Towards a more representative politics in the ethics of computer science

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ABSTRACT

Ethics curricula in computer science departments should include a focus on the political action of students. While 'ethics' holds significant sway over current discourse in computer science, recent work, particularly in data science, has shown that this discourse elides the underlying political nature of the problems that it aims to solve. In order to avoid these pitfalls—such as co-option, whitewashing, and assumed universal values—we should recognize and teach the political nature of computing technologies, largely through science and technology studies. Education is an essential focus not just intrinsically, but also because computing students end up joining the companies which have outsize impacts on our lives. At those companies, students both have a responsibility to society and agency beyond just engineering decisions, albeit not uniformly. I propose that we move away from strict ethics curricula and include examples of and calls for political action of students and future engineers. Through such examples—calls to action, practitioner reflections, legislative engagement, direct action—we might allow engineers to better recognize both their diverse agencies and responsibilities.

CCS CONCEPTS

• **Social and professional topics** → **Codes of ethics**; **Computing education**; *Accreditation*; *Socio-technical systems.*

KEYWORDS

politics, civics, activism, science and technology studies

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1 INTRODUCTION

Ethics is a hot word in computer science. Companies, organizations, and universities have begun to use the term in principles, declarations, and promotional material. Lately, this has occurred in the space of 'artificial intelligence (AI) ethics.' Ethics commitments have bled over into curricula as well. For example, in spring 2019 the Mozilla Foundation awarded grants to a number of computer science programs in order to increase the extent of ethics education [71]. Furthermore, a recent list shows more than 200 university courses that claim to fall in the category of tech ethics [38].

Clearly, something is afoot. At first glance, such attention might have those of us who argue that values are embedded in technology celebrating. The situation is not so clear. Such developments in ethics may actually be missing the original point of the critiques (as say [46]). Companies continue to develop computing technologies that arguably undermine common normative frameworks such as distributive justice and human rights, while still using the language of ethics.[1]

Take Amazon, for example. It appears to allow deployment of facial recognition technology on the U.S.-Mexico border [28]. The topics usually covered in discussions of AI ethics fail to capture the significance of such situations. The question of whether facial recognition technology 'fairly' identifies people across racial groups[2] appears moot when any contribution to the further criminalization of asylum seekers and exclusion from economic opportunity flouts principles of distributive justice.

Let us assume that someone has come to the conclusion that such a use of facial recognition technology, one that further harms asylum seekers, is unethical under a given theory which appears reasonable given broad interpretations of any class of ethical frameworks. The question then remains of what to do about it. This is particularly relevant given that ethics in computing seems to be restricted to applied engineering questions or 'microethics.' Applied in this sense, ethics would dictate how to change the design of a system, but not how to change structural systems of oppression in which such a system operates.

Of course, the description of the action of companies and engineers in relation to philosophical definitions of ethics is useful—whether, for example, Amazon's use of facial recognition technology on the U.S. border would be permissible in the strict egalitarianism distributive justice. Nevertheless, such an examination, if the only one conducted, would squelch the important political nature of the case, being: how do we operationalize our conclusion? Furthermore, current CS ethics curricula appear to be mainly applied and professional in nature. That is to say, current ethics education may not even go so far as to consider the structure of society.

Here, I do not necessarily mean to endorse distributive justice, but rather to highlight a difference between what are construed as chiefly ethical and political issues. Our interest, as would be that of anyone concluding an ethical chain of reasoning, should be to promote the world in which we find resolution of the ethical issue. This promotion is inherently political.

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[1] For an examination of distributive justice see [62].
[2] See discussions of mathematical fairness in the literature, e.g. [60].

Essentially, current debates in computer science are political and not just ethical ones. They involve questions of not just 'what values does this technology assume,' but also 'what kind of society does this technology create,' 'how can I create the kind of society in which I want to live.' The recognition and discussion of moral principles—ethics—of course are necessary but may not be sufficient for this.[3]

It is not apparent whether the current teaching of ethics in computer science covers the politics of technology in both design and action. In particular, the focus on applied ethics blunts the political nature of the situations in which computer scientists find themselves. Furthermore, ethics carries its own history and should have us ask: whose ethical theories are we using and whom might they leave out? Relevant are not only ethical theories, but also their professional realization. While scholars have historically found that both ethics codes and classes appear to have little impact on the actions of engineers (as [26] discuss) this may be due to the limits of the framing of such ethics.

Nevertheless, despite the limits of ethics as they exist in computer science, practitioners have begun to act. Reporting from summer 2019 details the actions of Stanford computing students to resist the big tech companies, who the students see as perpetuating injustice by supporting groups such as the U.S. Immigration and Customs Enforcement agency [42]. At Google in fall 2018, thousands of workers walked out to protest the company's sexual harassment policies. That came a year after tech workers organized to oppose building infrastructure to support the Trump administration's Muslim ban [52]. The Tech Worker's Coalition aims to organize both gig workers and software engineers to advance more just policies. Google has terminated contracts with the U.S. Department of Defense (DoD) due to pressure from employees, with some speaking up under the hashtag #TechWontBuildIt [82]. Companies such as Amazon [28] and Wayfair [43] have seen similar pressure. Amazon has also faced pressure with regard to climate justice [56] and has responded with increased environmental commitments [11].

After the 2016 U.S. presidential election, it was widely acknowledged that 'fake news' and targeted ads significantly contributed to the outcome of the election. While the C.E.O Mark Zuckerberg initially said this was "a pretty crazy idea" [92], he later changed his mind after facing pressure from his employees. The editor of Wired, investigating this case, found that "the place that you can put the most pressure on executives comes from engineers" [87]. Other commentators have begun to say the same [75]. Clearly tech employees have agency beyond being 'just an engineer' [45].

Many turn to technology company executives to answer for ethical issues because executives, supposedly, have the agency to make changes. We can see this, for example, in the furor over Mark Zuckerberg's U.S. Congressional testimony [96]. However, other scholars, as will be discussed, also advocate for employees to embrace their own obligations to society.

I explore how computer scientists might explore their agencies through ethics education. Of course, agency is intersectional, not uniform, and may be explored through means other than education.

[3]Such political implications are quite related to economic ones as [37] explore in human-computer interaction. See also [99] for more examples of the capital model of modern data systems and [94] for a theoretical analysis of them.

To study how tech employees might develop their ethical reasoning, I created and taught a course on ethics to computer scientists at the University of Washington. In line with this paper, the course aimed for students to develop both a broader conception of the dilemmas in current computing technologies and a more expansive framework for their own ethical responsibilities. A colleague and I then re-made the course to further focus on the structural and political implications of computing technologies and included previous and potential actions of stakeholders of such systems.[4]

While questions of ethics in computer science are relevant internationally, this paper focuses primarily on the U.S. because it is the political system I know best. I would greatly appreciate collaboration with scholars knowledgeable of other political systems.

In this paper, I argue that ethics curricula in computer science departments should cover social activism and politics as extensions of classical discussions of ethics. This argument proceeds in four parts. First, I review literature on the topics of ethics, civics, and employee responsibility. Second, I offer an argument for why we should cover political engagement in addition to ethics. Third, I explore how to implement such a change and offer recommendations. Fourth, I consider critiques one might have for my approach.

2 LITERATURE REVIEW

Here I conduct a literature review that consists of three parts. First, I review ethics in computer science and education. Second, I review current critiques of ethics. Third, I establish the responsibilities of engineers and review discussions of civics. In conducting this review, I used the ACM digital library, IEEExplore, and Google Scholar with terms such as "ethics," "civics", "politics," and "activism."

2.1 Ethics in Engineering

Ethics is "the branch of knowledge or study dealing with moral principles" [10]. Computer science already engages with some versions of ethics. Most university degree programs offer courses or components on ethics. The Accreditation Board of Engineering and Technology (ABET) requires at least an awareness of ethics.

2.1.1 In Computer Science. Let us begin with Moor, whose widely cited paper, "What is Computer Ethics?," established, through example, computer ethics as its own discipline. He advocates for the need to conceptualize the nature of computer programs and the realities they engender. He uses ethics both in the individual and societal sense. Indeed, "computer ethics [is not] the rote application of ethical principles to a value-free technology" [68, p. 268].

Stahl et al. comprehensively survey literature on ethics in computing through 2012 [85]. They appropriately focus on parallel discussions in other fields and offer a discussion of the history of ethics and what its use means. Nonetheless, they presuppose benefits from computing technology. They contend ethics will "ensure that computing can realize its potential benefits" [85, p. 1] and mention "the growing importance of computing as an enabler of economic activities" [85, p. 27].

2.1.2 In Computer Science Education. Skirpan et al. review computer science ethics classes [83]. They find tension between stand-alone and integrated ethics classes. In one sense, stand-alone classes

[4]Syllabus: https://courses.cs.washington.edu/courses/cse492e/20wi/

may more deeply examine social issues and retain instructors who can teach ethical theory, but students might intuit that the material is irrelevant to them, especially when those courses are offered from departments besides computer science. Integrated courses suffer a converse fate—they may not delve deep enough, and instructors may not have the background or desire to teach ethical or social components. Skirpan et al. detail a case-study of one course that attempts to integrate core concepts and ethics—to good results. Such teaching may actually increase engagement (a trait [26] find ethics courses often lack).

Similarly, Saltz et al. [78] offer a good recent history of computing ethics in addition to a study of the inclusion of ethics in the top 20 U.S. computer science programs. They look specifically at courses on machine learning (ML). I follow them in arguing that "to act responsibly, ML engineers must adopt perspectives and competencies that go beyond complexity analysis and usability, and into histories, social sciences, and morality" [78, p. 3]. Nonetheless, I find flaw in their method of evaluation in line with my argument. They excluded courses which "focused on high-level societal ethical considerations beyond the possible control of the organization supporting the data science effort" [78, p. 8]. As I will discuss below, this exclusion criteria removes the agency of engineers in pushing for extra-organizational forms of change.

Recently, [95] show, through a case study, how ethics might be better embedded throughout computer science curricula, even by involving other departments. Indeed, they say that their modules are most effective when related to the technical material students have already learned (which begins to address the tension found in [83]). This is a move in the right direction, but still does not acknowledge the political implications of such a restriction to technical material.

2.1.3 In Engineering Education. Through observational case studies, Colby and Sullivan [26] examine undergraduate engineering ethics education in the United States. They use engineering codes (e.g. from ABET) to frame the goals of university curricula. They build on the role of moral and civic learning as important for undergraduates to engage politically in a democracy [25]. In their study of undergraduate engineering ethics, Colby and Sullivan take a similar approach to this paper by defining ethics broadly—as including an obligation to society. They identify a number of particularly relevant areas for growth such as the apparent lack of desire of engineers to engage in social issues as compared to other undergraduates. Their proposed approaches include using active pedagogies, engaging faculty, and increasing institutional intentionality [26, pp. 335-336].

Gray et al., through a study abroad program for user experience designers, explicate the kind of cross-cultural learning that Colby and Sullivan note engineers may lack. Indeed, the concept of identity and empathy arise in what Gray et al. describe of as promoting "digital civics." Their study abroad experience "promoted identity transitions that more fully account for design as a social good" [44, p. 74].

Monteiro et al. conduct a case study of engineering courses in Portugal, exploring how engineers' mindsets place importance on ethics and civics education. Invariably, they find that "the engineer is seen more as an executor of technical orders than as a socially involved actor" [67, p. 168]. Interestingly for this paper, they almost always use ethics and civics in conjunction—suggesting a connection between theoretical reasoning and political action.

Drawing on science and technology studies in the context of scientific literacy, Hodson advocates for a focus on civic science literacy which encompasses "the knowledge, skills, attitudes, and values necessary for making decisions on matters such as energy policy, use of natural resources, environmental protection, and moral-ethical issues raised by technological innovations" [49, p. 197]. He establishes a number of levels of engagement with such literacy—from appreciating social impacts of technology to taking action about those impacts—which would inform a curriculum. It is through such political engagement that a curriculum can allow students to "learn how to participate in sociopolitical action," and "to encourage others to participate, too" [49, p. 204].

Bucciarelli and Drew, in proposing a new undergraduate degree program to better enmesh liberal arts with engineering, focus on how current engineering programs fail to teach civics. Indeed, ABET requires no civics courses and, instead, their ethics requirement often boils down to an "ethics lecture...on how to avoid negligence; there is little said about virtue ethics, or social/civic responsibility of the individual as member of a profession" [22, p. 105]. In their proposal, as in this one, they hope to demonstrate the compatibility of "education in science and technology (engineering)...with education in the humanities and social sciences, in particular with learning civics" [22, p. 106].

This is akin to what Schuler evokes as a necessary part of engineering culture: that—civic—engagement with the world be brought to "greater levels of visibility and appreciation and practice" [81].

Hekert uses the language of macro and microethics to describe a focus on, respectively, the social or the individual and professional. Like Moor, he makes the case that engineering ethics education focuses too much on microethics, eliding societal concerns. As I do, he advocates for a greater coverage of science and technology studies and corresponding curriculum revision [48].

2.1.4 Social justice. Such a visibility of social implications has increasingly come in the form of social justice. Leydens and Lucena find engineering curriculum detached from literature like science and technology studies, a lack of focus on the macroethical or societal concerns, little coverage of sustainability or inclusivity, and no theoretical grounding, such as in social justice. They advocate for a number of criteria to judge curricula, among which is, "(3) Acknowledging political agency/mobilizing power" [63, p. 32]. They find that contextual listening and appropriate teaching of, "this mapping of power reveals the degree to which citizens in a community are agentic—that is, how much agency they have in shaping their own future." [63, 26].

Riley [76] and Nieusma et al. [72] both provide further grounding for this unification of engineering and social justice. Such a framework is useful because social justice "tempers 'technical' imperatives by directing attention to social power imbalances surrounding technology decision making as well as inequitable material outcomes" [72, p. 10]. I follow after their suggestions in advocating for educational interventions.

Karwat et al. seek "to fundamentally redefine contemporary engineering practice by exposing the political and value-based

nature of engineering; by applying socio-ecological learning to technological design; by imbuing a different sense of responsibility in engineers; and by moving the scope of engineering beyond solely technological development" [57, p. 91]. In line with the suggestions of [80] and in a comprehensive compendium of prior literature, he operationalizes this by advocating for practitioners' self-reflection [58]. Importantly, he focuses on how this act of reflection is more representative, it acknowledges the inherent politics at play.

2.2 Critiques of Ethics

Recent work demonstrates the insufficiency of ethics in computer science. I cover general critiques, those related to ethics codes, and those stemming from practitioners.

Wagner examines how technology companies, particularly in the scope of AI, use ethics as an escape from regulation. He proposes a number of criteria to make ethics principles more robust, verifiable, not-arbitrary, and legally operational [93].

Metcalf et al. examine how the tech industry operationalizes ethics through 'owners,' or employees with that as their focus. This use of ethics, "strains an already broad term that in some contexts means an open-ended philosophical investigation into moral conditions of human experience and, in other contexts, means the bureaucratized expectations of professional behavior" [66, p. 1]. Furthermore, they cite [33] and [16] in arguing how the term "ethics" locates the problem in individuals and technical systems as opposed to in structures or societal systems.

Benjamin, quoted above, expands on her point, noting how care "gets limited to questions of ethics and safety rather than extending to issues of politics and democracy" [16, p. 208]. Her book offers a "race conscious orientation to emerging technology not only as a mode of critique but as a prerequisite for designing technology differently" [16, p. 35].

Hoffman explores the history of antidiscrimination with regard to fairness and big data, surfacing a few limits from the focus on bad actors, single axis thinking, and choice of a limited set of goods. These limits also plague ethics. She suggests that we should: pay attention to institutional order, not only focus on disadvantage, and take a more intersectional approach [51].

2.2.1 Regarding Ethics Codes. Ethics often find footing in the codes of professional organizations, like the IEEE (the Institute of Electrical and Electronics Engineers) [3] or the ACM (the Association of Computing Machinery) [6].

In a 1983 survey of engineers, Luegenbiehl assails ethics codes in engineering as not being used in practice—they're designed for cover as opposed to as actual resources [64].

In a way responding to Luegenbiehl, Jin and Drozdenko find that ethics codes do play a role in informing organizational culture (at least codes correlated with culture) and that acting in a socially responsible manner may be related to success at an organization, the success of the organization in general, or both [54].

Metcalf examines the history of ethics codes in fields such as computing, medicine, and journalism [65]. He finds that they need to be improved in terms of revisability, target populations, universalism, and reactive versus proactive creation.

Saltz et al. [79] study a variety of ethics codes and relate them to data science ethics. They find that there are unique challenges with data science ethics as particularly related to education.

Greene et al. find the current ethics codes of AI and ML groups co-opt the language of critics into a technologically deterministic framework [46]. Such determinism assumes that technology has to occur, that it determines outcomes such as societal improvement. They cite [12] in noting the lack of a moral background in the ethics principles examined. That is to say, principles assume a normative backing (e.g. what fairness means and how it relates to outcomes) that is not universally accepted by practitioners, but the principles project a kind of completeness and therefore elide the space for the debate over this moral background.

Stark and Hoffman [86] study the ethics codes of computing societies and of metaphorically related professional societies. While they note that ethics codes are useful in educating professionals and instilling norms, they find that these codes are limited. For example, the computing ethics codes mostly examine employees and their organizations and do not often include recognition of other groups which may be affected. While codes often include clauses about an engineer's responsibility to the public good, they fail to evoke exactly what this means. Stark and Hoffman thus note, like [46], that "conversations around professional ethics in data science and related fields such as ML/AI are a necessary but absolutely insufficient conditions for the kinds of progressive, just and equitable social outcomes we seek for the world" [86, p. 20].

2.2.2 From practitioners. Many technical practitioners have advocated for ethics and the inherently political nature of their work.

Green makes the case that data science is inherently political [45]. Ethics codes and courses fail to create mechanisms for accountability, artificially divide technology and society, and lack normative underpinning. It is this lack of clarity in ethics that should open the door for political discussion: "data scientists must recognize themselves as political actors engaged in normative constructions of society and, as befits political work, evaluate their efforts according to the material downstream impacts on people's lives" [45, p. 1]. Following a refutation of common arguments against the inherent political nature of data scientists, Green offers steps for how to realize these politics: through practitioners' interest, reflection, applications, and practice.

Rogaway presents how cryptography is inherently political with an intrinsically moral dimension. He specifically calls out the implicit and overt politics present in cryptographic work and argues that practitioners have an ethic of responsibility [77].

Agre, an AI researcher writing in the 1990s walks the line between a critical perspective and that of a practitioner, evoking some may bristle at critique. Nonetheless, "critical analysis...legitimizes moral and ethical discussion and encourages connections with methods and concepts from other fields" [13, p. 149].

Moore explores whether, given these critiques, AI technologies can be deemed as 'good' at all, particularly in light of the growing trend of the use of terms like "AI for social good" [70].

That technologies are political is not a new argument. From 2007, [55] mentions a similar danger of co-option of language and

the kind of technological determinism involved.[5] Even earlier, in 2000, mainstream computer ethics suffered from two problems: they "focus[ed] too narrowly on publicly recognized moral dilemmas" and tended "to downplay computer technology itself as an object of moral analysis" [20, pg. 11]. I add a third problem to mainstream computer ethics: they assume too narrow a scope.

2.3 Civics

Here I explore engineers' obligations and the use of "civics" in computer science. While defined as "the study of government and the state with particular emphasis on the rights and duties of the citizen" [8], as it is used "civics" relates to the kind of societal and political engagement that I advance in the argument of this paper.

2.3.1 Regarding Engineers' Obligations. Discussions of the scope of engineers are often limited to the technical capacity from an employer's view. That is to say, professional and applied ethics in computing, which make up the majority of the discourse, view engineers as being concerned only with the technical aspects of the products on which they work. Alternatively, one might view the engineer as responsible more generally to society and to the systems with which they interact—a position more in line with Moor's original formulation of computer ethics.

Pirtle and Szajnfarber [73] do just this. They make the case for the engineer's engagement with democratic responsibilities by examining ideals of engineering and science in philosophy.

Furthermore, engineers, and all of those with specialized skills, owe a debt to society for their training, as Schön demonstrates. Part of the social contract of specialization is using those skills for the betterment of all. Indeed, he suggests professional curricula should reflect the constrictions of practitioners' action, such development particularly in applied sciences, and reflection of practitioners on their organizational settings [80, p. 321].

2.3.2 In Computer Science. In engineering, and particularly in computer science and its sub-field human-computer interaction, civics takes on a number of meanings. Civics in this literature is used with regard to the development of explicit "civic tech," "digital civics" or the new part of civil society which exists online, and, in the sense of education, the culture of engineers.[6]

Civic tech. So-called "civic tech" has arisen as an alternative to the capital-driven domain of Silicon Valley. The rise of big data prompted discussion of how regulation might encourage "Data-Driven Innovation" in the building of civic infrastructure—the computational tools produced by various forms of government [47]. From interviews with government officials, hackers, and community groups in Atlanta, [18] evokes various understandings of civic tech. Through a series of speculative prototypes, [34] elicit themes for civic tech like "Mediated Civics, Computational Civics, and Proxied Civics." They take a pluralistic view of civics, which I follow. To them, civics are "the structures, practices, and experiences of public life" including the state and extending to activism and civil society [34, pg. 1]. In their work on relational service models, [91] use the term civics similarly.

Digital media may also promote learning of civics concepts, which is the use of civics in [4, 39, 61, 90]. In this sense, the politics of civic engagement are related to the work of computer scientists.

In this section, I have reviewed literature on ethics in computer science literature, professional ethics codes, ethics education, critiques of ethics in computer science, and civics in computer science. We see that current ethics courses face tension in whether to be integrated in the curriculum or stand-alone, how to engage engineers, and how to broaden the narrow frame of professional ethics. The political and societal engagement offered by liberal arts and civic education present these tensions in an alternative light, particularly given recent critiques of ethics in computing.

3 POLITICS AND ETHICS

My argument rests on a number of normative commitments. I ground my argument in social justice as operationalized by the capabilities approach.[7] I take a social constructivist approach and complicate a simple narrative of technological determinism (e.g. I disagree with [85] and [78] who excluded from their analysis courses covering extra-organizational implications of computing technologies), particularly as Wajcman evokes [94, p. 27].

I follow actor-network theory [21], in emerging the *agency* of students and future engineers in their associations with each other, their employers, technological artifacts, etc. I use the term *politics* both in terms of civic participation and theory, following Winner who describes politics as the, "arrangements of power and authority in human associations as well as the activities that take place within those arrangements" [97, p. 123]. I follow [66] in defining *ethics* primarily "as social phenomena and not as primarily philosophical abstractions" [66, p. 4], which accords with ethics as both personal and societal [48, 68]. I call for greater political engagement in ethics to increase the *representation* of other histories. So does Hoffman with regard to antidiscrimination [51]. Brey [20] calls for computer technology itself to be an object of moral analysis. Benjamin [16, p. 208] quotes [84] as saying "we have to decentralize our idea of where solutions and decisions happen, where ideas come from."

This argument proceeds in five parts. First, I establish the necessity, but also limits, of ethics. Second, I make the case that computing professionals are responsible to society more generally. Third, I present the role of the university as not just a knowledge creator but also to encourage students' action. Fourth, I incorporate current critiques of ethics in computing to argue for practitioners' political engagement. Fifth, I cover the actual political engagement and agency of computing professionals. Following these, I argue that computing ethics education should cover political engagement to a greater degree.

First, as is widely established, ethics are necessary for engineers. They are required for engagement with values but are not sufficient to lead to action. At the same time, as [26] find, engineers commonly perceive their role as limited. This is often called the 'engineering mindset.' Computer science students often limit their opportunities to shape or influence the world as occurring only through technology or the accumulation of capital. Along these

[5] [94, p. 27], [16, p. 40], and [23] offer a more in-depth exploration of technological determinism such as the difference between hard and soft determinism.
[6] See https://civictech.guide/ for a list of some projects.
[7] [45] cites Collins in defining social justice as "an organized, long-term effort to eliminate oppression and empower individuals and groups within a just society" [27]. [70] expands this in terms of the capability approach as do [63].

lines, [45] examines three very common responses to the politics of AI technologies. This is to say, current ethics education is both limited in scope and appears not to address engineers' perceived lack of agency.

Second, engineers have a responsibility to society beyond a strict interpretation of their roles in applied ethics. I argue that they are public servants and have a responsibility to society. Interestingly, the case to make some major tech companies such as Facebook utilities would strengthen this argument. If we assume that computing technologies, like the internet, social media, peer to peer messaging, e-commerce, are essential to modern life and part of civil society then engineers play a unique role in those organizations, regardless of whether they are employed privately or publicly.

In those civil roles, computing professionals possess some agency over products, companies, their workplaces, and beyond. As has been argued by [69], consider Facebook, which has approximately two billion user accounts and about forty-five thousand employees [9]. While clearly not proportional, this equates to about one employee for fifty thousand users. Of course, these employees do not possess total sway over the direction of the companies, but neither do they have no agency. Given the actions of tech employees already, one wonders how to encourage engineers to realize their agency. While, current discussion of ethics focuses on major decisions of companies and research centers, I propose we also focus on those who end up becoming integral to technology companies.

Third, given practitioners' responsibility, universities should act to encourage it. Some may think that political engagement is separate from the knowledge-creation ambit of universities. A social constructivist position shows us that we produce knowledge through interactions with each other—that knowledge does not exist by itself. In this sense, knowledge is already produced and acted upon as partially determined by an agent's normative positions; neither knowledge nor science is value free. Therefore, a university acting to refrain from covering the use of and arguments about knowledge in the world would have, as [45] and others have made clear, already adopted a political position—a conservative one.

Fourth, a greater focus on the political nature of the organizations and problems which computer scientists face will better address the problems raised about it. The restriction just to ethical issues such as the trolley problems [88] drowns out concern over the realization of ethically less ambiguous areas—such as the treatment of marginalized populations [53]. Along these lines, Green calls for data scientists to recognize the politics in their work and cast off the current use of ethics [45]. Greene et al. [46] find a lack of grounding and co-option in prominent AI ethics principles. Wagner finds that industry groups use ethics as a means to avoid regulation and do not provide means of assessment on those ethics [93]. Stark and Hoffman discuss how norms around equality and justice must supplant "processual" professional ethics [86]. Metcalf et al. [66] and Benjamin [16] find that the current presentation of ethics is too narrow. Likewise, ethics courses for engineers are lacking—Colby and Sullivan [26] find engineers less willing to engage in social issues and Bucciarelli et al. [22] discuss how these courses fail to be meaningful for students.

At the same time, there is a growing of interest in civic tech. For human-computer interaction students at least, cultural experiences increase desire to engage with civic tech [44]. This complements Colby and Sullivan's [26] other finding that engineers engage more when presented with active pedagogies and when part of institutions with clear missions—that which might have been lacking for students in the technical track found by Monteiro. This dovetails [49]'s call that science literacy include "sociopolitical action" as similarly evoked by [81]. Likewise, a focus on political action appears to show that the engineering mindset may not be recalcitrant as [26] find directly and in anecdotal evidence from my own experience.

All of this work demonstrates that there is more room to engage with politics in computer science. Such engagement might build on classic approaches like Value-Sensitive Design [41] to acknowledge the inherent political nature of technologies while, at the same time, presenting engineers with tangible solutions—working on problems according to their theory of change and advocating for the computing discipline to transform and not just recognize structural problems.

Fifth, the politics of computer science better corresponds with what is happening in the real world. As mentioned in the introduction, software engineers and computing professionals already exercise their ethical values politically.

These exercises have come through direct action, general advocacy bodies, intra-organizational advocacy, and a growth of more socially oriented problem areas such as 'civic tech'. Examples of direct action include the Google Walkout and the #TechWontBuildIt movement. General advocacy bodies include the Tech Worker's Coalition, the defunct Computer Professionals for Social Responsibility, and various not-for-profits like, more recently, the Center for Human Technology and older organizations like the Electronic Frontier Foundation. Intra-organizational efforts include how employees of Facebook convinced Zuckerberg to change the newsfeed [87]. Civic tech and public interest technology have begun to increase in prevalence as discussed in the literature review.

Ethics, as it exists in computing, treats professionals with limited agency, as they may themselves express. Still, these professionals are responsible to society beyond a strict understanding of their professional duties. Indeed, many critiques have assailed the missing politics in the use of ethics in computing. Nevertheless, computing professionals have begun to act extra-organizationally and in line with their responsibility. Therefore, I argue that we move towards addressing political engagement to a greater degree in the ethical education of computer professionals. Otherwise, we reify a politically conservative, as opposed to representative, conception of the ethics of computing.

4 RECOMMENDATIONS

In this section, I offer recommendations to incorporate the politics of computing in ethics education. First, I model how one might measure success of my proposal. A greater focus on politics might support ethics education through a number of mechanisms. I offer recommendations from bottom-up, second, and top-down, third.

In terms of open pedagogical questions in ethics and computing, I agree with the integrated curricula approach and the suggestions of [26, pp. 335-336] for increased instructor engagement, active pedagogies, and increased institutional intentionality. These might be expanded in light of the recommendations of [45]: through practitioners' interest, reflection, applications, and practice.

4.1 Signs of Success

A greater coverage of politics in computer science ethics curricula might succeed in a number of forms. In line with my aforementioned normative commitments, I cover how those changes might occur in both courses and in students.

4.1.1 Ethics Courses. First, the constitution of ethics courses might change. Courses might assign more critical perspectives to reduce the focus on dilemmas and employ discussion-based methods (e.g. using [1] as a reference). They might focus on action and provide examples of students and engineers who have acted politically in contemporary tech companies.

Critical Perspectives. Literature from a number of disciplines can explicate the political nature of computing. Some of these disciplines include critical data studies, science and technology studies, surveillance studies, race and ethnic studies, sociology, feminism, and the philosophy of science, some of which human-computer interaction covers.

For example, one might cover the shifts in power in our datafied society and the political implications of modern AI systems. To do so, as Hoffman does in her course,[8] one might start out with theory, such as Foucault's coverage of the Panopticon [40], weave through Desrosières' discussion of statistics [32], and tie these together with Deleuze's analysis on the transition of power in society [31]. Then, to bring these ideas into the big data age, one might employ Bowker and Star's book on classification [19], Dwork et al.'s summary and argument to expand our concern from just privacy [36], and Barocas and Nissenbaum's more practitioner-focused piece on privacy [15].

An ethics course might also present a unit on facial recognition as an emerging technology, addressing its technical underpinnings, connection to theory, structural implications, and previous actions. To this end, Arcas et al. [14], rebuking the prediction of criminality from photos of faces, serves as a good introduction. They begin with the history of measuring facial features to determine criminality in Italy, technically describe how machine learning works— regarding parameters, training data, and overfitting—review how biases emerge in such systems, and present the flaws and racism inherent to measurement of facial features. This might then be paired with Keyes' work on the trans-exclusive and gender-essentialist nature of automated gender recognition [59] which explicitly considers the "ethical underpinnings of part of the field." Then, one might use Crawford and Joler's [30] examination of various facial recognition training data sets—images and their labels—through their histories and taxonomies to argue that politics arise at every level of a computer vision task. Students might better realize the societal and political effects of [30]'s argument through news coverage such as [74]. Crawford's call to action against the use of facial recognition technology [29] reinforces that connection.

Furthermore, consider Barocas's course, "Ethics and Policy in Data Science" at Cornell which called on students to draft responses to the Consumer Financial Protection Bureau's "Request for Information Regarding Use of Alternative Data and Modeling Techniques in the Credit Process."[9] One might do something similar with facial recognition technology. For example, Washington State is currently considering privacy legislation which could cover government use of facial recognition technology.[10] Students could be directed to draft public comments[11] with regard to what they learn in the class, engaging with the technology like Hoffman does [50].

4.1.2 Students. Second, students might act differently. We might see students engage with and adopt more critical language. For example, they might use terms such as "values" or "sociotechnical." They might discuss the political nature of technical decisions and artifacts (e.g. in enforcing a gender binary). Students might identify their own normative commitments (e.g. "I'm more in favor of a pro-actionary principle than a pro-cautionary one"). Lastly, students might then act with their values in mind—by even engaging in activism. Such actions might include:

(1) Appealing for accountability from organizational leadership:
   (a) through letters, conversation, etc.;
   (b) by voting, if available;
   (c) by asking about companies' positions in hiring processes.
(2) Exercising discretion in their choice of work:
   (a) by exploring different research courses;
   (b) by not applying to certain companies.
(3) Engaging with technological issues publicly:
   (a) with their peers, colleagues, family, and communities;
   (b) by writing on social, or other, media.
(4) Engaging in direct action:
   (a) by participating in strikes;
   (b) by showing up to protests.

4.2 Bottom-up

It seems unlikely outside of significant lobbying efforts that universities will soon offer, if even require, a recognition of the political nature of computing technologies. Until, and in order to reach that point, those of us who would have computer science undergraduates recognize and explore their political voices regarding technology have a few options.

First, we can begin to use terms like politics in addition to terms like ethics. This is in contrast to the current use of ethics in computer science. If computer science ethics courses already address politics as I discuss in this paper (as opposed to, for example, teaching ethics in the sense of professional ethics codes or limiting discussions to dilemmas), the change to describe ethics courses as relating to politics might alone address the limits of ethics in computing. Nonetheless, that seems unlikely. Thus, using the term politics would also imply the adoption of the practices associated with it—like discussions of responsibility to society, engagement with critical literature, voting, debates, and a focus on action.

Second, we might focus on examples of activism in the tech world in our own courses. Students are accustomed to solving problems and may grow frustrated when presented with problems to which they have no solution. Indeed, the 'engineering mindset' appears at odds with the kind of open-ended philosophy of traditional ethics. Examples of positive action of tech workers might allow students to recognize that their 'solution space' extends to political

[8] See her syllabus: https://static1.squarespace.com/static/5b8ab61f697a983fd6b04c38/t/5c367df0898583acb0e1eee0/1547075056600/Hoffmann-INSC_598A_Syllabus.pdf
[9] See his syllabus: https://www.onlineethics.org/File.aspx?id=45373
[10] https://app.leg.wa.gov/billsummary?BillNumber=5376&Year=2019
[11] Submit comments at https://app.leg.wa.gov/pbc/bill/5376

action. Of course, examples will not motivate all students, but their use is nevertheless more in line with the telos of most accepted normative frameworks. That is, most students will not face the trolley problem in practice (see [53]), but they will likely end up working for organizations with histories of oppression.

Third, we should employ discussion-based methods (e.g. see [1]). Many undergraduate computer science programs offer large lecture style courses—often to hundreds of students. Even recent efforts in ethics and computer science, like the grants from the Mozilla Foundation [71], appear to bolster this large lecture approach. It appears unlikely that lecturing alone will allow students to engage with the inherently political and explorative nature of these problems—there's not a correct answer. While classes with fewer than 20 students would be ideal to promote dialog, larger classes might approximate this by breaking up into discussion groups, employing activities such as think-pair-share, using online platforms for students to engage with each other, etc.

Fourth, we can cite literature the better explicates the political nature of computer science, in line with the above discussion of critical perspectives.

4.3 Top-down

Accreditation and grant requirements, given their historical use, appear the most effective mechanisms to change department and university policies on ethics courses for computer scientists.

4.3.1 Accreditation. Accreditation dictates which courses computer science departments offer. In the United States, ABET (the Accreditation Board of Engineering and Technology) controls most accreditation, but this primarily applies to students seeking computer engineering rather than computer science degrees. (Changing the requirements for computer science degrees would more likely occur on the university level.)

Since the 2017-2018 accreditation cycle, the ABET requirements for student outcomes in computer engineering programs have changed in a manner that appears to make them more limited. The total number of required student outcomes reduced from nine to five. While the outcomes previously required that students attain "(e) An understanding of professional, ethical, legal, security and social issues and responsibilities" and "(g) An ability to analyze the local and global impact of computing on individuals, organizations, and society" [5] by 2018 - 2019, these had become, under the heading *student outcomes*, "4. Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles" and, under the heading *curriculum*, courses must cover "3. Local and global impacts of computing solutions on individuals, organizations, and society" [7]. Furthermore, the outcomes now use language that centers, to a greater degree, computing and the organizations in which students will work. Students should produce solutions that are "computing-based...in the context of the program's discipline." Their responsibilities and ethics are now relative to "professional" commitments. Both "social" and "issues" have disappeared from the new criteria, suggesting a perceived lack of importance. Notably, even [78], who conducted a review of ABET and how the top 20 U.S. computer science programs covered ethics, failed to comment on the implications of the 2018 - 2019 ABET changes. Still, while unnecessarily vague, the fact that curricula must include a focus on "local and global impacts" at least allows for the inclusion of a greater political awareness of computing technologies, as I suggest above.

Despite the drawbacks of recent changes, future accreditation criteria might include language to make more stringent the ethics requirement or, even better, the political nature of technologies.

4.3.2 Grants. Grants appear the most likely top-down mechanism to create change. While limited, the use of ethics in computer science demonstrates scholarly engagement which might imply interest in the expansion of curricula. For example, the Mozilla Foundation [71] recently awarded 3.5 million dollars among 17 schools. A foundation might do something similar to explicate the political nature of computing more specifically. In another example, the 2000s saw Congress, cognizant of the risks of the nanotechnology, mandate "the integration of research on societal, ethical and environmental concerns with nanotechnology research and development" [2]. An act might do the same for computer science.

5 LIMITATIONS

In the scope of advancing a more representative treatment of politics in computer science education one might levy a number of critiques. I address eight of these. These critiques are relevant but are exactly why we should forward the politics in computer science education—politics are already present, but currently not discussed enough.

First, one might object to my argument on the grounds that (computer) science should be apolitical. This is similar to arguments that science should be value-free or objective which [35] clearly refutes—values arise in all aspects of science.

Second, and closely related, is the critique that the political engagement of engineers is contrary to what their position should be—that is, largely subservient to management. As discussed in the literature review, this is also not the case. Computer scientists or engineers are as much members of society as anyone else and thus have the right and responsibility to act as such.

Third, one might argue that even if politics are embedded in technology and computer scientists have a role in engaging with those politics, it is not the role of the university to teach such engagement. I present an argument against this in section three. Nonetheless, readers might interpret me as insinuating a (deterministic) causal link between education and the political action of students. This is not my intention. To that end, one might conduct a systematic analysis to describe a relationship between, if it exists, computer science programs and the normative classifications of companies for which their graduates work.

Fourth, even if universities are allowed to act as such, one might argue that to do so would endanger the support computer science departments currently receive from technology companies. This is likely the case but appears necessary in focusing on normative outcomes. Indeed, to not teach future tech employees of their political roles is itself a political position and perhaps even an unethical one if these departments support the oppressive actions of tech companies by furnishing subservient graduates.

Fifth, and more practically, instructors in computer science departments might not be interested, available, or capable of teaching such classes. As [78, p. 7] cite a response to a 1996 article, one computer science professor, reacting to a report on ethics, said "ethics

is 'not computer science' and that it was 'difficult to imagine a computer scientist teaching these things.'"

This raises serious concerns for scaling classes which address politics (or even ethics). Clearly, the ability to teach set-theory does not qualify a professor to lead a discussion on Foucault. Nevertheless, computer science departments possess the funds and this dearth of instructors might conveniently solve issue *six*: that focusing on computer science departments encourages academic silo-ing and silences critical scholars whose careers are predicated on paying attention to such issues around technology. The lack of teaching ability in computer science departments might be an opportunity for educators and interdisciplinary engagement. Still, such a shift might open the door for students to stop paying attention—'it's just the ethics instructor, not real work.' Effective endorsement from authority figures in computer science, co-teaching, and sufficient technical coverage (e.g. a lecture on how facial recognition works) might overcome such responses.

Seventh, one might argue that my presentation of agency is limited. Of course, my discussion does not fully address the complications of agency. Intersecting identities, such as of citizenship or economic status, gender, sexuality, and race, complicate a simple presentation of agency. For example, consider a female-identifying first-generation college student whose parents were born outside of the United States and a male-identifying student whose parents both hold doctorates and pay for his tuition outright. Even if both are offered jobs as a "Software Engineer I" at a large cloud computing company with military contracts in a major Western U.S. city and both hold similar normative and political commitments, these two will possess a very different sort of agency. While both are offered six-figure salaries, the man appears to face fewer risks in turning the job down. As stated in the recommendation section, students have a variety of means through which to act politically besides just 'talking with their feet.' Still, neither students, tech employees, nor the communities for whom they claim to act, might be expected to fulfill just one presentation of a reflective practitioner. Their means are manifold.

Eighth, and most importantly, one might argue that greater political engagement is still whitewashing. In that sense, such instruction could lead to greater harms. The proposal to encourage more coverage of politics in ethics curricula might even backfire. Instructors might interpret it as just one more box to check. Students, given an outlet for their moral action, might then do nothing outside of the classroom. I am most concerned by this critique. Nonetheless, by maintaining a focus on others' action outside of the classroom as models for students and with engaged instructors with exposure to the literature, the potential for such a backfire seems less likely.

It is not my intention to indicate that re-naming or changing of curricula will engender structural transformation. If instructors did start teaching political agency as part of ethics classes, it would still be just a bandage. Instead, this is part of a greater campaign to recognize the political nature of computer science. Ideally this leads to and works with the kind of activism, legislation, and behavior change necessary for the application of a given ethical theory.

Lastly, political exercise carries risk. Such risk is not reason enough to avoid showing students their responsibility and agencies but is worth noting. For example, organizers of the walkout against sexual harassment at Google in the fall of 2018 have faced retaliation [89] and since left [24]. In December 2019, four Google union organizers were fired for their efforts [17]. These risks are not uniform and complicate an intersectional understanding of agency.

6 CONCLUSION

In this paper, I have identified a problem with the ethics curricula in computer science and suggested a solution through greater incorporation of politics. I began by reviewing literature on ethics in computing. Then I offered a systematic argument for why such an incorporation of politics would be appropriate. Then I attempted to operationalize this argument through recommendations. Cognizant of critiques, I finished by covering limitations to my approach.

Stark and Hoffman [86] aptly quote Langdon Winner as testifying to Congress to deplore, "those who conduct research about the ethical dimensions of emerging technology to gravitate toward the more comfortable, even trivial questions involved, avoiding issues that might become a focus of conflict" [98].

This work aims to support the increased proliferation of ethics courses. It also focuses on the bigger picture political questions at stake. Ethics education in computer science has many ways to improve before even reaching the point of advocacy.

As Ethan Zuckerman, a prominent MIT computer scientist, has said, "My guess is that courses that force us to have these sorts of arguments are critical to unpacking the intricacies of emerging technologies and their implications. To be clear, there's the field of science and technology studies, which makes these questions central to its debates" [100].

Values, and discussions about them, under-gird the work of computer scientists. Recent uses of ethics, particularly regarding technologies like artificial intelligence, appear to ameliorate the concerns of computing technologies, but in practice, 'ethics' does not go far enough to recognize the inherently political nature of these technologies. While past works on ethics in computing have focused on research, regulation, and executives, practitioners, too, have a role. Indeed, some tech employees have already begun to act beyond their organizationally prescribed scope. Given the issues with ethics as it is used in computer science and students' likely receptivity to action-based teaching, we should teach the politics of computing. Doing so would provide students opportunities to explore not only values in technologies and normative frameworks, but also means for redressal.

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