A Third University is Possible? A Collaborative Inquiry within Engineering Education

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Abstract:

Engineering education is a terrain of struggle dominated by capitalist, white supremacist, and settler colonial logics and structures. Dominant forms of engineering education today function to reinforce these interlocking logics and structures, exacerbating existing societal inequities by distorting life-giving relationships to land, labor, and lives in ways that are incommensurable with decolonial projects. Put another way: the long-standing societal inequities on which EuroAmerican capitalism relies are sustained by engineering education as we know it.

Within the United States, colleges and universities are the primary sites for the reproduction of dominant engineering education. As such, engineering education researchers within colleges and universities exist at a critical junction capable of shifting dominant engineering education toward an anticolonial praxis. Drawing from la paperson's 2017 text *A Third University is Possible,* we come together as settler scholars to unpack ways in which our structural agency can be used to reconfigure assemblages within the university towards its largely unprecedented operation as decolonizing, or "third" universities.

La paperson's text does not explicitly address engineering epistemics or pedagogical commitments specifically but offers an overall critique of concepts such as productivity, economic contribution and achievement that ground the familiar "second" (neoliberal) US university today. Leveraging a collaborative inquiry methodology, we have learned from each other as a group from the social sciences, engineering education, and engineering through memoing and dialogue. We know we reproduce that which we desire and struggle against, occupying inherently incommensurable positions. As we intentionally cultivate hope for ourselves through our collaboration, we leverage transformative justice tools toward a praxis of collective accountability to counter settler moves to innocence discussed in Tuck and Yang's essay *Decolonization is not a metaphor.*

Introduction

> If we can begin to acknowledge this fundamental truth - that genocide *is this place* (the American academy and, in fact, America itself) - then our operating assumptions, askable questions, and scholarly methods will need to transform. At a moment of historical emergency, we might find principled desperation within intellectual courage.
>   --Dylan Rodríguez (2012, p. 812) [1]

> My position is impossible, a colonialist-by-product of empire, with decolonizing desires. I am, and maybe you are too, a produced colonist. I am also a by-product of colonization. As a colonialist scrap, I desire against the assemblage that made me. This impossibility motivates this analysis, which seeks not to resolve colonialist dilemmas but to acknowledge that they include specific machined privileges that may be put to work in the service of decolonizations.
>   --la paperson (p. xxiii) [2]

In the 2017 book, *A Third University Is Possible*, la paperson [2] offers a technological analysis of the machinery and assemblages that structure the university– its infrastructures, in the broadest use of that term–framing the institution as an amalgamation of first, second, and third universities. These terms do not refer to distinct categories of institution, or even to sequential iterations of the same school: they are the multiple functionalities of the modern university. To la paperson, the first university is the academic-industrial complex, the colonial space of accumulation and expansion, of neoliberal linkages between the production of knowledge and revenue generation; it is the R1 where STEM and particularly engineering are situated and animated through large governmental and corporate research grants. Simultaneously, the first university accumulates through student debt, where the "ability to turn anyone into a debtor is what fuels the first university towards inclusion" (p. 38). The first university is built upon enduring legacies of chattel slavery, land grants, and colonization.

The second university is composed of the independent schools and "liberal arts" colleges, ideologically committed to critical theory and critique as means for societal transformation; the transformation shall come through the deconstruction of systems and the personalized pedagogies of self-actualization. While it can meaningfully counter the academic-industrial complex as a more democratic and participatory academy, the second university remains circumscribed within the ivory tower with an end goal as a pedagogical "utopia that everyone should and can attend," (p. 43), with its expansion dependent on the continued accumulation of the first university. When viewed through Max Liboiron's definition of colonialism as "settler and colonial access to Indigenous Land, concepts (like decolonization and indigenization), and lifeworlds to advance settler and colonial goals, even if they are benevolent ones," (p. 26) [3] the utopian visioning of the second university can be understood as underpinned by settler moves to

innocence. Tuck and Yang describe settler moves to innocence as "those strategies or positionings that attempt to relieve the settler of feelings of guilt or responsibility without giving up land or power or privilege, without having to change much at all," (p. 10) [4], naming colonial equivocation as one of these moves where forms of social justice work are conflated with decolonization in ways that reinforce colonialism [4].

The third university holds a mission of decolonization and is materialized through the "scrap material" of the first and second universities, functioning to break down and produce counters to the first and second universities. In *A Third University Is Possible*, la paperson discusses decolonization as "the double movement of anticolonialism and rematriation - restoring the futures that Indigenous land and life were meant to follow. … Decolonization is, put bluntly, the repatriation of land, the regeneration of relations, and the forwarding of Indigenous and Black and queer futures - a process that requires countering what power seems to be up to" (pp. xxii and xv) [2]. Our aim with this paper is to consider engineering education as a site where first and second universities interact, where the interactions of these two universities can animate the third.

How, we ask, would engineering education need to see itself, and its position in the academy, to support a turn from violence and privilege that mark the first and second universities, to enact change toward and care of the third? Recent observers have made clear that what can be useful "scrap material" is not easily determined, but the effort must be made if we are to transform the harmful conditions endemic in engineering and the academy today. Grande [5] theorizes the academy as "*an arm of the settler state*" (p. 48, emphasis in original) in order to make space for collaborations and collusions between abolitionist and decolonial theorizations of the academy stemming from Black radicalism and critical Indigenous studies geared toward a refusal of the university. Harney and Moten [6] discuss professionalism, the reproduction of professions, as the critical approach of the university, positioning the work of the critical academic as a site of professional negligence around the structures they/we uphold through critique; this is perhaps one form of the self-consoling integrationism of a neoliberal polity that Curry points to [7]. Harney and Moten too grow wary and weary of the problem-posing approaches that never seem to materialize into solutions, as Holly Jr. and Masta put it [8]. Harney and Moten also posit the fugitive space of the undercommons as a site for this waryness, a constantly shifting constellation of void defects in but not of the university that constitute a "nonplace of abolition," that is "not so much the abolition of prisons but the abolition of a society that could have prisons, that could have slavery, that could have the wage, and therefore not abolition as the elimination of anything but abolition as the founding of a new society," ([6] p. 42). It is within this framework of the university, a settler structure, an academic-industrial complex that houses third universities, that we situate ourselves.

We loosely framed this exploration as one of collaborative inquiry, learning from each other as a group from the social sciences, engineering education, and engineering through memo-ing and dialogue. We have structured this paper to mirror the Highlander Research and Education Center's model for change [9]: we begin by recognizing root causes embedded in systems and structures (e.g., colonialism, racism, militarism, individualism, etc.) and our positionality in relation to these. Building on shared values of community, movement-building, learning, and wellness, we seek to listen deeply to one another and to scholars in our midst, centering experiences and critical reflections of those directly impacted. We then pose questions in hopes of identifying possible spaces and opportunities for collective transformation and liberation, exploring the promises and limitations of life-affirming technologies already being deployed in a variety of settings.

Our Positions of Embarkation; Our starting points?

To distinguish between the second and third universities and thus empower change, we turn our attention to our intentions.

> Amy: Radical and activist scholars guide us to understand that dismay and reformist inclinations in no way equate with care, and we find here a powerful confrontation with ameliorative programs of "tolerance" and "diversity" [10-11]. But we want to focus in this paper on the specific caveat perhaps most pertinent to those aspiring to confront the EER establishment, ie., ourselves: that is, the awareness that critique is not equivalent to change. Curry [7] makes clear that critique can in fact foreclose action, by preserving the institutions (and intellectual traditions) that reward the critical project; this project of critique, and the career-building it facilities, we think, are precisely the second-university's manifestations of engineering education research. When I imagine that as a doubter I somehow stand outside the second university, outside of the STEM establishment in its educational and workforce expressions, I mistake the nature of my life circumstances, my day-to-day security. There are few "outsides" for the tenured academic, and in particular, wherever I, the cis-gendered, abled, white, U.S.-born tenured academic go, I am inside. As Curry demonstrates, for Black persons there is only incongruity [7]; ie, there is no "inside" in U.S. society and its institutions. We need to be careful about the claims of solidarity we offer to marginalized communities, and any promises to make something different. But this shouldn't keep us from aiming, informed by history and critique and cognizant of how these inclinations differ from abolition, for the elimination of current practices and institutions like those of the first and second university.

Donna: I dearly hope and want to believe that a third university is possible, yet I am wary of academia's tendency to co-opt and neutralize even the most powerful liberatory constructs. When I dare to hope, I check my privilege - is my hope merely naive self-consolation, a pretense that systemic injustice can be ended through a set of neat, simple, well-designed actions? While the university has perhaps provided some shelter to dissident voices, and even fostered certain movements for change, we must not pretend the university can somehow stand separate from an unjust society. As a queer activist who fought over 15 years to change the position of a protestant denomination on LGBTQ+ ordination and marriage, I know well that these enormous policy shifts, while certainly significant, did not end heterosexism and transphobia in church or society. At the same time, cynicism presents a problematic inertia. Does doubt in the possibility of a third university justify the status quo? How dare I, in my privilege as a white settler tenured faculty member, underestimate the power of organized movements to make change? My queer activism has taught me that even small shifts can make a life-or-death difference in the lives of individuals, and that a sea change can occur within institutions through deliberate organizing. Even losses, though painful, are crucial catalysts and builders of sustaining community. As a department head in an engineering discipline, I benefit from the trappings of academic middle management. While I resist this notion, the tacit bargain was to exchange one type of power - the free voice of a tenured faculty member engaging critical scholarship - for another - that of an administrator who can shift reward structures and influence institutional priorities. In the department head role, I see the university's systemic inequality in ways I was not privy to before. I am incensed, disgusted, disheartened, and at times despairing of any prospect for change. Some mentors tell me that I need to survive in my position in order to make change at this level - but I do not feel those ends justify these means.

If only I were a smarter strategist who could find the levers to bring down the old system, or stand up the new - but that's not how this works. That's not how it was meant to work. I contemplate giving up my position, or the academy entirely - equally untenable as I realize there is no outside for me. I see our discipline of engineering education as experiencing similar tensions - playing rigor games to survive within engineering [12], struggling and failing to create a liberatory space, reproducing dynamics of oppression. With all this in the balance, the only option is to dare yet hope, and dream, and risk, and act, and try again. I am confident in this path because of powerful educational experiences in my own life that have reoriented me - for example, an experience during a "work week" at Highlander that challenged me to viscerally shift my relationship with work. While it is difficult for me to articulate, the experience of breaks from work in community was so powerful that it began to break down the engineering-capitalist-protestant work ethic so deeply ingrained in me from all aspects of my very WASPy (and very engineering) formation.

Joey: As the closeted-until-grad school queer, white Latinx settler child of unionized state workers, I was/am trained to seek the full set of privileges of the "settler," "the idealized juridical space of exceptional rights granted to normative settler citizens and the idealized exceptionalism by which the settler state exerts its sovereignty. The "settler" is a site of exception from which whiteness emerges. Whiteness is property; it is the right to have rights; it is the legal human; the anthropocentric normal is written in its image" (p. 10) [2]. It was this training that led me to believe in the notion that the research and development of "green" battery technology offer a primary solution to climate disaster and its interrelated ecological collapse, a belief that was reinforced and fortified by university studies of and pushes to professionalize into materials science and engineering (MSE). Within MSE, there exists a fundamental (epistemic? ontologic? axiologic?) discontinuity around the willful reduction of material conditions to techno-economics and greenwashed claims toward sustainability that I couldn't contextualize until I engaged meaningfully in labor, abolitionist, environmental, and other forms of community organizing during my graduate studies. Those shifts, critical consciousness raising processes per Freire [13], would have been impossible with my engineering education in MSE alone (by design). Alongside an embrace of my queerness that I had long suppressed in my seeking of the full set of privileges of the "settler," those shifts put me on the path to understanding that the logics, promises, and processes of violence animating and driving environmental injustice simultaneously animate and drive dominant engineering today, including access to land as resource and the violent processes that comprise the settler colonial structures required to maintain that access [2]-[4], [14]-[19]; see Table 1 for a schema of some of the processes.

There is a presence that comes from the generative internal conflict of shifting away from innocence, away from the false notion of terra nullius that dominant engineering thrives on, of choosing not to strive for a constructed and fortified juridical space, of wading through the complicity in harmful relations inherent to existing in the first university. As an abolitionist engineer, I too desire against the assemblages that made me and experiment with assemblages of the scraps of the first and second universities, with the agency of the scyborg that la paperson describes [2]. As an interstitial defect presently located at the spatial overlaps between the lattices of power known as engineering and engineering education research in the academy, I seek atomic rearrangements (pod maps!) [20] and conditions that grow third university cracks in this structure, desiring that the crack lengths become critical enough to forward the Indigenous and Black and queer futures these lattices have long functioned to suppress and obliterate [2].

Table 1: Modern promises and the colonial processes that subsidize them, reproduced from Stein (settler) [21].

Systems	Modern Promise	Colonial Process
Capitalism (Economic system)	Continuous economic growth and wealth accumulation	Racialized expropriation and exploitation of humans and other-than-human beings
Nation-state (political system)	Security and order; protection of people and property; cohesion through shared identity	State-sanctioned violence, including policing, prisons, borders, and global militarism
Universal reason (intellectual system)	A single, universally relevant knowledge system that offers certainty, predictability, consensus	Suppression and attempted obliteration of other knowledges (epistemicide); knowledge used to index and control the world
Extractivism (ecological system)	Infinite consumption of 'natural resources' for human use	Climate change; biodiversity loss; denial of the intrinsic worth of other-than-human beings
Separability (relational system)	Independence, individualism, and unrestricted autonomy	Refusal of interdependence and its related responsibilities

If engineering is the process through which logics/ideologies are manifested materially through the design and assemblage of technologies, dominant engineering is a means of reproducing the settler state and its (false) promises. The language of dominant engineering we use throughout this paper stems from Liboiron's use of the term dominant science, where "*dominant* keeps the power relations front and center, and it's these power relations I am usually discussing," (p. 20) where it becomes "dominant to the point that other ways of knowing, doing, and being are deemed illegitimate or are erased" (p. 21) [3]. Dominant engineering is a structure, an assembled set of technologies, affixed by the political and ideological superstructures [22] represented as systems in Table 1 and the infrastructures maintaining colonial processes in Table 1. If we as settler engineers, engineering educators, and engineering education researchers are to act on the imperative advanced by the Red Nation that "the path forward is simple: it's decolonization or extinction. And that starts with land back," (p. 7) [18] how are we connecting to and resourcing the mass movements that have been giving form to decolonial paths for generations? What fatal couplings of power and difference (Gilmore, 2002) [23] that structure dominant engineering can we sever or rearrange towards these ends? How?

To grapple with these questions, we work with la paperson's *A Third University Is Possible* [2] in the context of engineering education within the academy to leverage what Max Liboiron has discussed as an infrastructural theory of change [24]. Liboiron themself draws on both la paperson and Michelle Murphy's *The Economization of Life*, where Murphy write that, "I call them infrastructural to underlie the ways knowledge-making can install material supports into the world - such as buildings, bureaucracies, standards, forms, technologies, funding flows, affective orientations, and power relations" (p. 6 [25], cited [25]). The authors offer this paper with the understanding that Maldonado and Meiners articulate, in which:

> our allegiance and accountability are to movements that engender material redistributions and to the production and circulation of analysis and labor capable of cracking this political moment, even temporally, to free up more lives. We write from one place we inhabit, the university ... to make visible emergent lines and arrangements of power and resistance that inhibit and build abolition. We … write to find our people (p. 72) [26].

Dominant Engineering and Industrial Complexes

> Decolonization, which sets out to change the order of the world, is, obviously, a program of complete disorder. But it cannot come as a result of magical practices, nor of a natural shock, nor of a friendly understanding. Decolonization, as we know, is a historical process: that is to say that it cannot be understood, it cannot become intelligible nor clear to itself except in the exact measure that we can discern the movements that give it historical form and content.
> - Franz Fanon (p. 2) [27]

Through Fanon's framing of decolonization, we can understand the historical process of decolonization through its movements. In queering academic postcolonial discourse toward the post + colonial, la paperson discusses how "posts+ are not 'exit signs' from colonialism, like the way *postracial* or *postcolonial* is sometimes conceived, but sites for reanalyzing colonial and decolonial activities. Apprehending the post+colonial is to feel the beyond and before of it, 'the *not yet* and, at times, the *not anymore*' of Indigenous sovereign land and life," posting in relation to colonialism (p. xxii) [2]. Shorter offers a visualization of this sort of post+ing through "The Great Chain of Being," a sixteenth- through nineteenth-century concept through which "European intellectuals understood our entire system of life as a great chain wherein power and intelligence extended from the highest point (God), down to the most lifeless substances, rocks" (p. 30) [28]; see Figure 1. In it, the triangle "represents how settlers like to imagine Native people: behind them in terms of civilization, below them in terms of societal advancement, or, in the rare instances that assume contemporaneity, perhaps above settlers in terms of not being

tainted by capitalism or materialism," (p. 31) where the posts+ can give insight toward the degree to which the triangle and y-axis expand or contract through re-entrenchment or dissolution of colonialism as an assembled set of technologies and the infrastructures maintaining those technologies. Gaining a historical understanding of the powers upholding the engineered infrastructures that manufacture and maintain these technologies, the energy these technologies use and leverage, and the forces that drive the movements giving decolonization historical form and context can help us situate the position and trajectories of dominant engineering and engineering education. We can also situate ourselves within these structures.
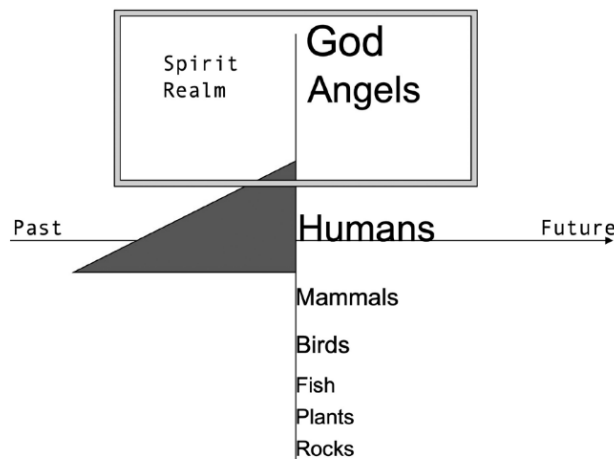

Figure 1: Shorter's "visualization of the Great Chain of Being with time axis and representations of Indigenous people," (p. 33), Figure 2 from [28].

The term engineering derives from the word engineer, dating back to early modern references to builders of military engines, primarily mechanical contraptions used in war, leading to a need to distinguish civil engineering as a way for engineers to specialize in non-military project construction [29]. These origins resource colonial warfare, continuing through to modernity in the form of industrial complexes. Our use of the term, "industrial complexes" is in itself complex, a multi-scalar object of analysis [23] broken up into statements, in much the way that Hill Collins and Bilge discuss complexity as a core theme of intersectionality [30]. They unpack distinct but interrelated domains of power that industrial complexes cross: interpersonal, disciplinary, cultural, and structural [30]. It is these domains of power that we leverage to deconstruct relationships structuring the assemblage of dominant engineering.

Dominant engineering builds and maintains the material infrastructures of industrial complexes

Hill Collins and Bilge [30] discuss how the structural domain of power refers to the ways intersecting power relations organize, shape, and structure institutions and organizations. These

infrastructures uphold interconnected industrial complexes structured to maintain the systems outlined in Table 1. In Figure 2, we offer a rendition of an industrial complex, an assemblage designed to intertwine industry with social or political systems and institutions, as a concrete slab creating a separation between the various buildings built upon the slab and the land on which the slab sits. The buildings each represent their own industrial complex, sometimes analyzed individually (e.g. the academic-industrial complex) sometimes in relation to each other (e.g. military and prison industrial complex [18]). The slab sits on stolen land, represented as gold both for the ways it is viewed as a natural resource to be extracted for profit and for the ecological damage the existence of the slab has caused. Dominant engineering is tasked with growing and maintaining the industrial complex, researching and training engineers on how to construct ever taller, more efficient buildings upon a foundation meticulously tested for cracks and reinforced for 'optimum' performance of the dispossession of life.
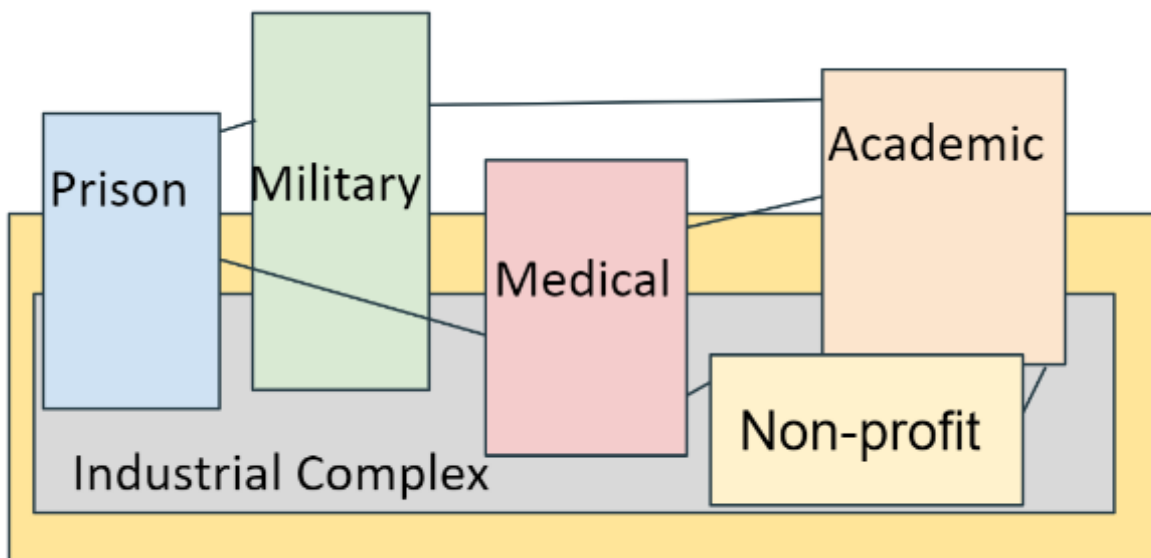

Figure 2: An industrial complex, home to interconnections amongst the prison, military, medical, academic, and non-profit industrial complexes represented as buildings, built on and in the industrial complex. The industrial complex lies atop stolen land.

Dominant engineering has an industrial complex

Hill Collins and Bilge discuss how "when it comes to the organization of power, ideas matter in providing explanations for social inequality and fair play" (p. 10) [30]; that is, the ideas circulated and the means by which they are circulated shape the cultural domain of power. In taking up the formulations of "diversity, equity and inclusion" (or, DEI) since the early 2000s, engineering education and workforce planning in the U.S. have enacted a particular project of

fairness. This is one in which innate endowments of talent and fortitude, as defined by existing economic systems (capitalism) and epistemic enterprises (universities and occupations), will rightly result in differing degrees of economic and personal security for individuals and in which, due to the supposedly replete cultural transformations of the previous decades, race, gender and other identifications cannot possibly be playing a role [31]. Meritocratic ideologies support industrial capitalism's long-standing stratified wage structures and vice versa. For example, the idea of engineering classrooms as inclusive, tolerant sites of learning fully shaped by DEI intentions makes complete sense of divergent educational opportunities across communities: not everyone can be an engineer, in every sense of those words. If we are unbiased, the absence of Black students from graduate programs in STEM, say, can only be explained by the intellectual and behavioral deficits of absent persons. That is, the "post-racial" U.S. need worry no more about anti-Black, misogynistic, anti-trans or other social-structural "flaws" and accepts that some persons will have greater wealth, more secure property rights, assured access to healthcare, greater environmental safety, and generally less difficult life circumstances than others; the achievement of well-being is contingent on one's ability.

With this foundation, resources for education, and DEI efforts to find the "missing millions" of BIPOC and women engineering personnel, proceed from extremely narrow and conciliatory presumptions [32]. Across thousands of research projects, policy studies and program descriptions–funded by many millions in public and private research grants–we see no mention of white supremacism, anti-BIPOC and anti-gay violence, Black mass-incarceration or other documented conditions of the 2020s. These conditions are defined by the formal universe of DEI discourse and planning as unrelated to "under-representation." The fact that Black communities in the U.S. live in the afterlife of slavery [33], or that trans folks are murdered with regularity, are not ignored; rather these events are unthinkable in proximity to efficacious engineering.

DEI as a neoliberal catchall academic term functions with an aim of reconciliation, laden with moves to innocence obscuring notions of equity that act with an ethic of incommensurability. As Tuck and Yang discuss,

> …an ethic of incommensurability, which recognizes what is distinct, what is sovereign for project(s) of decolonization in relation to human and civil rights based social justice projects … guides moves that unsettle innocence, stands in contrast to aims of reconciliation, which motivate settler moves to innocence. Reconciliation is about rescuing settler normalcy, about rescuing a settler future. Reconciliation is concerned with questions of what will decolonization look like? What will happen after abolition? What will be the consequences of decolonization for the settler? Incommensurability acknowledges that these questions need not, and perhaps cannot, be answered in order for decolonization to exist as a framework." (pp. 29 and 35) [4]

Ideas form the basis of discipline in the discipline of dominant engineering, the psychological complex engineering education instills in engineers through the disciplined manufacturing processes of professionalization directed to grow industry.

Dominant engineering professionalizes the building and maintaining of industrial complexes

Hill Collins and Bilge discuss how "in essence, power operates by disciplining people in ways that put people's lives on paths that make some options seem viable and others out of reach," (p. 9) where "different people find themselves encountering different treatment regarding which rules apply to them and how those rules will be implemented," (p. 9) [30]. Through the privileging of technical knowledge and expertise that the U.S. as a settler colonial nation state concentrates in dominant engineering, engineers are well resourced to research, design, test, and build material infrastructures upon stolen lands. Professionalization into the branching disciplines of dominant engineering has long required the disciplining of engineers to maintain the infrastructures of the industrial complex. As Harney and Moten discuss, "professionalization is not the opposite of negligence but its mode of politics in the United States," (p. 12) naming it "unwise to think of professionalization as a narrowing and better to think of it as a circling, an encircling of war wagons around the last camp of indigenous women and children" (p. 13) [6]. This negligence as a mode of politics is itself engineered, systematized into dominant engineering education through the rigor/us [12] manufacture of engineers to uphold colonial processes. Dominant engineering normalizes the industrial complex through the disciplining of professionalization. To refuse this normalization is to be made illegible in the professionalized practice dominant engineering.

The infrastructures maintaining and maintained by dominant engineering are upheld through the interpersonal interactions that shape the education and professionalization of engineers

Hill Collins and Bilge [30] describe how "power relations are about people's lives, how people relate to one another, and who is advantaged and disadvantaged in social interactions," (p. 7) where intersectionality can be leveraged as an analytical lens to highlight "the multiple nature of [how] individual identities … differentially position each individual," (p. 7). The interpersonal is often the level we experience the normalized harms of dominant engineering most intimately, where the disciplining of engineers, engineering educators, and engineering education researchers becomes visceral. Per la paperson, the level where "you are sensing how power 'in your face' is jointed to global latticeworks of power" (p. 64) [2].

The product of dominant engineering is industry itself, acting to construct, stabilize, and validate the material infrastructures of (prison, military, medical, academic, nonprofit, etc.) industrial complexes. The current and longstanding hegemonic condition is one where engineering is synonymous with industry, structurally maintained in such a way that engineers are professionalized through technical or techno-economic rationalizations that advance the colonial

processes outlined in Table 1. As engineering educators and engineering education researchers, our entangled positions within the superstructure of this engineering-industrial complex in assemblage provides us the potentiality to study, teach, and otherwise build relationships that sever the fatal coupling of power and difference that constitute the social formations maintaining this hegemonic condition [22], [23]. Positioning engineers as those who build and maintain industrial complexes is simultaneously "common sense," in that engineers build the infrastructures of modernity, and also potentially a break from precepts of dominant engineering when industrial complexes are understood as the socio-political constructs of death-making.

In her 2007 book *Golden Gulag*, Ruth Wilson Gilmore [34] traces the political economy of prisons through California's history of welcoming and benefiting from the presence of defense contractors, laying the groundwork for the development of the state's prison system. Stringent sentencing guidelines introduced in the 1970s brought significant increases in incarceration rates and severe prison overcrowding. Political rhetoric emphasized traditional moralistic and punitive responses to societal transgressions and deemphasized rehabilitative approaches, and state officials responded by allocating funds, labor, and land toward expanding the capacity of the California prison system, despite economic recession, until it became the largest in the world. Racialized notions of criminality play out over this infrastructure.

The role of construction engineers in literally designing and building this infrastructure of white supremacy, and the role of industrial engineers in optimizing their efficient function, are briefly mentioned in Gilmore's analysis. She discusses a capital cost reduction study undertaken in 1996 by David Ashley and Melvin Ramey [35], both then civil engineering professors in the University of California system:

> the central *problem* remained crime and its mitigation through imprisonment, and the *solution* turned on cost-effectiveness in the design-bid-build sequence for prison construction – rather than any reevaluation of, for example, the relation between crimes (old or new), education, and recidivism. (p. 118) [34]

Gilmore goes on to say that,

> the unspoken power of this study lies in the way the university presents itself, via its sober, analytical engineering faculty, as an eminently efficient institution. (p. 118) [34]

So efficient, she notes, that the University abandoned affirmative action as "an inefficient (nonmarket) mode of resource allocation." (118) [34]

Gilmore notes in that passage the mis-framing of the problem, pointing us toward the abolitionist questions the engineers didn't ask. Can there be an engineering that asks abolitionist questions? That builds infrastructural support for social systems and life-affirming institutions that eliminate the need for incarceration? For those of us "in but not of" the academy, it is this break that we

seek to expand through everyday actions that telescope into collective power. A shifting of the trajectory of engineering and engineering education toward the abolition of the fatal couplings of power and difference maintaining engineering in assemblage with the industrial complex.

Life-affirming technologies

> If the academy is concerned about not only protecting and maintaining Indigenous intelligence but also revitalizing it on Indigenous terms as a form of restitution for its historic and contemporary role as a colonizing force (of which I see no evidence), then the academy must make a conscious decision to become a decolonizing force in the intellectual lives of Indigenous peoples by joining us in dismantling settler colonialism and actively protecting the source of our knowledge: Indigenous *land*.
>
> - Leanne Betasamosake Simpson, As We Have Always Done, P. 172 [15]

As the academy is the primary nucleation site for the education and professionalization of engineers and for the growth and reproduction of dominant engineering, engineering education and the research thereof can function not only as superstructural vectors for the interruption of dominant engineering and the engineering-industrial complex it sustains and is sustained by, but its abolition. Building on Gilmore's multiscalar object of analysis that holds a goal of figuring out "what [and who] makes oppressive and liberatory structures work, and what [and who] makes them fall apart," (p. 17) [23], la paperson seeks a multiscalar subject of power in their use of scyborg, elaborating:

> I am using subject here to include a person (the scyborg) who is interpellated in lattices of power (the scyborg is at once subjugated by power, produced as a subject by power, and a subjective participant in power) but also the wills, forces, and desires that surround and exceed a person (the scyborg in assemblage). The scyborg is a who/what that powers multiscalar dynamics in lattices of power. (p. 64) [2]

It is this agentic, multiscalar subject of power, the scyborg, that we can embody to act across scales of engineering, engineering education, and engineering education research. Toward this end, we can leverage the set of axioms which la paperson offers as propositions upon which the structure of a third university can be built:

1. It already exists. It is assembling. It assembles within the first and second universities.
2. Its mission is decolonization.
3. It is strategic. Its possibilities are made in the first world university.
4. It is timely, and yet its usefulness constantly expires.
5. It is vocational, in the way of the first world university.
6. It is unromantic. And it is not worthy of your romance.
7. It is problematic. In all likelihood, it charges fees and grants degrees.

8. It is not the fourth world.
9. It is anti-utopian. Its pedagogical practices may be disciplining and disciplinary. A third world university is less interested in *decolonizing the university* and more in operating as a *decolonizing university.*
10. It is a machine that produces machines. It assembles students into scyborgs. It assembles decolonizing machines out of scrap parts from colonial technology. It makes itself out of assemblages of the first and second world universities. To the degree that it accomplishes these assemblages, it is effective. (p. 52-53) [2]

It is here that Grande's suggestion of "a parallel politics of dialectical co-resistance" (p. 60) [5] between "abolitionist and decolonial theorizations of the academy as articulated through Black radicalism and critical Indigenous studies, respectively," (p. 47) through "a corpus of shared ethics and analytics: anti-capitalist, feminist, anti-colonial," (p. 61) can be particularly salient for the interlinked fields of engineering, engineering education, and engineering education research. As Tuck and Yang discuss [4], "enslavement is a twofold procedure: removal from land and the creation of property (land and bodies). Thus, abolition is likewise twofold, requiring the repatriation of land and the abolition of property (land and bodies)," (p. 30). Decolonization, as a double movement of anticolonialism and rematriation [2] does not have a synonym and is not a metaphor [4], although its movements can find resonance with abolitionist movements, particularly as Grande describes, through refusal.

Tuck and Yang [36] discuss refusal in the context of research, naming ways they have embedded refusal "throughout the[ir] research process, at all stages of inquiry," (p. 815), saying:

> Refusal makes space for recognition, and for reciprocity. Refusal turns the gaze back upon power, specifically the colonial modalities of knowing persons as bodies to be differentially counted, violated, saved, and put to work. It makes transparent the metanarrative of knowledge production—its spectatorship for pain and its preoccupation for documenting and ruling over racial difference. Refusal generates, expands, champions representational territories that colonial knowledge endeavors to settle, enclose, domesticate. We again insist that refusal is not just a no, but is a generative, analytic practice. (p. 817) [36]

Refusal as a generative, analytical practice can take the form of caretaking. In *The Red Deal*, The Red Nation describes how "caretaking is often unrecognized work that is heavily gendered, severely criminalized, and never fairly compensated," (p. 23) delineating that "a green economy should be born from, and center the labor and needs of, caretakers," (p. 23) described as "educators, healthcare workers, counsels, water protectors, and land defenders" (p. 23) [18]. Caretaking within the academic-industrial complex can be an abolitionist, anticolonial strategy of presencing and "standing with." As Kim TallBear describes, "a researcher who is willing to learn

how to "stand with" a community of subjects is willing to be altered, to revise her stakes in the knowledge to be produced" (p. 2) [37].

One example that glimpses decolonizing care-laden strategies is the Pre-Engineering Education Collaboratory (PEEC) project at Oglala-Lakota College [38]. At Oglala-Lakota College (OLC), pre-engineering education shifted its center to support tribal sovereignty, developing local expertise and addressing community priorities on the Pine Ridge Reservation. This meant becoming place-based, preserving and incorporating Indigenous knowledge and perspectives, and honoring the tribe's non-extraction commitments. In student-centered and experiential learning, students improved the quality of life of tribal members while also earning credentials in, for example, aspects of green construction. Such an approach disrupts managerial tendencies in engineering, values rather than stigmatizes practical knowledge or trades certifications, and neutralizes the epistemic violence of engineering education by recognizing, honoring, and incorporating these elements holistically. Finally, the deep care embedded in OLC's value of non-abandonment could not form a starker contrast to dominant engineering education's weed-out culture. Students attend OLC as long as it takes, and in one of the highest poverty zip codes, the community comes together to find the resources for students to continue to completion. With the implementation of these approaches using constructivist pedagogies, retention rose from 20 to 60 percent, the number of graduates doubled, and they enjoy a 96 percent placement rate of students into jobs on the reservation (i.e. staying in the community to further the nation's goals), or into graduate school. Such an approach further disrupts mainstream diversity discourse around talent shortages. The value of technoscientific mastery is not contribution to industry's bottom line, high salaries, or capitalism writ large - it is the furtherance of the Lakota nation (and is aligned with its non-extraction commitments).

While the PEEC collaborations in South Dakota and three other states live within existing power dynamics between predominantly white universities and tribal colleges, and likely reproduce some of those dynamics, at the same time one can glimpse the possibilities of la paperson's third university. Care work as an affirmation of life is already embedded in pieces of the first and second universities, work that can take anticolonial shifts through what could be understood as abolitionist strategies. The folks at Rustbelt Abolition Radio discuss three distinct yet interrelated flavors of abolition that each engage with forms of refusal:
1. Autonomist Abolition entails a strategy of fugitivity or constant refusal of the instruments of capture and their "catch all solutions" while, at the same time, building hyperlocal (though dispersed in undetectable networks) infrastructures for sustaining bodies (people, collectives, swarms) in resistance.
2. Insurrectionary Abolition entails a direct confrontation and antagonizing of the "big P" Police and its constant attempts to maintain order, while simultaneously attempting to liberate occupied territories.

3. Procedural Abolition entails winning and defending non-reformist reforms enshrined in policies that diminish the reach of the carceral state while simultaneously redirecting collective capacities towards social infrastructures that do not reinstate carceral instruments of capture and control. [39]

Autonomist Abolition can be understood through the framing and methodology of mutual aid, which Dean Spade discusses as "collective coordination to meet each other's needs, usually from an awareness that the systems we have in place are not going to meet them," (p. 7) [40]. Spade outlines three key elements of mutual aid as:

1. "Mutual aid projects work to meet survival needs and build shared understanding about why people do not have what they need," (p. 9)
2. "Mutual aid projects mobilize people, expand solidarity, and build movements," (p. 12)
3. "Mutual aid projects are participatory, solving problems through collective action rather than waiting for saviors," (p. 16)

Mutual aid structures often function at the size of research labs [41]. Abolitionist educator Mariame Kaba offers a lens into how these sort of community-based safety projects are already operating through "1 Million Experiments," emphasizing that the aim is not to present alternatives to police and prison but rather the building of different structures grounded in transformation instead of punishment [42]. Lab structures in engineering could be realigned toward mutual aid projects, refusing dominant engineering and acting simultaneously as spaces of engineering, engineering education, and engineering education research. As many organizers are naming, we need mass movements of millions of people to refuse the death-making of this industrial complex structure, for which dominant engineering acts as a keystone [40], [42], [18]. We as engineers, engineering educators, and engineering education researchers cannot continue to rely on a relational system that separates us from these mass movements.

Insurrectionary abolition is outside of the scope of this paper, a refusal on our end that we hope leaves space for your own radically imaginative practice as to how it may connect to dominant engineering, engineering education, and engineering education research. Procedural abolition within the academy can be framed through a lens of transformative justice. Drawing from movements within university contexts and the staircase of accountability for individuals in the Creative Interventions toolkit [43], Stas Schmiedt and Lea Roth from Spring Up discuss stages of accountability and taking responsibility at organizations or institutions where there is normalized harm, see Table 2 [44]. They particularly highlight how activists and organizers are catalysts that drive continual community pressure for the organization or institution to further its efforts to take accountability or responsibility when the institution has deemed it has done enough.

Table 2: Stages of accountability and taking responsibility for normalized harm in organizations or institutions. Drawn from Stas Schmiedt and Lea Roth's discussion with Mariame Kaba [44].

Stage	Description and Institutional Response
Whistleblower	An individual or group of people come forward naming normalized harm. This can often be connected to specific, egregious incidents. Response is typically denial and gaslighting.
Performative Apology	Escalation from community members demanding the institution addresses the harm. Response is a performative apology without shifts in behavior.
Committee is formed	Continued pressure leads to the formation of an institutionally committee comprised of activists and institutional actors with little institutional power. The committee investigates the harm and generates a list of recommendations or suggestions. Response is an acknowledgement of recommendations, but often no meaningful engagement.
Assessing the problem	Some form of audit, survey, working group, and/or hiring of external consultants. Results may or may not be publicly released. Responses often neglect to mention specific ways the assessment will be acted on (if at all).
Create a support role	Hiring of a representative of the community into a tokenizing, support role. This is often one of the suggestions from the problem assessment and is a first tangible action taken by the institution.
Shifting in community norms	Implementation of new curriculum, new onboarding practices, new reporting mechanisms. Stage where you start seeing institutional or cultural change as consistent and ongoing shifts as a result of the problem assessment. Stops being performative and begins to function as a new transformation.
Institutionalization of changes	High level administrators, trustees, and/or board members going through a new training or review process.
Systemic leadership change	Systemic leadership change to reflect the community, apology for complicity in ongoing normalized harm, reparations. Complete reconfiguration of the structure of the institution, who has power within it, and resourcing the apology.

Another glimpse of life-affirming technologies related to the third university can be found in Aotearoa/New Zealand. As part of reparations settlements related to the 1840 Treaty of Waitangi, school lands were transferred from the Crown to various Maori tribes (Iwi), with the

government subsequently paying rent to the tribes for continued university operation [45]. This shift in monetary and real estate assets accompanied and facilitated further shifts in cultural assets. Bilingual and bicultural education has been part of public education there for decades, and Maori knowledge and Maori traditions have a more central place in universities in Aotearoa/NZ than in other settler nations such as the United States. In this context, Maori scholars Angus and Sonja McFarlane have advanced the Braided River approach (He Awa Whiria) [46] to marry Indigenous and western knowledges across many disciplines including engineering [47].

It is important to not misunderstand this example. Reparations have not been a perfect solution for past injustice, and tribal compensation has been riddled with inequities that continue to be expanded, corrected, and revised [48]. It does provide to us in North America a glimpse of the possibilities of shifting power and resources. (It also suggests the essential importance of shifting material and cultural assets, not just epistemics.) What if the considerable resources identified within U.S. land grant universities [49] were returned to tribes? What could be different if those universities rented from the indigenous caretakers of our land? What cultural practices, epistemics, and ontologies would come to the fore? Ojibwe author David Treuer [50], in telling the history of Native America since Wounded Knee, describes elements of what we might imagine could transpire in third universities. What sort of structures might you/we build to turn this from theory to praxis?

Inconclusion

On our end, we'll continue our work of learning together as a pod about the violence across the telescoping scales of power that hold our settler-colonial privilege in place. Moving uncertainly, incommensurably, toward situating ourselves in ways that cause a "ripple in the patterning of power" (p. 64) [2], beyond critique toward more embodied refusal of scyborgs embedded in the university. Testing out machines that may work toward opening the decolonial cracks in the university we desire, recognizing fully well those machines might blow up in our faces. There is nothing inherently decolonial about scyborgs and we still feel rather far away from land back despite understanding it as imperative. What you do next is still up to you, "different scyborgs have different powers in shaping assemblage. What your particular powers are is important for you to figure out" (p. 62) [2].

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