

Binary Optics: Colonial Classification of Trans Lives in Algorithmic Technologies

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Abstract

This article argues that algorithms are not neutral, but encode colonialist visions from the past into the present that disproportionately harm trans lives. I argue that colonial classification regimes brought forward by Western states that sought to sort, order and classify humans into binary categories—such as binary gender—are extended through algorithmic technologies into the present. This contemporary encoding of colonial classification reinscribes the default notion of binary gender, which makes algorithmic technologies unequipped to account for nuances of gender diversity, failing to comprehend those defying binary categorisation, and directing violence towards trans lives. I suggest that, only by tracing the colonial origins and development of broader sociopolitical ideals of human classification and differentiation along axes of race/gender into algorithmic code, it becomes visible how colonial logics historically permeated and prevail through novel means to this day – curating a ‘binary optics’ continued by algorithmic operations. Critically, this enables us to unveil and understand the extent and implications of how algorithmic technologies encode harmful and exclusionary practices.

Introduction

While political incentives to implement algorithmic technologies—popularly labelled as novel, revolutionary ‘AI’ systems—continue to starkly rise globally, so does the immediate need for frameworks that assess their discriminatory outcomes and perpetuated injustices; especially, how they continue legacies of colonial and cishnormative violence that harm racialised and gendered minorities—and in particular trans people—from the classificatory operations embodied by algorithmic technologies that reiterate colonial practices of binary classification into unjust categories of race/gender (Amaro 2022; Browne 2015; Buolamwini 2024; Costanza-Chock 2018; Perilo et al. 2024; Quinan and Hunt 2022; Scheuerman et al. 2021; Tacheva and Ramasubramanian 2023). This point of analysis is important for adequately understanding the workings of algorithmic technologies and aiding the liveability of trans people. Yet, this perspective often gets omitted from critical research on algorithmic bias,

fairness or discrimination, which puts trans people at further risk in an increasingly algorithmic reality.

Despite the promises presented by the hype around AI, algorithms have been proven to be neither neutral nor operationalise the world objectively nor innovatively solve pressing issues of society, but participate in concealing and (re)producing problems of hierarchised differentiation and human valorisation based on colonial logics of binary gender. Prominent scholarship accentuates how facial recognition software algorithms are unable to comprehend trans faces, resulting in an essentialising of gender as immutably binary and trans-exclusionary, which puts trans people at significant risk of harm (Keyes 2018; Scheuerman et al. 2021) as they “claim the face as a new site for “scientifically” classifying gender/sex [and] the White, cisgender face as the “natural” standard that must be protected from racialized, gender non-conforming “others.”” (Scheuerman et al. 2021, 10-11). Similarly, airport body scanners at borders configure trans bodies as deviant from their encoded cisgender body template and flag them as security threats (Hall and Clapton 2021; Wilcox 2017), while digital nation states increase the administrative violence and bureaucracy for trans citizens’ access to welfare services (Andersen 2024; Hicks 2019). Social media platforms catalyse loops of anti-trans content without being designed with trans communities in mind (Kender and Spiel 2025). In this light, it is understandable that trans people report higher negative attitudes towards AI than cis people (Haimson et al. 2025).

However, while gesturing to the problematic facets of algorithmic technologies for trans people, scholarship has not outlined a comprehensive account of the colonial legacies of classification underlying algorithmic infrastructures or traced a holistic history of the interlocking discontinuities, moments and transformations between colonial classification regimes of binary gender and the operative gaze of algorithmic systems. The questions are, how do algorithmic technologies reiterate colonial patterns and desires of human classification from the past, and how are trans people implicated by the binary gaze of these systems? In which ways

have colonial classification practices cemented binary gender as the truth into the fabrics of society, and how are algorithms embedding this notion of life into the digital reality?

In this paper, I argue that colonial classification regimes of binary gender are not distant vignettes from a dark and far-flung past, but rather, are reinvigorated by and co-constitute the algorithmic technologies of the present. This reality exacerbates disproportionate forms of violence towards trans lives that appear undeniably obscure and are often blurred within an inescapably codified world and human existence under the guise of ‘complexity’ or ‘progressiveness’ that in return make them more difficult to trace or unveil.

In recognising and dismantling systems of classification, this paper, as a part of my PhD, argues that attending to the realities of trans people enables a crucial exposure of the facets of algorithmic violence directed at trans people, but also extends the scope of analysis beyond that. Trans lives, in their diverse, multifaceted and ambiguous nature, are not fixed, neatly measurable binary entities, which make possible a further unveiling of the ways in which algorithms—from their inherent binary configurations—fail to perceive the full extent of the lives they are trying to render. Algorithmic technologies continue not only the colonial project of inscribing binary gender, but exclude and discriminate against those not adhering to this idea of ‘gender’.

Only by changing the optics to consider the sociopolitical infrastructures of counting and differentiating life as binary that algorithms have been developed within, we can truly begin to uncover and untangle the harm. In what follows, I outline the premise of my PhD and its core incentives for tracing the entangled colonial issues of algorithmic classification and its implications for the liveability of trans people.

Classificatory Formations: From Colonial Classification to Algorithmic Classification

The central premise of analysis is that, during the colonialist endeavours of Western nation states, an overarching urge to classify and sort humans into binary categories of race/gender emerged, rendering human life only possible along the axes of white/coloured and man/woman (Schiwy 2007) through the “premise that the totality of human life can conform to them” (Mortensen 2012, 13) or be existentially dismissed. These binary forms of categorisation established an artificial yet effective mechanism of controlling, dividing, and restricting human life into hierarchical indexes of value.

This colonial logic of classification, I take to be the coded imposition of the body as a technology and territory of knowledge extraction, which slowly evolved through sophisticated differentiating practices. My PhD examines these various practices in terms of e.g. slavery data collection schemas of race/gender categories, physio-phrenological practices aimed at ascribing truth onto measurements of the skull, body and facial traits to enforce the binary outline

of the human alongside discourses deeming those not adhering to this default as innately fraudulent and deceptive. Nowadays, algorithmic technologies continue this classification in an accelerated automated format that “serve[s] to reinscribe this colonial order by reproducing—and automating—essentialized (and racialized) notions of gender/sex difference” (Scheuerman et al. 2021, 8) to inscribe and reinforce the gender binary through the concealment of code.

I contend that a meaningful and critical approach to gender, politics and algorithms requires a historical genealogical tracing of the various sociotechnical classification techniques and their development over time as the underlying operative logics woven into algorithms. I pose that, shifting the focus to tracing *how* this came to be over time and from where the reduction of life originated, *which* logics underlie what it entitles to classify, and *the ways* algorithms encode legacies of colonial classification principles, means moving closer to understanding the lived implications of algorithms along with modes of refusing and recoding the injustices.

I aim to trace a co-constitutive history of algorithms and trans lives to understand the intricacies, tensions, impossibilities and potentials between algorithms as categorisation of humans and trans as a human category to make visible the engineered essentialist harms and persistent colonial visions reiterated by algorithmic code. In proposing this conceptual framework, I not only criticise the perpetuated harm, but unveil and destabilise the naturalised ideas of binary gender and algorithmic objectivity to illuminate the entrenched structural colonial imperatives of racialised and gendered oppression powering algorithmic technologies. Methodologically, my PhD moves beyond suggesting technical fixes, analysing one singular technology or statically stating that the coloniality of binary gender poses an algorithmic problem. Instead, I adopt a critical genealogy that traces how logics of colonial classification are reiterated through algorithmic code – emerging from the colonial origins of human classification, matured over the development of nation state administrative and statistical calculations, and later became automated into the code of algorithmic technologies.

What is currently at stake in our contemporary moment is not only that of scalar AI advancements, but how integrating algorithmic technologies into the fabrics of society—embedded in an ever-intensifying political landscape—stands to automate the eradication of trans liveability and elimination of human rights. As a counteract to this violent global development, my PhD provides a critical account of the intersection between trans liveability and algorithmic classification; namely, how colonial regimes of binary gender multifariously undergird the classificatory outcomes of our present algorithmic reality, while stealthily reifying colonial boundaries along binary lines as an ontological control over life and which lives can be lived. In this way, it provocatively unsettles and reframes the mechanisms by which gender is compulsively recodified through algorithmic logics.

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References

- Amaro, R. 2022. *The Black Technical Object: On Machine Learning and the Aspiration of Black Being*. Sternberg Press.
- Andersen, C. K. 2024. Decoding Digital Denmark: Assessing the State of Algorithmic Violence and Trans (Un)Liveability in Denmark. *SocArxiv* preprint. <https://doi.org/10.31235/osf.io/986dc>
- Browne, S. 2015. *Dark Matters: On the Surveillance of Blackness*. Duke University Press.
- Buolamwini, J. 2024. *Unmasking AI: My Mission to Protect What is Human in a World of Machines*. Random House.
- Costanza-Chock, S. 2018. "Design justice, AI, and escape from the matrix of domination." *Journal of Design and Science* 3(5): 1-14. <http://dx.doi.org/10.21428/96c8d426>
- Haimson, O., Mayworm, S., Ingber, A., and Andalibi, N. 2025. AI Attitudes Among Marginalized Populations in the US: Nonbinary, Transgender, and Disabled Individuals Report More Negative AI Attitudes. In *Proceedings of the 2025 ACM Conference on Fairness, Accountability, and Transparency (FAccT '25)*, 1224-1237. New York: Association for Computing Machinery. <https://doi.org/10.1145/3715275.3732081>
- Hall, L. B., and Clapton, W. 2021. Programming the machine: gender, race, sexuality, AI, and the construction of credibility and deceit at the border. *Internet Policy Review*, 10(4): 1-23. <https://doi.org/10.14763/2021.4.1601>
- Hicks, M. 2019. Hacking the Cis-tem. *IEEE Annals of the History of Computing*, 41(1): 20-33. <https://doi.org/10.1109/MAHC.2019.2897667>
- Kender, K., and Spiel, K. 2025. Social Media as Marginalisation Machine: The Trans Desire for Solidarity Spaces. In *Proceedings of the 2025 CHI Conference on Human Factors in Computing Systems*. 1-17. New York: Association for Computing Machinery. <https://doi.org/10.1145/3706598.3713136>
- Keyes, O. 2018. The misgendering machines: Trans/HCI implications of automatic gender recognition. In *Proceedings of the ACM on human-computer interaction 2*, CSCW 1-22. New York: Association for Computing Machinery. <https://doi.org/10.1145/3274357>
- Morgensen, S. L. 2012. Theorising gender, sexuality and settler colonialism: An introduction. *Settler Colonial Studies*, 2(2): 2-22. <https://doi.org/10.1080/2201473X.2012.10648839>
- Perilo, M., Valença, G., & Telles, A. 2024. Non-Binary and Trans-Inclusive AI: A Catalogue of Best Practices for Developing Automatic Gender Recognition Solutions. *ACM SIGAPP Applied Computing Review*, 24(2): 55-70. <https://doi.org/10.1145/3687251.3687255>
- Quinan, C. L., and Hunt, M. 2022. Biometric bordering and automatic gender recognition: Challenging binary gender norms in everyday biometric technologies. *Communication, Culture and Critique*, 15(2): 211-226. <https://doi.org/10.1093/ccc/tcac013>
- Scheuerman, M. K., Pape, M., and Hanna, A. 2021. Auto-essentialization: Gender in automated facial analysis as extended colonial project. *Big Data & Society*, 8(2): 1-15. <https://doi.org/10.1177/20539517211053712>
- Schiwy, F. 2007. Decolonization and the question of subjectivity: Gender, race, and binary thinking. *Cultural studies*, 21(2-3): 271-294. <https://doi.org/10.1080/09502380601162555>
- Tacheva, J., and Ramasubramanian, S. 2023. AI Empire: Unraveling the interlocking systems of oppression in generative AI's global order. *Big Data & Society*, 10(2): 1-13. <https://doi.org/10.1177/20539517231219241>
- Wilcox, L. 2017. Embodying algorithmic war: Gender, race, and the posthuman in drone warfare. *Security dialogue*, 48(1): 11-28. <https://doi.org/10.1177/0967010616657947>