

## **The Curriculum, Undone: Knowledge and Power in Computer Science Education**

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In recent years, critical scholars have repeatedly presented evidence of the societal harms propagated by data-intensive systems. Efforts in this area point to the role that AI and data practices play in (among others) automating bias and harm, exacerbating local and global power dynamics, and shifting power away from individuals and towards few powerful organizations (Benjamin 2019; Eubanks 2018; Srnicek 2017). Importantly, there are concerns with the broader political economy of technology development by which material and conceptual resources are often concentrated in the hands of few large corporations, and their own ethical and political agendas (Whittaker 2021; Cath and Keyes 2022).

Work in this area has pointed to the role of computer science education in reinforcing and concretizing harmful epistemic norms and assumptions in data and AI practice (Connolly 2020). As some have observed, technical training—with its emphasis on the values of abstraction and formalism—contributes to data and AI practitioners' sense of exceptionalism by building ideological barriers between computer science practice and social responsibility (Malazita and Resetar 2019; Agre 1992). This growing recognition of the social and political dimension of technical practice has generated several pedagogical frameworks and interventions, investigating (among others) the value of teachers' ethical role modelling (Grande et al. 2024), the potential of embedding ethics activities and assignments within technical training, including social science and humanities concepts and sensitivities (Farghally et al. 2025; Klumbyté et al. 2022), and the role of critical counternarratives as a beneficial teaching methodology (Kirdani-Ryan and Ko 2022). Yet, mainstream approaches to ethics and responsibility within technical training tend to treat ethics as a siloed discipline that practitioners apply to their own practice, often without deeper conceptual engagement with different skills and epistemologies (Raji et al. 2021).

In this paper, we reflect on our experience doing collaborative research and teaching as a Science and Technology Studies scholar and a Computer Scientist within the undergraduate program of a computer science department. Drawing on interviews with core teaching staff, we investigate the norms, values, and assumptions that inform the computer science curriculum at our institution. Here, we observe the emergence of two

different notions of *undone science*: on the one hand, we illustrate how forms of ethical and sociological knowledge around computing practices and systems get sidelined or ignored, in favor of mathematics and programming skills. Contributing to this marginalization of social and ethical expertise are longstanding epistemic norms about the value of technical or “hard” skills over non-technical, “soft” ones (Downey 2021); assumptions of and around industry needs and expectations, and systemic incentives and pressures put on academic staff to focus on advancing state-of-the-art research rather than teaching and pedagogical interventions (Jillepalli 2025). Further, our findings seem to point to a more *active undoing* of the limited ethical and sociological training that students receive, or a conflict between explicit and implicit normative commitments. While students are taught the value of humility (one of the School’s core values) and the pitfalls of techno-solutionism, they are often still expected to solve complex problems with technology (Sætra 2023). Similarly, while there is a recognition that social and ethical issues pervade every aspect of technical practice, many subject areas seem to adopt a “but not here” approach under the assumption that technical work is removed from such concerns (Darling-Wolf and Patitsas 2024). Notably, despite an appreciation for the rights to intellectual property and protected environment, as well as care in deployment of computational systems, many universities have quickly and uncritically rolled out generative AI onto their campuses (Galanos 2024).

On the other hand, our participants express a tension between the reductionist and positivistic tendencies of computer science epistemology and the messy reality of applied computing practice, where the complexities and ambiguities of the real world can’t be easily reduced to classes and numbers (Thylstrup and Hartley 2025). In this sense, some of our participants stressed the importance for students to become comfortable with the messiness and ambiguity of real-world data (as opposed to sanitized datasets often used for teaching purposes). Here, we see potential in a notion of undone science that appreciates and foregrounds uncertainty: a science, or form of knowledge, that is always *undoing itself*. A recognition of uncertainty as fundamentally constitutive to the project of computation, rather than a technical or statistical problem (Fazi 2018).

In our reflections, we ask: How can we mobilize different forms of knowledge to counteract technological determinism and accelerationism? How can we create meaningful opportunities for students’ and practitioners’ resistance to participate in harmful data practices? And what institutional, disciplinary, or societal constraints would shape these efforts? Emerging from our data is a broader question around the social and political role that higher education plays in reinforcing specific epistemic values and assumptions in computer science and its related industry. Is the University’s sole responsibility – as some of our participants argue or lament – to cater to the needs and expectations of markets and the tech sector? Or is it, rather, to equip individuals and

communities with the critical tools necessary to challenge and counteract the increasing concentration of material and cultural resources in the hands of a few powerful actors and organizations?

In attending to these overlooked spaces of knowledge (and power) formation within computer science education, we can hopefully resist harmful data practices while exploring possibilities for more sustainable and just approaches to complex social and political problems.

## References

- Agre, Philip E. 1992. 'Formalization as a Social Project'. *Quarterly Newsletter of the Laboratory of Comparative Human Cognition* 14 (1): 25–27.
- Benjamin, Ruha. 2019. *Race After Technology: Abolitionist Tools for the New Jim Code*. Wiley.
- Cath, Corinne, and Os Keyes. 2022. 'Your Thoughts for a Penny? Capital, Complicity and AI Ethics'. In *Economies of Virtue: The Circulation of 'Ethics' in AI*, edited by Thao Phan, Jake Goldenfein, Declan Kuch, and Monique Mann, vol. 46. Theory on Demand. Institute of Network Cultures.
- Connolly, Randy. 2020. 'Why Computing Belongs within the Social Sciences'. *Commun. ACM* 63 (8): 54–59. <https://doi.org/10.1145/3383444>.
- Darling-Wolf, Hana, and Elizabeth Patitsas. 2024. "'Not My Priority:" Ethics and the Boundaries of Computer Science Identities in Undergraduate CS Education'. *Proc. ACM Hum.-Comput. Interact.* 8 (CSCW1): 174:1-174:28. <https://doi.org/10.1145/3641013>.
- Downey, Gary Lee. 2021. 'Critical Participation: Inflecting Dominant Knowledge Practices through STS'. In *Making & Doing. Activating STS through Knowledge Expression and Travel*, edited by Gary Lee Downey and Teun Zuiderent-Jerak. The MIT Press. <https://direct.mit.edu/books/oa-edited-volume/5153/chapter/3403234/Critical-Participation-Inflecting-Dominant>.
- Eubanks, Virginia. 2018. *Automating Inequality: How High-Tech Tools Profile, Police, and Punish the Poor*. St. Martin's Publishing Group.
- Farghally, Mohammed, Mohammed Seyam, and Margaret Ellis. 2025. 'Embedded Ethics in CS: Experiences with Integrating Ethics Assignments in Sophomore, Junior, and Senior Level Courses'. *Proceedings of the 30th ACM Conference on Innovation and Technology in Computer Science Education V. 1* (New York, NY, USA), ITICSE 2025, 583–89. <https://doi.org/10.1145/3724363.3729054>.

- Fazi, M. Beatrice. 2018. *Contingent Computation: Abstraction, Experience, and Indeterminacy in Computational Aesthetics*. Rowman & Littlefield.
- Galanos, Vassilis. 2024. 'Are Two More-than-Halves Spurious? Sociopolitical Underpinnings behind Adoption Rates of Generative AI in Casualised Higher Education: An Actionable Critique – Teaching Matters'. *Teaching Matters*, February 19. <https://blogs.ed.ac.uk/teaching-matters/are-two-more-than-halves-spurious-sociopolitical-underpinnings-behind-adoption-rates-of-generative-ai-in-casualised-higher-education-an-actionable-critique/>.
- Grande, Virginia, Thomas Taro Lennerfors, Anne-Kathrin Peters, and Kristina von Hausswolff. 2024. 'The Virtuous, the Caring, and the Free: Ethical Theory to Understand the Ethics of the Teacher as a Role Model in Engineering Education'. *European Journal of Engineering Education* 49 (1): 1–21. <https://doi.org/10.1080/03043797.2023.2236959>.
- Jillepalli, Ananth. 2025. 'Effects of Neoliberalism on Computing Education Research and Practice'. *ACM Trans. Comput. Educ.* 25 (4): 58:1-58:13. <https://doi.org/10.1145/3766901>.
- Kirdani-Ryan, Mara, and Amy J. Ko. 2022. 'The House of Computing: Integrating Counternarratives into Computer Systems Education'. *Proceedings of the 53rd ACM Technical Symposium on Computer Science Education - Volume 1* (New York, NY, USA), SIGCSE 2022, vol. 1 (February): 279–85. <https://doi.org/10.1145/3478431.3499394>.
- Klumbytè, Goda, Claude Draude, and Alex S. Taylor. 2022. 'Critical Tools for Machine Learning: Working with Intersectional Critical Concepts in Machine Learning Systems Design'. *Proceedings of the 2022 ACM Conference on Fairness, Accountability, and Transparency* (New York, NY, USA), FAccT '22, 1528–41. <https://doi.org/10.1145/3531146.3533207>.
- Malazita, James W., and Korryn Resetar. 2019. 'Infrastructures of Abstraction: How Computer Science Education Produces Anti-Political Subjects'. *Digital Creativity* 30 (4): 300–312. <https://doi.org/10.1080/14626268.2019.1682616>.
- Raji, Inioluwa Deborah, Morgan Klaus Scheuerman, and Razvan Amironesei. 2021. 'You Can't Sit With Us: Exclusionary Pedagogy in AI Ethics Education'. *Proceedings of the 2021 ACM Conference on Fairness, Accountability, and Transparency* (New York, NY, USA), FAccT '21, March 3, 515–25. <https://doi.org/10.1145/3442188.3445914>.
- Sætra, Henrik Skaug. 2023. *Technology and Sustainable Development: The Promise and Pitfalls of Techno-Solutionism*. Taylor & Francis.
- Srnicek, Nick. 2017. 'The Challenges of Platform Capitalism: Understanding the Logic of a New Business Model'. *Juncture* 23 (4): 254–57. <https://doi.org/10.1111/newe.12023>.

Thylstrup, Nanna Bonde, and Jannie Møller Hartley. 2025. “Argh! The World Doesn’t Fit the Model!”: Small Acts of Worldmaking in Data Annotation for News Media’. *Media Theory* 9 (2): 105–32. <https://doi.org/10.70064/mt.v9i2.1273>.

Whittaker, Meredith. 2021. ‘The Steep Cost of Capture’. *Interactions* 28 (6): 50–55. <https://doi.org/10.1145/3488666>.