



humanistic Engineering

A Transformative Agenda for a Better Future

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Engineering is failing humanity. While engineering advances are changing society with incremental benefits and novel, transformative technologies, there are aggregate measures that show a troubling trajectory. Technology is enabling more efficient work, where we have seen a 140% increase in productivity since 1973. However, there have not been proportional gains in worker real wages, which effectively stagnated over the same period.¹ We are told that technology is democratizing and empowering. If true, we would expect people to be sharing in a larger percentage of society's resources. However, we see the opposite, with the top 1% holding a historic and increasing proportion of wealth.² If technology is improving health, we would expect increases in life expectancy. However, since 2014 US life expectancy has been declining.³ If technology were giving us benefits beyond the material, we would expect improvements in happiness. However, happiness in the US has been trending downward since 1973, where recent declines are highly correlated with the frequency of phone and digital media technology use.⁴ If technology were making us more resilient, the corona virus response should have been swift and effective. However, we saw the opposite. In fact, contemporary communication technology spread misinformation and modern industrial engineering technologies like just-in-time production inhibited our ability to acquire health resources.⁵ This is to say nothing of the existential threat of climate change that, despite scientific consensus since the 1970s, has yet to receive adequate response.

While not the sole perpetrator of these problems, engineering has played a significant role: it developed the technologies that have undermined human labor's value and enabled the associated effects. We know that technology profoundly impacts our work and lives, so why have engineers failed to fix the above issues?

In my experience, most engineers think that science and engineering are neutral and that human values evolve with our increasing knowledge. The problems outlined above and the history of totalitarian regimes (like the Soviet Union and the Nazis) show this is false. Rather, society uses science and technology to enforce its existent values. This means that engineering is driven by the market-based ideologies that dominate our society.⁶ With this perspective, it is not surprising that engineered technology serves to reduce labor costs and extract resources from the populous. Thus, if we engineers want to reverse the dangerous societal developments, we need a value system to drive our work in better directions. **We need values!**

The philosophy of humanism offers a source of (hopefully) noncontroversial values. Humanism puts paramount importance on common good and solving human problems rationally. Thus, I am proposing the

¹<https://www.epi.org/productivity-pay-gap/>

²<https://www.federalreserve.gov/publications/files/scf17.pdf>

³<https://jamanetwork.com/journals/jama/article-abstract/2756187>

⁴<https://worldhappiness.report/ed/2019/the-sad-state-of-happiness-in-the-united-states-and-the-role-of-digital-media/>

⁵<https://www.tandfonline.com/doi/full/10.1080/13669877.2020.1756379>

⁶<https://global.oup.com/academic/product/a-brief-history-of-neoliberalism-9780199283279>

creation of **humanistic engineer**, a value-driven approach where **all engineering should be done with the explicit purpose of improving people's lives and advancing humanistic goals**.

I have identified the **five principles of humanistic engineering** that all engineered technologies should satisfy. All engineered technologies should be:

1. **Human-centered**: designed to facilitate the needs/goals of the people impacted by them.
2. **Accessible/inclusive**: not limit benefits and access based on disability, race, gender, sexual orientation, socioeconomic class, and so on.
3. **Sustainable** (at minimum) and, ideally, a net positive environmentally.
4. **Democratic**: encourage people to engage with, repair, and/or modify technologies for their own ends.
5. **Empowering**: give people capabilities and control over their lives beyond what was previously possible. They should never seed power to other interests.

I want humanistic engineering to be the leading practice across all of engineering by 2040. **A transformation of undergraduate education is critical to accomplishing this vision.** This is because training engineers will spread the influence and impact of humanistic engineering throughout society. To be effective, humanistic engineering should become a fundamental part of undergraduate engineering education. Throughout their undergraduate career, students will learn methods for accounting for the fundamental principles in any engineering project and how to use their disciplines to accomplish humanistic ends.

This undertaking will be inadequate if engineers must ultimately work for institutions that do not uphold humanistic values. Thus, a critical part of this education will focus on teaching students to use their power as engineers to influence employers. This will mean instructing them in how to organize with fellow workers, bargain with management, deploy whistleblowing, and exert collective action.

Achieving the education goals will require initiatives beyond the purely pedagogical. First, basic research will need to lay the groundwork for humanistic engineering: determining how to measure and model fundamental principle concepts and integrate humanistic engineering into engineering disciplines. Second, infrastructure will need to be established to provide support for humanistic engineering practitioners who find themselves in power differentials with employers. In my vision, professional organizations will serve this role by providing whistleblower legal aid; job placement (for those who lose jobs for standing up for humanistic values); and (if necessary) large-scale collective action.

A potential advantage to humanistic engineering will be diversity. In areas where work more directly engages with human issues (like law, medicine, and social science), gender disparities have been addressed more effectively than in engineering. Furthermore, underrepresented groups have been on the sharp end of the problems highlighted above. It is thus not surprising that these populations would not see engineering as an uplifting force. I believe that bringing humanistic perspectives to engineering and using it to reverse current anti-humanistic impacts will attract more diverse populations to the discipline.

With current research and education emphasizing robotics, artificial intelligence, and data science, the anti-humanistic effects of technology will likely get much worse. More skilled and knowledge-based work will be automated away; reductions in labor needs will concentrate resources upward; and people's lives will be more surveilled and marketized. This will degrade our happiness, health, and financial security... But this does not have to be the case. Engineering, as a fundamental mechanism for translating science into the world, has the capacity for immense societal impact. By advancing humanistic engineering and making it the dominant paradigm, we have the potential to correct society's biggest pathologies and achieve a happier, healthier, and more equitable future.