Joy, Love, and Well-being: Envisioning a Future Free of Oppression. Reflections on Engineering Practices, Training and Experiences

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Both authors reflect on personal accounts of engineering toward social justice and peace. Upon reflection, each of our experiences as engineers working toward clean water suggests the presence of potentially existential threats for engineering practitioners - and possibly designers more generally: hyper-specialization and the problem-solver narrative. Our reflection on well-intentioned efforts that seek to remove oppression from practices and foster mutual understanding may inadvertently contribute to oppression and reveal a third threat: engineering parasites. Lastly, we envision systems free of oppression in both practice and training centered on joy, well-being, and love.

Key Words:

Equity, Community development, Generalist, Built Environment

INTRODUCTION

Sitting at home, in pause, in isolation, the mundane takes on a new form - what we accept as rhythm, we begin to notice as choice. Shelter-in-place orders in response to the Covid-19 pandemic disrupted routines that sometimes felt dizzying into a moment of stasis and suspension. In this moment of pause and increased awareness, we reflect on engineering and design practices from lived experience and learned expertise. In this reflection, we explore our own narratives as practitioners in engineering and design. We recognize them as common narratives in our fields and relate them from first-hand experiences to suggest potential paths toward a practice free of oppression.

To provide context, we begin this article by offering short biographies from each author to enrich our reflections as engineering and design practitioners.

Allen Townsend is a water security, sustainability, and stewardship expert with over 10 years of progressive international experience, whose work intersects with food, energy, and human systems. He has advised a sitting US Ambassador on foreign water-energy policy, worked within HCA Healthcare (the largest healthcare facility operator in the world) on corporate sustainability, and has served in numerous consulting roles globally and across sectors. His portfolio is rounded by experience in sustainability strategy, infrastructure planning, building adaptive communities, and water, sanitation, and hygiene (WASH). As a PhD Fellow in the Convergent Behavioral Science Initiative at University of Virginia, Allen studies behaviorally-centered programs designed for achieving environmental and social outcomes at scale. Allen earned a Master of Public Affairs in Water Governance and Policy from O'Neill School of Public and Environmental Affairs, Indiana University Bloomington, and a Bachelor of Science in Civil Engineering from Clemson University.

Katelyn Stenger is an expert on behavioral design within complex adaptive systems. She has six years of experience designing, engineering, and researching the built environment. Katelyn has founded and led a social justice start-up proposing policies for lead-free water and has engineered building facades for the Hudson Yards Project – the largest US real-estate development in the past century. Following an interest for policy, behavioral science, and designing the built environment, Katelyn researches as a PhD Fellow in the Convergent Behavioral Science Initiative at University of Virginia. She researches how to democratize behavioral design, with a goal to scale behavioral insights and widen who can shape decision-making spaces. Katelyn's approach is rooted in complex system science and emphasizes adaptability and inclusion as systems, cultures, and policies evolve. Katelyn earned a Bachelor of Science in Mechanical Engineering from Rose-Hulman Institute of Technology.

We share our primary accounts of engineering practices in the remaining sections to provide communities of color with clean water access. We then reflect on those experiences and describe

potential threats to engineering and design practitioners. We close by envisioning engineering systems free of oppression, in both practice and training.

PRIMARY ACCOUNTS

Clean water in Champei Commune, Cambodia, Allen Townsend

Even to this day, I question if our project team improved the water situation in the village or if we created more problems.

I initially joined a non-profit humanitarian organization to make an impact and refine my engineering and leadership skills. I enjoyed our team, which attracted energetic, social, and purpose-driven engineers. Unexpectedly though, the experience influenced me to question my role as an engineer. I initially believed our team was positively impacting a community but felt conflicted by the project's end. This experience showed me the limits of engineering and the potentially harmful narratives and practices within the field. Eventually, following these questions and interest in water equity and governance led me to pursue my master's degree.

Our project team focused on providing clean drinking water to a village community in the Champei Commune of Cambodia. Like other communities in the region, our team believed this community suffered from inadequate access to the foundation of any society - potable water. While the community had water sources, we accepted that access to potable water, a public health issue, needed an engineering solution. In terms of becoming a healthy, prosperous community, I believed an unreliable and unsafe water supply was one of the things holding this community back.

The community's primary water source was a large pond, excavated by previous international aid organizations. While the pond appeared to be an incremental step towards establishing access to clean water, it also created other problems. Community members used the pond as a drinking water source and a place to bathe themselves and their livestock. Additionally, the pond contained pesticides from upstream rice fields, and through lab testing, we confirmed the water did not meet World Health Organization's standards for drinking water quality.

Over months of face-to-face and virtual conversations with the community, the project team and I gained a richer perspective of the community's water infrastructure needs. Divergent from the original problem definition produced by a local non-profit organization supposedly in concert with the community, we learned that the community desired a water system to irrigate rice fields and not a drinking water system. While my training and experience as a civil engineer prepared me for addressing this project's technical challenges, I felt conflicted. I quickly realized our team was failing to navigate the social and cultural complexities of water needs and critically reflect on our position of power as we engineered a water system. While understanding the community's priorities, we proceeded to engineer and build a potable water system believing this would allow

the community to survive, ignoring the community's desire for an irrigation system that they believed would allow them to thrive.

My internal conflict about this experience led to my pursuit of broader knowledge and skills to best equip myself in making a positive impact within society. Through my pursuits, I realized that my engineering training might have underappreciated humanity-centered design. As our decision-making environment becomes increasingly complex, now may be the best time to reappraise approaches to engineering and design, including how engineers engage with the community stakeholders we serve and the skills we train to prepare engineers.

Clean water in Philadelphia, United States, Katelyn Stenger

While working as a mechanical engineer, I became aware of lead contamination in drinking water systems from the Flint, Michigan water crisis in the United States. After testing the water in my home, I realized I too was drinking lead-contaminated water, and quickly learned lead contamination in Philadelphia was common.

I focused on acting locally, targeting the city's large-scale water infrastructure in my role as founder of the social entrepreneurial start-up, Philly Droplet, located in Philadelphia, PA, USA. I pitched the idea to map lead piping locations with socio-economic factors to support policy changes for building codes at a Code for Philly event, a community of civic technologists that use data and design as a means of civic engagement. Afterward, five others joined the Philly Droplet team from a range of occupational backgrounds: data analyst, graphic design, engineering, web development, as well as identities: LGBTQ+, Black, Latinx. With youthful confidence from this momentum, I made Philly Droplet my full-time focus, believing we could address lead contamination in Philadelphia by mapping its location and advocacy.

Black and Latinx persons have experienced systematic health disparities in the United States (Schell et al., 2020), further revealed by the disproportionate deaths and adverse health effects on such communities throughout the COVID-19 pandemic (Gravlee, 2020). For example, historic redlining housing policies still affect communities of color in the United States, contributing to poor health outcomes (Hoffman et al., 2020; UVA Medical Center Hour, 2020). At that time, we looked for connections between Philadelphia's housing data and American Community Survey data on income and education status. Unfortunately, Philadelphia's housing records did not keep up with changing housing conditions. While our initial approach did not provide enough support for policy changes, we still wanted to improve water quality in our city.

We remained steadfast in our mission to remove lead from drinking water in Philadelphia. Unsure of how to navigate city government, we contacted local government officials and legislative representatives. From digging through Philadelphia's housing codes, we developed a policy proposal for Councilmember Reynolds-Brown to amend renovation housing codes, including

removing lead piping from homes renovated by the city - a small contribution to the systemic problem on public health disparities in the United States.

Up to this point, I could no longer sustain myself; I exhausted my savings and felt mentally and emotionally exhausted. I wondered if that proposed policy might be good enough and felt a bit defeated. Our efforts supported connections between Philly Droplet's goal and crucial decision-makers. As the only team member with time during the day (other team members maintained their prior full-time positions), I met with council members and their legal teams, non-profit directors, the City Director of Finance, and the City Director of Housing.

This experience left me wondering: how can engineers and designers sustain their civic engagements? Civic engagement requires time to work on programs and time to meet with community stakeholders who can help develop the project. Civic engagement relies on social capital and financial resources. A small grant could have extended our work but does not address its sustainability. What are some ways to boldly envision civic engagement for engineers and designers?

As an engineer, I could only understand a small fraction of the expertise needed to successfully ensure lead-free water in Philadelphia's housing stock through data analytics. I am incredibly grateful for my team members and their diverse perspectives for realizing new approaches to improve community health. At the same moment, I felt ill-prepared in my abilities to enact community-level change. Through this experience, I realized the improvements my engineering and design skills offered applied to well-defined, technical contexts framed as problems. While Philly Droplet consisted of civically-engaged, technically-trained people, we neglected necessary collaborations with other organizations or policy professionals.

REFLECTIONS

Our experiences as engineers working toward clean water indicate the presence of three potentially existential threats for engineering and design practitioners: hyper-specialization and the problem-solver narrative. For the third threat, we reflect on well-intentioned efforts that seek to remove oppression from practices and foster mutual understanding but may inadvertently contribute to oppression. Revealing a third threat: engineering parasites. Lastly, we envision futures free of oppression in both training and practice.

Existential threats to practitioners of engineering and designers

Hyper-specialization

Trends toward hyper-specialization may threaten practitioners. Hyper-specialization means breaking work previously done by one person into more specialized pieces done by several people (Millgram, 2015). Whether through training or accumulated knowledge, hyper-specialized practitioners become more precise and efficient in their abilities and services. However, these

practitioners become more brittle, breaking like glass, as contexts change or have a more limited ability to diagnose and address problems, even in areas adjacent to their specialization. As these practitioners enter new contexts, they may be unaware of essential partnerships or approaches, and may inadvertently cause harm. As such, hyper-specialization also causes negative friction when partnering and tackling wicked problems, which require and benefit from transdisciplinary partnerships and practices (Buchanan, 1992).

In the Philly Droplet context, Katelyn shared that she felt ill-prepared for community-level change. Connecting engineering and design practices to outreach has seen application in both industry-set initiatives and curriculum (Savage & Knight, 2018). However, these approaches can fall short in addressing how to adapt thinking when contexts change. Rather than risking continual expansion of the proverbial toolbox, or worse still — relying on practices of ‘seeing only nails when you have a hammer’, practitioners can embrace a complementary approach of the generalist. This approach would help expand questions, frame situations for improvement, and make sense of complex contexts common to wicked problems (Kohnen & Saul, 2020).

While hyper-specialization can be problematic for teams having to operate in changing contexts, we see it as an existential threat to engineering and design practices, particularly when coupled with the problem-solver narrative.

The problem-solver narrative

Training prepares engineers and designers and often introduces useful but sometimes harmful narratives. One common narrative that we identify is the problem-solver narrative. This narrative may limit approaches to practice when practitioners form a tautological identity from such narratives (e.g., ‘I am an engineer; therefore I am a problem-solver. I am a problem-solver; therefore I am an engineer.’). In the most tragic circumstances, this obsession may lead to problem seeking behaviors. Being a “problem-solver” is so ingrained into engineering that the problem-solver narrative often replaces what it means to engineer. Scouring communities and contexts, those entangled by this narrative may ceaselessly seek to make a difference by using hyper-specialized knowledge and skills to design for others. A “problem-solver” narrative can unduly chain individuals to the satisfaction derived from tangible, measurable outcomes and drives nonstop action in the sustainment of this ego. While mounting global problems desperately need solving, the powerful narrative may be incomplete for the scope and complexity of today’s challenges. Put another way, the narrative may deserve expansion rather than discarding.

Further, this narrative can excuse otherwise paternalistic practices in the guise of making an impact. These practices may harm communities by inadvertently creating new problems or failing to address the original problem’s root source. For instance, in the Champei Commune, a well-intentioned non-profit organization dug a pond as a source of drinking water, the pond became polluted. Another in-country non-profit then submitted an application on behalf of the community for an engineering humanitarian organization to develop a safe drinking water

system. While the team eventually addressed the drinking water problems with the successful construction of a new system, insufficient community engagement contributed to failing to address the community's deeper desires. Perhaps worse still, from the community's perspective, the team may well have created a new problem of operating and maintaining a more sophisticated water technology.

In combination, hyper-specialization and the problem-solver narrative can contribute to practitioner myopia or problem 'tunneling'. With the backdrop of structural inequalities and disparities at play, these two threats lead to a third threat: institutions of oppression described as engineering parasites.

Engineering parasites

As engineering and design practitioners, we may unintentionally perpetuate particular forms of oppression. For instance, the international non-profit organization Engineers Without Borders' mantra - along with other well-intentioned humanitarian organizations - seek engineers to solve problems within communities whose residents may be poor and/or dark persons and help them survive (LaPorte et al., 2017). Engineers with little or no experience in these contexts are tasked with working in struggling communities for "engineering" needs (Savage & Knight, 2018). In a way, such practices engender engineering parasites that need these poor and/or dark communities to be underserved and failing, supporting the feel-good, quick-fix narrative and providing the financial reason for their existence (Love, 2019). The definition we provide is a direct transfer from what Dr. Bettina Love's named as educational parasites in the field of education. In short, we found consilience, as the sources of oppression in education contexts are often similar sources of oppression in engineering contexts. Practitioners need to pluck this engineering parasite out of their field and envision thriving strategies and approaches with communities. A system that is free from oppression will root out engineering parasites, as they inadvertently set expectations of survival for such communities and eclipse the proper expectation that practitioners will help design and engineer with communities to thrive.

Engineering parasites may also take form under calls for empathy within the design process. While perspective-taking is a valuable skill in designing for others, attempts to induce empathy may inadvertently excuse a powerful minority (i.e., primarily cis, hetero white men in the United States) to continue designing without diversifying their teams (Weaver, 2020). Here, underrepresented engineers and designers in the United States may include but are not limited to people identifying as Black, Indigenous, women, trans-, and/or disabled. Moreover, we must take caution to prevent weaponizing empathy, trivializing others' lived experiences, and inadvertently contributing to approaches that design for rather than design with a community (Bennett & Rosner, 2019). Empathy exercises do not excuse the homogeneity of who designs (Carroll & Creative Reactions Lab, 2020). Practitioners need to realize if the team is not diverse, the team is not complete and will not be best suited for success. Thus, practitioners need to remain resolute in advocating, including, and amplifying underrepresented people to their teams and fostering an

environment of belonging to uproot white supremacy's deep tendrils, constricting and poisoning engineering practices and design.

To be clear, we see hyper-specialization and the problem-solver narrative each as potentially existential threats to engineering and design practitioners. These two threats taken together underpin and support the existence of the third threat, engineering parasites. From our experience, we identify common characteristics of such threats (e.g., red flags), so other engineering and design practitioners might better identify and root out such threats. Suppose efforts are championed by a development or aid organization to 'make an impact'. In that case, practitioners should ask questions such as: what the impact is, for whom does this impact benefit, what do community stakeholders have to say about it, and who holds power in the project. Change is hard but very possible with time, effort, organizing, and community. If the theory of change and outcome measures seek short-term wins, with little or no effort to systematically effectuate root causes, seek to reorient such projects toward a longer time horizon to be consistent in ideation, implementation, evaluation, and—most importantly—iteration. Otherwise, such short-term scope risks harming communities or continually solving previously created problems, as evidenced in Allen's experience. Lastly, if the projects and partnerships rely heavily on technically-skilled volunteers or under-compensated professionals with little experience in the applied context, the team risks poorly designed outcomes or inconsistent engagement, as observable in Katelyn's experience.

We stress this is a working list drawn from our individual experiences and by no means the last word. We also attempt to delineate our reflection's limitations and when these threats might apply or not through this list.

FUTURES FREE OF OPPRESSION

Practitioners associated with engineering and design benefit from occupational symbolic and material wealth in the United States. For instance, most newly hired engineers in the United States benefit from occupational material wealth when they receive an income above the median income, regardless of tenure (U.S. Bureau of Labor Statistics, 2019). Those who want to improve their communities by leveraging their skill sets might inadvertently perpetuate systems of oppression and engineering parasite through their work, as in Allen's case, or found a civically engaged start-up without enough resources as in Katelyn's case. In either stance, freeing society of oppression takes time, effort, community, and vision.

Institutions (e.g., companies, non-profits organizations, coalitions) would do well to reorient their purpose toward a future free of oppression and a mission centered on joy, love, and well-being (Freeman, 2020). In other words, institutions would need to rethink the value they provide and their models for existence. Beneath these, leaders within these engineering institutions would interrogate these elements' harmonization across the organization's design. What is our culture?

How do we build teams that support psychological safety and individual growth? How do we cultivate diversity, equity, and inclusion? How do we share power when we partner with communities to design and engineer projects? These are a few questions leaders tasked with creating their institutions to support thriving communities centered on joy, love, and well-being would confront. Accordingly, engineers would approach challenges with greater humility and curiosity.

In Western contexts, the problem-solver narrative enlists those in positions of power. Problems may primarily derive from those in positions of power, as demonstrated by water infrastructure reflection within the Cambodian community. Uprooting the problem-solver narrative by editing its existence toward a generative, partnership narrative that promotes joy, love, and well-being may lead to a system free of oppression. In uprooting and redirecting this narrative, practitioners may be free from scouring for problems associated with survival and focus on communities' functional and thriving traits (Love, 2019). For example, returning to the Cambodian community reflection, the engineering team's problem-solving stance confined them to a technical context and restrained their consideration from agricultural solutions. By instead approaching the situation from a place of joy, love, and well-being, having greater humility and curiosity might have more quickly revealed opportunities to enable upward socio-economic mobility and afford the community members a more secure and prosperous community altogether.

A future free of oppression would embrace collaboration across identities and remove the threat of hyper-specialization by valuing a more balanced mix of specialists and generalists within teams. More practitioners would also receive interdisciplinary training and experience developing integrated solutions by restructuring project designs and deliverables. Some higher-learning institutions have stepped towards engineering generalist, as seen with renaissance engineering (N.T.U., 2020). Still, these efforts fall short when engineering overlooks critical discussion on the practice's limitations and implicit narratives. Perhaps a more significant step is cross-training engineers in liberal arts (Dartmouth Engineering, 2021). For practitioners, an alternative to additional formal education could imply 1) gaining a richer appreciation of the systems and institutions that perpetuate inequalities and injustices that we operate within through deeper immersion, 2) critically appraising our unconscious biases and the boundaries of our knowledge and practices, and 3) valuing partnership with both learned expertise and lived experience.

Engineers and designers would empower communities through more community-based, grassroots practices paired with systematic, sustainable approaches in a future free of oppression. As illustrated within the Philly Droplet case, sufficient financing and community support could have extended and potentially sustained civic engagement and advocacy. In this future, "Individual action and individual liberation will be replaced by community action and liberation" (Kendi, 2019). Institutions can support grassroots approaches by allocating time for engineers and designers. These practices would provide opportunities for sensemaking, community engagement, and build trust with community partners. Practitioners who participate in systems

free from oppression would become proximate with communities, partnering and designing with those affected by these designs. This approach might mean building on what works as identified by design partners rather than searching or identifying problems. Existing practices, such as co-design, assist in creating systems, designs, and futures free of oppression (Carroll & Creative Reaction Lab, 2020; Kimbell & Bailey, 2017; Wilson, 2018). Further, practitioners could ensure institutional learning and that lessons pass forward by committing to monitoring on-going projects and investing in project evaluations.

In a future where we have rejected the current paradigm and embraced liberation, engineers and designers would operate in a system of inclusion in a dignitarian sense. Engineers would acknowledge and address past legacies of inequalities and injustices that limit progress and collaboration. Practitioners would actively embrace settler colonialism, critical race theory, Black feminism, dis/ability, critical race studies, and other critical theories that frame injustice and practitioners' experiences toward justice (Love, 2019). In this future, engineers and designers would support strengthening individual and institutional capacities and enhance community governance. Practitioners and those who train them would celebrate approaches that focus on love, well-being, and joy. We believe that only under these conditions communities and individuals can thrive.

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NOTES

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