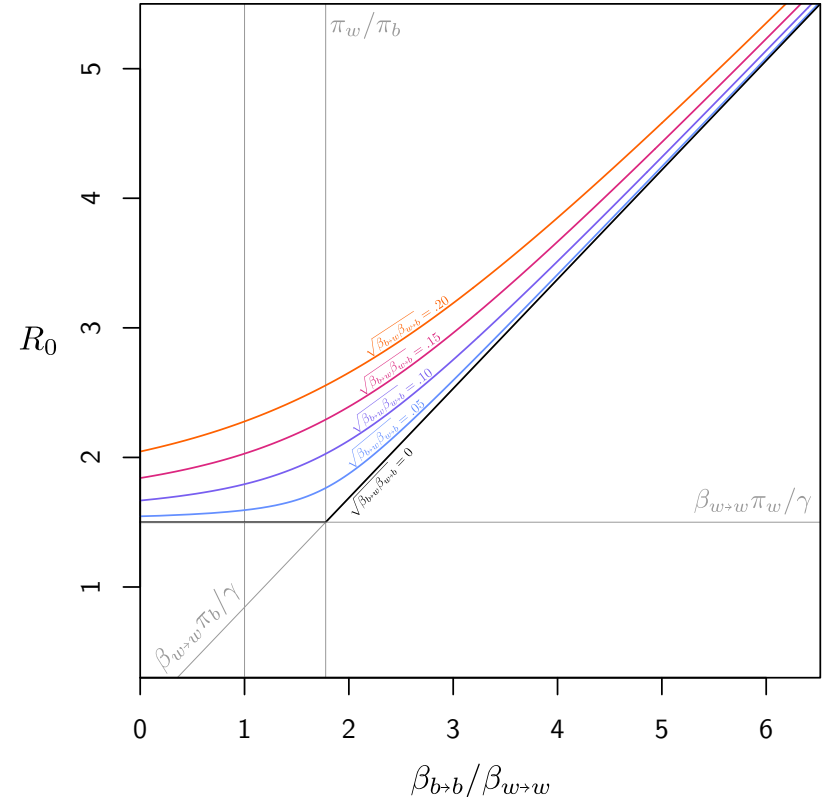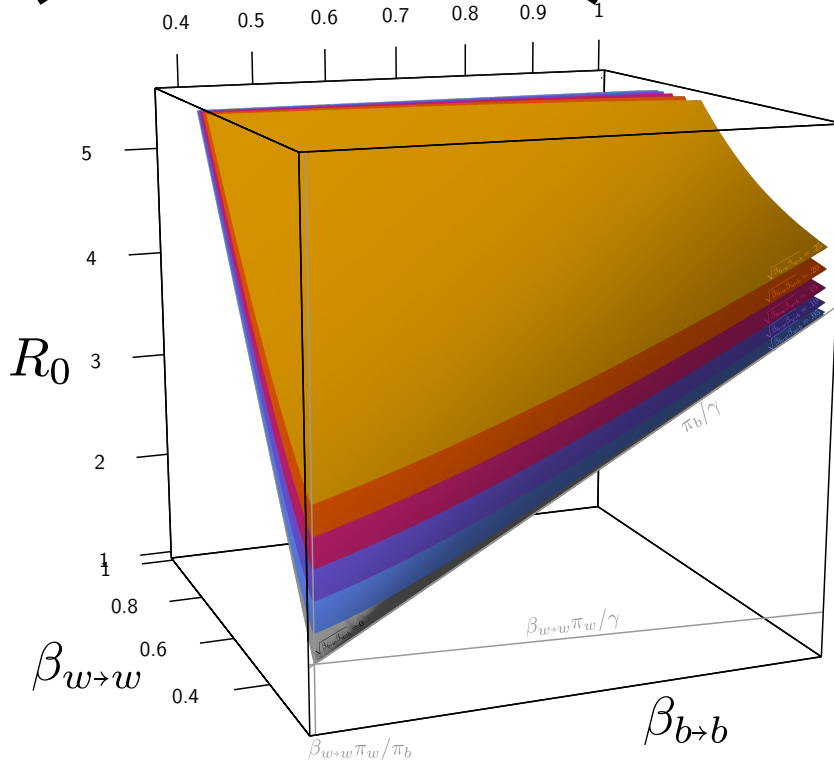# Matrix population model (mechanistic)

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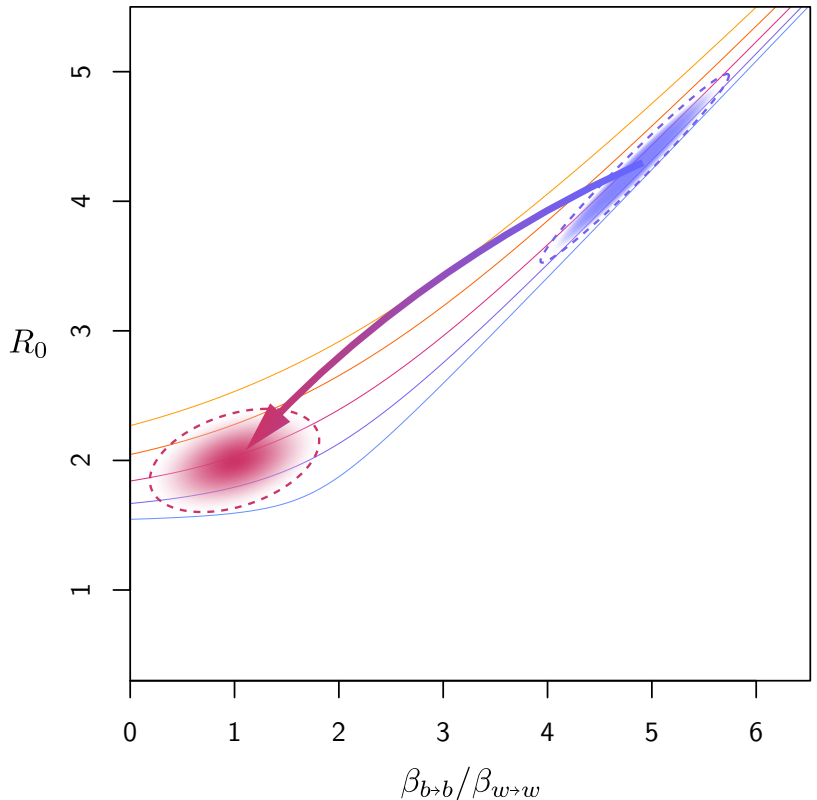
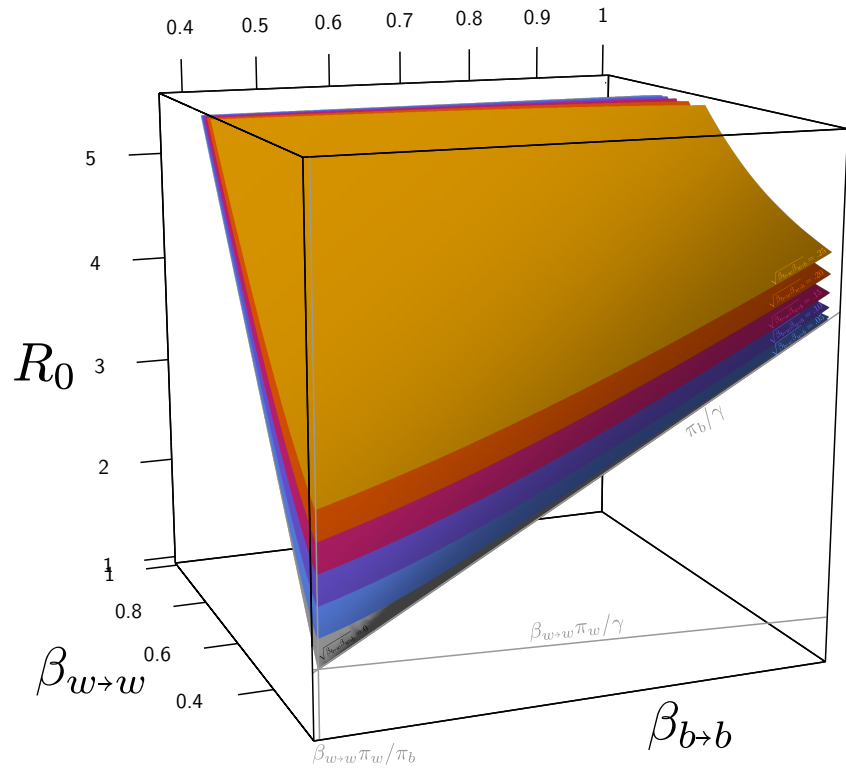References

Comparative argument with South Korea
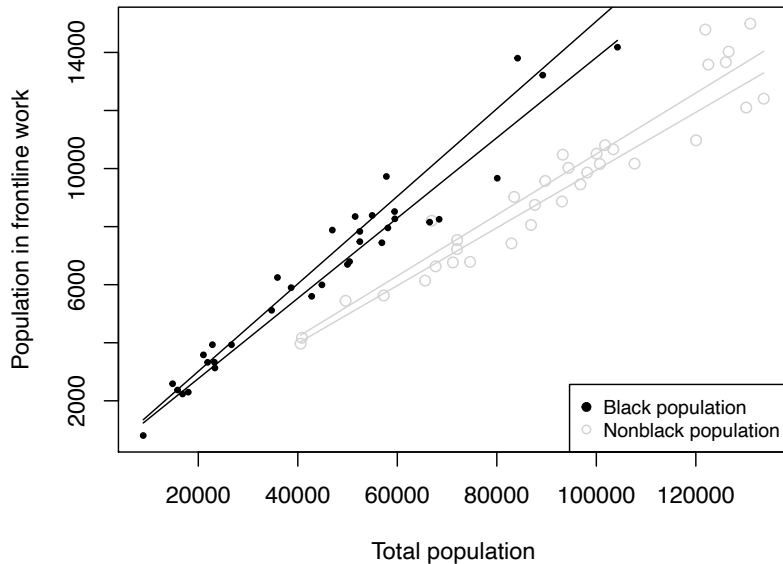
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Racial disparities in employment (observational, statistical)

Louisiana frontline workers, by Parish

Count model coefficients (negative binomial with log link)	Black population		Non-Black population	
	Estimate	95% CI	Estimate	95% CI
$e^{\widehat{\beta_0}}$ (Ratio)	0.1443	(0.1383, 0.1507)	0.1022	(0.0995, 0.1050)
$\widehat{\theta}$ (Dispersion)	61.46	(31.57, 91.36)	155.92	(80.63, 231.21)
Observations	34		34	
$2 \times$ Log Likelihood	-544.656		-543.912	

Racial disparities in housing (observational, statistical)

Louisiana overcrowded housing, by Census tract

	Black population		Non-Black population	
Count model coefficients (negative binomial with log link)	Estimate	95% CI	Estimate	95% CI
$e^{\widehat{\beta_0}}$ (Ratio)	0.0565	(0.0520, 0.0614)	0.0283	(0.0264, 0.0303)
$\widehat{\theta}$ (Dispersion)	1.15	(0.985, 1.35)	1.32	(1.155, 1.507)
Zero-inflation model coefficients (binomial with logit link)				
logistic($\widehat{\alpha_0}$)	0.458	(0.424, 0.492)	0.336	(0.306. 0.368)
Observations	1,090		1,121	
Log Likelihood	−3,060.825		−3,699.218	

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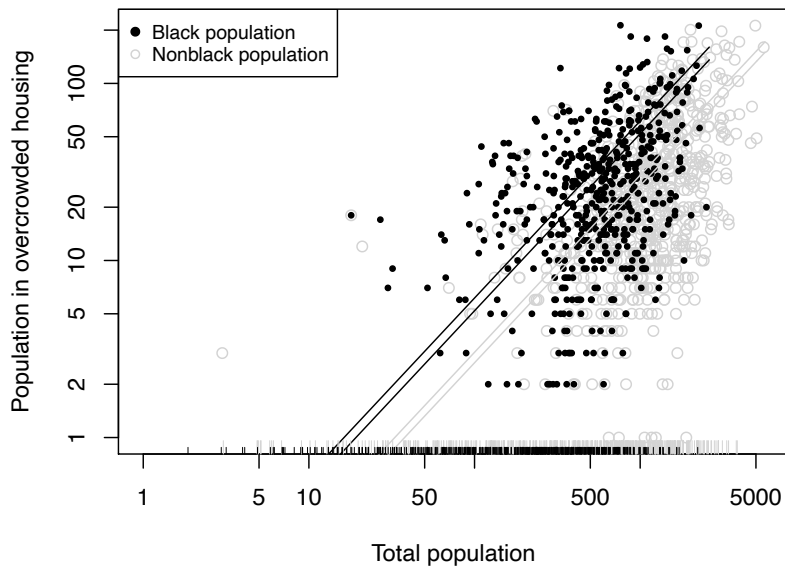at Harvard University

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Many gaps among moving pieces

- Only some of the arrows are justified; and they are not justified in the same ways

- The point? Get around how empirical quantitative methods are inherent conservative, in only being able to study the world that is and has been, with the data that we can get. If we think of that conservatism as a normative set of assumptions, our study is no less (or more) justified than the hegemonic modeling literature

What are critical quantitative methods? What could they be?

Why critical quant?

- Strategic positivism (Wyly)/strategic quantification/strategic modeling (after Spivak's "strategic essentialism") to demonstrate inequality?
  - Rhetorical use: convince power-brokers?
  - Counterpoint: did Du Bois or Well-Barnett's work move the needle on anti-Blackness? (Benjamin, 2019)
- "Counterhegemonic modeling" (Richardson, 2020): modeling ironically to reveal the absurdity of modeling?
- Perspective transformation/critical consciousness: breaking down assumptions to create accomplices? (Malik & Malik, 2021)
- Alternatively: just because quantification is currently associated with power does not mean it is essentially so. Qualitative inquiry can be just as or more oppressive, it just isn't currently in power

Why not critical quant

- Reifying a source of epistemic violence that enables and sustains structural violence

- Toni Morrison: "The function, **the very serious function of racism is distraction**. It keeps you from doing your work. It keeps you explaining, over and over again, your reason for being. Somebody says you have no language and you spend twenty years proving that you do. Somebody says your head isn't shaped properly so you have scientists working on the fact that it is. Somebody says you have no art, so you dredge that up. Somebody says you have no kingdoms, so you dredge that up. None of this is necessary. There will always be one more thing."

How critical quant?

- Minimal: use the same old methods, but interpret the coefficient of "race" as being the effect of *racism* (Bonilla-Silva, Ruha Benjamin).
  - The problems: race in a statistical formulation can't accord with theorizing (Issa Kohler-Hausmann, Lily Hu) because can't disentangle (causal graph language: can't "intervene on structure", which Dan Malinksy has work about), and intervening on "perceived race" doesn't get past structural racism (e.g., a Black family in the 50th percentile of US household wealth means something different than a white family in the 50th percentile of US household wealth)

- Moderate: use the same old methods, but contextualize with theory.
  - Problem: the core assumptions of the statistical formulation are directly in conflict with the theory that is being used to contextualize their outputs (Abbott, 1988)

- Maximal: reimagining.
  - Problem: hard, and would it be useful? Maybe for future imagining, but probably not for present action

Where critical quant?

- No single organized community; but to some extent, many people are doing

- "CritQuant" label in education, but very internal and not aware of tons of relevant prior works

- Institute in Critical Quantitative, Computation, & Mixed Methodologies (ICQCM): currently focused on training, which is the most important work, but I hope to also see it as a future hub

- Much classic sociology work; some great works in statistics, and now in CS/machine learning

- Use of the word "critical" (and to a lesser extent, in CS, "sociotechnical") can serve as signaling by which people can find each other in specific communities

Challenge: realism

- Statistics: most principled and well-developed of quantitative methods in social research, in that it has a theory of how the world is (although one based on mathematical convenience rather than conviction)

- (Machine learning inherits its foundations from statistics)

- (Can talk about simulation modeling, mathematical sociology, "sociophysics", microeconomics… but I've found that, while it may have its place, I believe that even less than empirical quantification)

- Even the mainstream of Bayesian statistics is realist (there is an objective reality; subjective beliefs just help us get there faster)

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Sticking points

- How can we dissolve such a powerful binary?
  - Related: the the actor/analyst (emic/etic) binary (Jardine 2004; Collins 2008)
  - (lateral anthropology [Candea 2018, 2019; Gad and Jensen 2016] flattens how actor and analyst relate, but still has this binary)
- "…cultural studies have maintained a hermeneutics of suspicion toward the methods of quantification. But, to what extent does this suspicion toward quantitative inquiry compromise the deconstructive project of cultural studies by falling into the trap of the quantitative/qualitative and, related, nature/culture binaries?" (Dixon-Román 2016)

Challenge: Meaning-making

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Thin description

Ordinary Language	Mathematical Language

Thinning

1. DELIMITATION
Motivating question posed

2. DENOTATION →

Theoretical model

↓

Motivating question answered
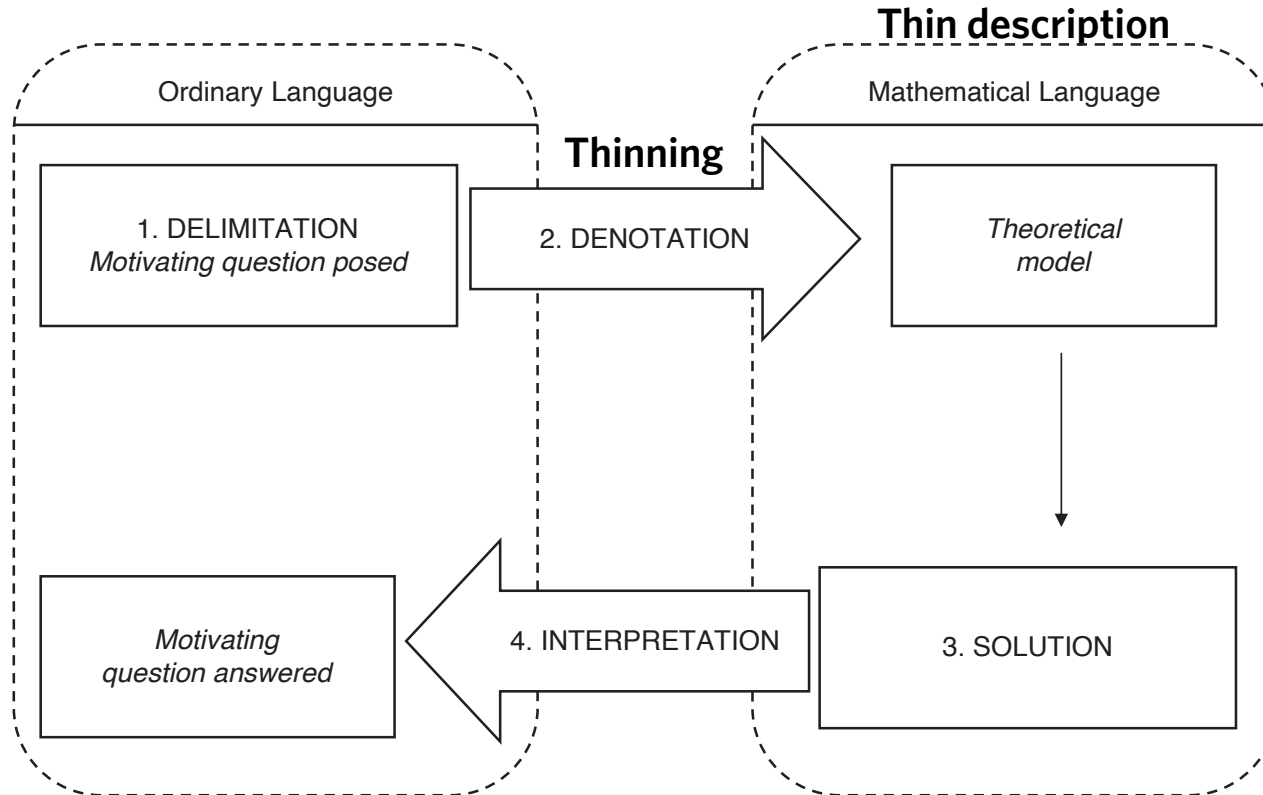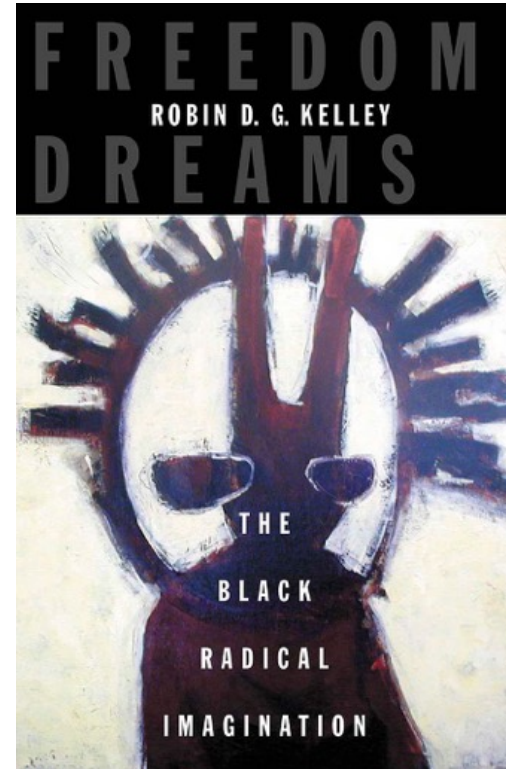
← 4. INTERPRETATION

3. SOLUTION

Diagram: Spiegler, 2015; "thin description": Porter, 2012

Hopes for reimagining

"reparations proposals from black radical movements focus less on individual payments than on securing funds to build autonomous black institutions, improving community life, and in some cases establishing a homeland that will enable African Americans to **develop a political economy geared more toward collective needs than toward accumulation**." (Kelley, 2002)

Abbott A. Transcending general linear reality. Sociol Theory. 1988;6(2):169–186. doi: 10.2307/202114.

Agre PE. 1997. Toward a critical technical practice: lessons learned in trying to reform AI. In: Bowker GC, Star SL, Turner W, Gasser L. Bridging the great divide: social science, technical systems, and cooperative work. Mahwah (NJ): Erlbaum; 1997. 131–157.

Benjamin R. Race after technology: abolitionist tools for the New Jim Code. Polity; 2019.

Collins HM. Actors' and analysts' categories in the social analysis of science. In: Meusburger P, Welker M, Wunder E. Clashes of knowledge: orthodoxies and heterodoxies in science and religion. Springer; 2008. 101–110. doi: 10.1007/978-1-4020-5555-3_4.

Collins HM. "Son of seven sexes": the social destruction of a physical phenomenon. Soc Stud Sci. 1981;11(1):33–62. doi: 10.1177/030631278101100103.

de Sousa Santos B. Epistemologies of the south: justice against epistemicide. Routledge; 2014.

Dixon-Román EJ. 2016. Diffractive possibilities: cultural studies and quantification. Transform Anthropol. 2016;24(2):157–167. doi: 10.1111/traa.12074.

Fay B. Critical social science: liberation and its limits. Cornell University Press; 1987.

Gad C, Jensen CB. Lateral concepts. Engag Sci Technol Soc. 2016;2. doi: 10.17351/ests2016.77

Gelman A, Hennig C. Beyond subjective and objective in statistics. J R Stat Soc Ser A. 2017;180(4):967–1033. doi: 10.1111/rssa.12276

Guba EG, Lincoln YS. Paradigmatic controversies, contradictions, and emerging confluences. In Denzin NK, Lincoln YS. The SAGE handbook of qualitative research. London: SAGE; 2005. 191–215.

Hellman D. When is discrimination wrong? Cambridge (MA): Harvard University Press; 2008.

Horan C. Insurance era: risk, governance, and the privatization of security in postwar America. Chicago: University of Chicago Press; 2021.

Hu L. Disparate causes, pt I. Phenomenal World. 2019 Oct 11. https://www.phenomenalworld.org/analysis/disparate-causes-i/

Hu L. Disparate causes, pt II. Phenomenal World. 2019 Oct 17. https://www.phenomenalworld.org/analysis/disparate-causes-pt-ii/

Hu L. Direct effects. Phenomenal World. 2020 Sep 25. https://www.phenomenalworld.org/analysis/direct-effects/

Jardine N. Etics and emics (not to mention anemics and emetics) in the history of the sciences. Hist Sci. 2004;42(3):261–278. doi: 10.1177/007327530404200301.

Kiviat B. The moral limits of predictive practices: The case of credit-based insurance scores. Am Sociol Rev. 2019;84(6):1134-58. doi: 10.1177/0003122419884917.

Kiviat B. Which data fairly differentiate? American views on the use of personal data in two market settings. Sociol Sci. 2021 Jan 13;8(2):26-47. doi: 10.15195/v8.a2.

References (2/2)

Kelley RDG. A day of reckoning: Black Feminist dreams. In: Freedom dreams: the Black Radical imagination. Boston (MA): Beacon Press; 2002. 110–134.

Kleinman A, Kleinman J. Suffering and its professional transformation: towards an ethnography of interpersonal experience. Cult Med Psychiatry. 1991;15(3):275-301. https://doi.org/10.1007/BF00046540

Kohler-Hausmann I. Eddie Murphy and the dangers of counterfactual causal thinking about detecting racial discrimination. Northwest Univ Law Rev. 2019;113(5)1163-1228. https://scholarlycommons.law.northwestern.edu/nulr/vol113/iss5/6/

Latour B. Reassembling the social: an introduction to Actor- Network Theory. Oxford University Press; 2005.

Malik MM. A hierarchy of limitations in machine learning. arXiv: 2002.05193 [Preprint]. 2020 Feb 29: [68 p.]. Available from: https://arxiv.org/abs/2002.05193.

Malik M, Malik MM. Critical technical awakenings. J Social Comput. 2021 Dec; 4(4):365-384. doi: 10.23919/JSC.2021.0035.

Malinsky D. Intervening on structure. Synthese. 2018;195(5):2295-2312. doi: 10.1007/s11229-017-1341-z

Morrison T. A humanist view. Black Studies Center public dialogue, Pt. 2. Portland State University, Oregon Public Speakers Collection. 1975 May 30. https://mackenzian.com/blog/2014/07/07/transcript-morrison-1975/.

Ochigame R. Informatics of the oppressed. Logic. 2020 Aug 31;11. https://logicmag.io/care/informatics-of-the-oppressed/

Ochigame R. Remodeling rationality: an inquiry into unorthodox modes of logic and computation [dissertation]. [Cambridge (MA)]: MIT; 2021. https://hdl.handle.net/1721.1/140189

Payne G, Payne J. Positivism and realism. In: Key concepts in social research. SAGE, 2004. 171-174. doi: 10.4135/9781849209397

Polanyi M. The tacit dimension. Doubleday; 1966.

Porter TM. Thin description: surface and depth in science and science studies. Osiris. 2012;27(1):209–226. doi: 10.1086/667828.

Tuhiwai Smith L. Decolonizing methodologies: research and indigenous peoples. 2nd ed. London & Zed Books; 2012.

Richardson ET, Malik MM, Darity WA Jr, Mullen AK, Morse ME, Malik M, Maybank A, Bassett MT, Farmer PE, Worden L, Jones JH. Reparations for Black American descendants of persons enslaved in the U.S. and their potential impact on SARS-CoV-2 transmission. Soc Sci Med. 2021 May;276:113741. doi: 10.1016/j.socscimed.2021.113741.

Richardson ET. Epidemic illusions: on the coloniality of global public health. MIT Press; 2020.

Spiegler P. Behind the model: a constructive critique of economic modeling. Cambridge University Press; 2015.

Wyly E. Strategic positivism. Prof Geogr. 2007;61(3):310-322. doi: 10.1080/0033012090293195

Zuberi T, Bonilla-Silva E. White logic, white methods: racism and methodology. Rowman & Littlefield Publishers; 2008.