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# How Medical Technologies Materialize Oppression

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Biomedical practice can encode and perpetuate oppressive ideologies. This encoding and perpetuation, scholars like Liao and Carbonell (2023) convincingly argue, can occur not only via social practices, but also through medical technologies themselves. In other words, medical technologies can "materialize oppression": they can be biased in a way that systematically "reflects and perpetuates unjust power relations" (Liao and Carbonell 2023, 9).

In this paper, I examine *how* medical technologies materialize oppression, offering a preliminary, non-exhaustive taxonomy of the mechanisms of this materialization. While scholars like Liao and Carbonell focus primarily on physical medical instruments, I offer new examples that illustrate these mechanisms at work, focusing on medical data classification technologies and infrastructures. A clearer view of how these mechanisms operate suggests possibilities for building technologies that liberate rather than oppress.

## THE "REFERENCE MAN" MECHANISM

Meet Reference Man. Created in 1975 to simplify experimental calculations of radiation exposure, he is "between 20 and 30 years of age, weighing 70 kg, is 180 cm in height … is a Caucasian and is a Western European or North American in habitat and custom" (ICRP 1975). The (often implicit) use of "Reference Man" in medicine—i.e. the practice of taking the bodies of politically dominant groups to be the species norm—is a mechanism for materializing oppression.

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Liao and Carbonell's (2023) discussion of the pulse oximeter, a widely used device for measuring blood oxygen saturation, offers an example of this mechanism in action. The pulse oximeter has been found to be less accurate for Black patients, leading to underdiagnosis of hypoxia. Scholars argue that the historical and ongoing treatment of white bodies as the norm—and nonwhite bodies as deviations—led to the development and widespread acceptance of the pulse oximeter in medical practice, despite these dangerous inaccuracies (see Liao and Carbonell 2023).

"Reference Man" can also be found lurking in a high-profile 2017 study claiming to show a greater than 50% decline in sperm counts from 1973 to 2011 (Levine et al. 2017). The authors of the study chose to classify sperm count data into the geopolitical categories of "Western" vs. "Other" countries, and used the average sperm count of men in 1973 "Western" countries as the species norm against which all other average sperm counts were compared. As my colleagues and I have argued elsewhere (Boulicault et al. 2021), the unquestioned use of this data classification scheme over other equally or more scientifically warranted classification schemes (e.g. "urban" vs. "rural"), implicitly situates bodies labeled "Western" as exemplary, natural, and now imperiled. As such, this scheme invokes "powerful and pernicious narratives around gender, sex, race, ethnicity, and anxieties about changing demographics in 'Western' countries and the future of 'Western' civilization" (Boulicault 2021). Indeed, the research on sperm count decline has been taken up by white supremacist and misogynistic groups to support a narrative that the fertility of men in whiter "Western" nations is in danger, linking the danger to immigration, a perceived increase in ethnic and racial diversity, and to the influence of feminist and anti-racist social movements (Boulicault et al. 2021).

## ESSENTIALIZING SOCIAL DIFFERENCES

Medical technologies can also materialize oppression through the biological essentialization of social differences. Race essentialism is the view that differences across races are biologically determined, and sex essentialism is the view that differences across sexes are likewise biologically determined. A well-known example of this mechanism in action can be found in the spirometer, a device for measuring lung capacity. Given observed differences in average lung capacities between patients of different races, spirometers are designed to "race-correct," i.e. to take into account a patient's race when measuring their lung capacity. Despite evidence that these average differences are primarily caused by social and environmental conditions, spirometric race-corrections are widely interpreted to reflect differences in innate, essential biology. This unwarranted interpretation, scholars like Lundy Braun (2005) and Liao and Carbonell (2023) argue, results from and reinforces racist narratives of Black inferiority, and results in the underdiagnosis of lung dysfunction in Black populations, thereby perpetuating racial health injustices.

For another example, consider how sex categories are used in research on COVID-19 health outcomes. Early in the COVID-19 pandemic, researchers observed a striking trend: men were more likely to suffer adverse COVID-19 outcomes than women. Although evidence suggested that these differences were largely a result of social differences—such as gendered differences in occupations and health behaviors—researchers looked primarily to innate, sex-linked biology for explanations, investigating, for example, the use of sex-hormone-based treatments (Boulicault et al. 2022). This kind of unwarranted sex essentialism "can divert attention and resources away from investigations of social causes of disparities" (Boulicault et al. 2022). Further, the focus on essential sex differences masked intra-group variation and led researchers and the public to overlook, for instance, the fact that, though men had higher morality rates than women overall, Black women had higher mortality rates than white men (Rushovich et al. 2021). As such, COVID-19 data sex classification systems that facilitate unwarranted sex essentialist assumptions can materialize oppression across multiple social axes.

## INVISIBILIZING

In some cases, medical technologies materialize oppression through the categories they *don't* include. Consider again COVID-19 data classification. Research found that few US state-level public health agencies explicitly collect data on trans and nonbinary people (Perret et al. 2021). And although many states include an "unknown" sex/gender category in their classification infrastructures, the meaning of this category is often unclear and discordant across states. The result is that trans and gender-expansive people—and in turn how the pandemic affects these vulnerable populations—are made invisible, reflecting and perpetuating oppression of these communities (Perret et al. 2021).

## ASSUMPTION EMBEDDING

Rebecca Jordan-Young describes how measurement technologies embed assumptions, arguing that measures are "vehicles through which assumptions travel in studies without being tested" (Jordan-Young 2011, 55). When those assumptions are oppressive, assumption embedding materializes oppression. Consider, for instance, the two most widely-used technologies for measuring human fertility: semen analysis for men, and ovarian reserve testing (ORT) for women. Both male and female fertility—defined as the ability, under certain specified conditions, to produce offspring—changes as we age. Yet only ORT builds this temporal information into the fertility measurement technology itself. Elsewhere (Boulicault 2021), I've argued that this temporal discrepancy in fertility measurement technologies is not warranted by evidence. Instead, this discrepancy is a result of heteronormative, racialized and gendered assumptions that positions women as responsible for reproduction and family life.

## FEEDBACK LOOPS

In the United States, high-risk care management programs provide intensive healthcare services to patients who are at risk of ongoing serious health issues. Entry to these programs is often determined by algorithms, which are used to evaluate approximately 200 million Americans every year. Obermeyer et al. (2019) found that one such algorithm systematically underestimated the risk faced by Black patients. It did so because it used the amount of medical care received by a patient in the past as an indicator for the amount of medical care the patient would need in the future. Because Black patients have historically received less medical care due to systemic racism, this indicator was reliable for white patients, but not for Black patients. And because the risk-prediction algorithms relied on this unreliable indicator, Black Americans were enrolled less often in care-management programs, which would in turn, result in Black Americans receiving less medical care in the future. What results is a self-perpetuating feedback loop: Black Americans unjustifiably will receive less medical care in the future because they have unjustifiably received less medical care in the past.

## CONCLUSION

My hope is that this taxonomy can serve as a tool for both understanding how medical technologies can materialize oppression and, more importantly, that it can help us find ways to harness these mechanisms to build medical technologies that materialize *justice* instead. It must be emphasized, however, that this will not be a simple task. Recall the example used to illustrate the "invisibilizing" mechanism: COVID-19 state-level data classification infrastructures render the concerns of trans and gender-expansive communities invisible. A seemingly natural solution is to introduce more gender categories. Yet, given histories of stigmatization, surveillance and abuse of trans and gender-expansive individuals and communities by clinicians and medical researchers, simply adding categories for trans and gender-expansive people into public health data infrastructures comes with risks. As such, building medical technologies that promote social justice and liberation will require not only technical work but also robust social and ethical work that engages deeply with the histories, experiences and expertise of the marginalized communities that these medical technologies are intended to serve.

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