Engineering Ethics and Unionization: Challenging NSPE's Positions on Engineers' Relationship with Labor Unions

Lazlo Stepback, Purdue University

Lazlo Stepback is a PhD student in Engineering Education at Purdue University. His current research interests focus on engineering ethics, the connections between personal morals and professional ethics, and how students ethically develop as engineers. He earned a B.S. in Chemical and Biochemical Engineering at the Colorado School of Mines (Golden, CO) in 2020.

Dr. Joey Valle, Purdue University

Joseph 'Joey' Valle is a queer Latine Ashkenazi Jew employed as a postdoctoral worker in the School of Engineering Education at Purdue University. Dr. Valle received a Ph.D in Materials Science and Engineering at the University of Michigan - Ann Arbor. They were awarded an NSF STEMEdIPRF Postdoctoral Fellowship: Advancing Engineering Education in Universities on Labor and Unions to study intersections of engineering and labor.

Engineering Ethics and Unionization: Challenging NSPE's Positions on Engineers' Relationship with Labor Unions

Introduction:

US engineering professional societies have been influential institutions that propagate a constricted understanding of the roles and responsibilities of an engineer within society by upholding an alignment of industry over engineering reflective of a hegemonic adherence to business professionalism [1, 2, 3]. The ideology of business professionalism, described in more detail to follow, advances beliefs that engineers are, and should be, unshakably beholden to capitalist corporate owners and the industries they extract profit through [3]. In this paper, we examine the historically anti-union attitudes and actions of the National Society of Professional Engineers (NSPE), and their adherence to the ideology of business professionalism, through analysis of ethics case studies published by their Board of Ethical Review (BER). As an advocate of professional engineering licensure and as leaders in engineering ethics standards, NSPE's consistent anti-union stance lays bare a clear bias to the needs of industry and the capitalist mode of production at the expense of the collective bargaining power of engineers as workers. NSPE is an influential organization in the codification of engineering rules of practice, so it is valuable to deconstruct their application of their code of ethics to justify anti-union arguments.

As workers tasked with materializing social visions, engineers in the United States, and the technical knowledge they hold, are significant forces of production in modern society [4]. When describing the relations of production between engineers and the instruments and resources they use to produce goods in US society, or means of production, Riley explains that engineers "are a primary vehicle through which the means of production is accomplished," while overwhelmingly "engineers do not control the means of production because they are beholden to the desires of management, CEOs, shareholders, the market, etc." [5]. Overwhelmingly, US engineering labor is concentrated within large corporate organizations, leading some such as Goldman to describe engineering as a "captive profession" unwillingly ensnared in corporations [6] and others such as Davis to claim, "the relationship between engineering and certain large organizations, like that between the heart and the body, is symbiotic … it is their natural habitat," [7].

David Noble asserts a more active role of engineers, particularly engineering managers and corporate executives with backgrounds in engineering, in propagating the growth of corporate capitalism and shaping the positions of engineers within corporations. Noble describes how engineers leveraged their societal relationship to technological development and production by "informing their work with the historical imperatives of corporate growth, stability, and control … the engineers, moreover, went a step further to ensure that their technical work meshed with the imperatives of corporate social relations; rather than restricting their attention to technical matters, they *consciously* undertook to structure the labor force and foster the social habits demanded by corporate capitalism" [1]. As engineers serve capitalism via industry, they reject their positionality as workers along with any solidarity with the rest of the working class that would undermine capitalist hegemony. Given the structural alignment between engineering and

corporate capitalism, it is unsurprising that for centuries US engineering education has been shaped to the needs of capitalists and the industries through which they amass wealth [1, 3, 5, 8]. The deference of engineers towards capitalist corporations is reflected in the code of ethics put forward by NSPE and subsequent revisions.

Labor unions offer engineers an opportunity to democratically organize to improve their living and working conditions and to create a world where their labor is no longer beholden to capitalist corporations. Valle, Bowen, and Riley have discussed how the maintenance of business professionalism and techno-rational orientations is connected to the hindrance of the sociopolitical development of engineering workers and accompanying improvements to health, safety, and the welfare that can come from engineers building labor unions and being active participants in the labor movement [9].

Next, we offer a brief history of US engineering unionism and anti-union constructions of professionalism advanced by engineering professional societies, specifically NSPE. We also turn to ethics case studies that NSPE has published over the last 60 years regarding the relationship of engineers with labor unions for evidence of the anti-union and anti-worker ideologies guiding NSPE's ethical standards.

A Brief History of Engineering Labor Unions

As stated above, labor unions are democratic institutions workers build collectively to improve their living and working conditions. Dignity and respect for workers and their communities are often central organizing principles of labor unions, and the ability to collectively bargain and enforce the terms and conditions of work with an employer has been a key means of building and demonstrating the power workers collectively hold. Broadly, labor organizations can be categorized along lines of craft unionism or industrial unionism. Craft unionists seek to organize particular sections of skilled or unskilled workers based on their particular work functions and were some of the earliest forms of labor unions. Industrial unionists seek to organize all workers within a particular industry. Following the passage of the 1947 Taft-Hartley act, some US labor unions have formed as business unions, unions oriented around a belief that labor unions should be run like businesses while posing no threat to the state or corporations employing their members. These business unions tend to be less democratic and engage in an advocacy model of change that does not center its base of power on the workers and their communities [10]. Part of the power labor unions have comes from labor strikes and other forms of direct action, acts individuals or groups take to bring about social change rather than relying on intermediaries or representatives to act on their behalf. As Valle, Bowen, and Riley have described, strikes are a form of liberatory pedagogy seldom engaged by engineers and engineering educators [9]. For example, even though they did not strike on the common good grounds Valle, Bowen, and Riley's argument centers on, Boeing's stock prices plummeted roughly 20% and production slowed to a trickle when over 17,000 engineers enacted one of the largest white-collar labor strikes in US history for 40 days in 2000 [5, 11].

The US is one of the most hostile environments for union organizing amongst industrialized states, and engineers along with other professional workers have generally joined labor unions only if they perceive the labor movement as a whole to be large and strong [3, 12]. US engineering unionization rates reached a relatively low high point in the late 1950s when roughly 55,000 of 500,000 (11%) of engineers were unionized. Zussman notes that the wave of unionization amongst engineers during this period was largely defensive to avoid joining industrial union bargaining units that were largely composed of the very 'non-professional' and 'blue-collar' workers engineers considered themselves above [13]. Strauss outlines how at the time, about 10,000 engineering workers (2%) were represented in industrial unions and about 45,000 engineering workers (9%) were represented in professional engineering unions, of which 25,000 (5%) belonged to the Engineers and Scientists of America (ESA) federation of engineering unions [14]. Presently, according to the Bureau of Labor Statistics, the combined number of unionized architects and engineers sits roughly at 231,000 of 3,335,000 (7%) [15].

Meiksins and Smith offer a theory of structural contingency to explain the relatively low rate of unionization of US engineers [8]. They contend that structural forces exist within all industrial capitalist societies creating pressure for organizational professionals like engineers to unionize. The degree to which these pressures produce unionized engineers is dependent on the specific conditions in the different national contexts. Most clearly, they identify the context in the US as driven by individualistic attachment of many US engineers to categorize themselves into a higher status position than non-professional technical workers and 'blue-collar' workers more broadly. Even during the period Layton dubbed the 'revolt of the engineers' of 1910-1930, reform movements concerned with engineering ethics and improving the material conditions of engineers dismissed and denigrated the unionization of engineers [2, 16]. In many of the cases where engineers did manage to unionize, they did so in separate bargaining unions of a more craft and business union orientation, largely in order to avoid joining industrial unions [3].

Meiksins and Smith note that throughout the history of the US labor movement, major labor organizations have not demonstrated sustained interest in organizing engineers [3]. In the early 20th century, the craft union oriented American Federation of Labor (AFL) had the potential to be a home for engineers' unions; however, AFL leadership saw engineers as a category of workers outside of those they sought to organize. They were skeptical of the inclusion of professional engineers and middle-level corporate employees out of fear they would advocate for management within the labor movement as they had in professional societies [3]. The more industrial union-oriented Congress of Industrial Organizations (CIO) did seek to recruit professional engineers into its affiliates and even created a separate white-collar union, the United Office and Professional Workers of America (UOPWA). Particularly notable is the professional union the Federation of Architects, Engineers, Chemists, and Technicians (FAECT) that formed in 1933, affiliated with the CIO when it formed in 1937, merged into UOPWA in 1946, and was expelled by the CIO in 1950 for Communist affiliations in alignment with requirements in the 1947 Taft-Hartley Act [17].

A significant hindrance to sociopolitical development of engineering workers and efforts for engineers to unionize has been the hegemonic ideological alignment of engineering with

business professionalism [3, 9, 18]. The ideology of business professionalism propagates beliefs that engineering is rightfully beholden to the interest of capitalist corporate owners, continually reforming engineering to better meet the needs of corporations seeking endless growth and extraction of profit [3]. Such an ideology positions professionalism as inherently incompatible with unionism because unionism gives workers the power to collectively negotiate with and push back against capitalist corporate owners and the industries they extract profit through [3].

NSPE and their Anti-Union Roots

"The concept of Unionism in engineering was one of [the] real reasons for NSPE's creation and a movement that D.B. Steinman ['Father' of NSPE] wanted to prevent with engineers. This topic is covered frequently as early as the late 1930's in [NSPE publication] *The American Engineer*." - from *The Complete PEI History of NSPE* [19]

"The [National] Society [of Professional Engineers] throughout its history has maintained a consistent stance opposing collective bargaining for engineers." - Paul H. Robbins, first Executive Director of NSPE [20]

The National Society of Professional Engineers (NSPE) formed in 1934 as a staunchly anti-union organization. Its origin can be traced to its predecessor organization, the American Association of Engineers (AAE), being accused of acting like a labor union by the management-oriented leaders of other engineering professional societies [16, 19, 21]. The AAE was founded in 1914 with a major objective of improving the material conditions of poorly paid younger members of the engineering profession while still being strongly opposed to engineering unionism [16]. At its founding, there were two philosophical orientations, one seeking to establish a labor union affiliated with the AFL and another seeking a professional society, with the latter dominating the organization's actions. Claiming a moral right to higher status and compensation, AAE leadership such as Frederick Haynes Newell pushed for a unified, independent engineering profession [16].

Upon a push by rank-and-file engineering members, AAE began supporting licensure as a means of improving material conditions while maintaining a privileged status and avoiding unionization. It was clear that an interest in improved material conditions rather than the ideals advanced by AAE leadership drove membership. Membership ballooned after AAE assisted in winning a substantial wage increase for railroad engineers in 1918 but was followed by a sharp decline by the mid-1920s when AAE leadership began backing away from seeking material improvements for its members. Notably the engineer-manager class from across professional societies made a concerted effort to denounce AAE by claiming it was an example of trade unionism because of its interest in seeking higher compensation for rank-and-file members [16]. This pro-union framing of the AAE occurred despite continued denunciation by AAE leadership of unionism, such as in their 1919 *Statement of the A.A.E. on Trade Unionism in the Profession* where they advanced the business professional notion of the incompatibility of professionalism and unionism [22]. It was this declining AAE, whose leadership had already alienated much of

its previous rank-and-file membership, that D.B. Steinman ‘Father of NSPE’ was president of in 1925-26.

The NSPE continued the anti-union orientation of business professionalism it inherited from the AAE and other engineering professional societies. Perhaps most notoriously, engineer-manager leadership of the five Founder Societies (AIChE, AIME, ASCE, ASME, and IEEE), NSPE, ASEE, and a representative of the Engineering Joint Council presented to the House Labor Committee draft language for federal legislation that would become the Professional Provision of the 1947 Taft-Hartley Act [20]. NSPE hired a lobbyist who, alongside Executive Director Paul H. Robbins, “worked feverishly with Senator John Ball (MN) to lobby the entire US Senate” for the passage of the Taft-Hartley Act and the Professional Provision [19]. Robbins testified before the House Labor Committee in 1946 in favor of the Professional Provision [20].

The Taft-Hartley Act of 1947 was enacted to significantly restrict the activities and power of labor unions after millions of workers went on strike in 1945 and 1946. The act made some types of strikes illegal as well as closed shops that require employers to only hire union members, amongst other labor practices. The Professional Provision of Taft-Hartley made it so that engineers and other professional workers could demand to form separate bargaining units from “unskilled and skilled workers” in industrial unions so as to avoid concerning themselves with “the welfare of many different types of workers, including unskilled and professionals,” [19]. Unlike the orientations of those such as Davis who consider professionalism to be predicated on ethics, the Taft-Hartley Act defines a professional as “one whose work is predominantly intellectual and varied in character, involving consistent exercise of discretion and judgement, incapable of standardization, and requiring advanced scientific judgement,” [7, 23]. At their Fall 1948 meeting after the passage of Taft-Hartley, NSPE officially put on record the following two positions: “1) That the individual responsibility and independent judgment required of a professional engineer is incompatible with the regimentation fundamentally inherent in unionization; and 2) [t]hat the NSPE believes that the provisions of the Taft-Hartley Act which apply to professional employees should be utilized by registered professional engineers as a means of avoiding regimentation into unions” [19].

Beyond lobbying efforts to pass the Taft-Hartley Act with the Professional Provision, *Building for Professional Growth: A History of the National Society of Professional Engineers* by NSPE’s first Executive Director Paul H. Robbins and *The Complete PEI History of NSPE* by the History Committee of the Professional Engineers in Industry (PEI) section of NSPE detail decades of explicit, intentional anti-union activity by NSPE [19], [20]. After Taft-Hartley's passage, “a number of NSPE state societies also were active in supporting legislation in their states to enact right-to-work laws,” [20]. Right-to-work laws are designed to weaken labor unions and imperil workers that have resulted in significant increases in workplace mortality where they have been enacted [24]. In 1957, NSPE’s Maryland branch assisted anti-union efforts amongst engineers in the Westinghouse Electronics Division at Friendship Airport. Also in 1957, the Minnesota branch of NSPE assisted engineers at the Honeywell Company in decertifying the United Auto Workers (UAW) from representing Honeywell engineers, instead forming a ‘sounding board’ organization whose purpose “was to study employment problem areas, publish their findings, and suggest

changes to improve the professional climate for engineers of particular employers. It was hoped that such findings, ideas, and suggestions would result in management decisions on particular problems as they occurred," [20].

In 1958 NSPE increased membership dues 30% to fund research on the engineering profession and to combat unionism, including through the distribution of anti-union literature to engineering school libraries and senior engineering students [19]. In 1960, the NSPE Board of Directors adopted several policy statements including that "unionization of professionals [is] inconsistent with the best interests of either the profession or the general public," "professionals should be able to vote separately in decertification proceedings" to remove engineers from unions even if the workers in their union choose to recertify their union, and seeking to resource engineering technicians in opposing unionization "because the unionization of engineering technicians could hinder the professional activities of engineers" [19]. During a wave of higher education faculty unionization in the 1960s, NSPE "spent considerable time exploring means by which an engineering faculty could resist moves toward unionization," [20].

Through the 1960s and 70s, craft unions in the construction industry sought legislation to legalize single craft picketing an entire construction site but NSPE lobbied against such legislation arguing such strikes would "impinge upon the engineer's ability to perform whatever functions he might have at the construction site." In 1975, NSPE testified before the House Subcommittee on Labor Management Relations that passing such a law would "encourage building trade unions to use coercive tactics and pressures in attempting to unionize engineering and surveying employees involved in a construction project," [20]. In 1976 NSPE funded a decertification drive for engineers employed by the Leeds & Northrop Company. 1980 NSPE weighed in as a 'friend of the court' in the US Supreme Court case regarding Yeshiva University, which did not have an engineering faculty, to support the notion that teaching and professional staff had sufficient supervisory authority to bar them from unionizing. The Supreme Court decided in favor of this position, with the far-reaching effect of barring the faculty at all US private higher education institutions from unionizing.

It is within this historical context that we analyze NSPE's use of the codes of ethics to further their anti-union actions and the ideology of business professionalism.

NSPE's Ethics Based Arguments Against Unionization

Over the last several decades NSPE has released ethics case studies to address how they believe a professional engineer should ethically behave in a variety of situations, allowing us to perform a textual analysis of NSPE's published opinions about the unionization of engineers. The data for this analysis comes from ethics case studies that NSPE has analyzed and published through their Board of Ethical Review (BER). NSPE has made these BER ethics case studies available to the public and there are hundreds of cases about a wide range of ethical issues an engineer may face. We focus our analysis on the BER cases that are directly related to unionization and engineers' interactions with unionized labor and address the primary message the BER seeks to convey to engineers with each case. The BER analysis of these cases is grounded in the NSPE Code of

Ethics, so we will also investigate how the BER interprets the code of ethics in a manner that is purposefully anti-union and anti-worker in line with the broader organizational stance and ideology of business professional.

Each BER case is succinct with its analysis, so we are able to directly investigate the moral arguments NSPE has made in regard to the relationship between engineers and labor unions. The BER cases are structured with the context of the case, the ethical questions involved, and the codes of ethics references immediately presented, followed by a discussion and conclusion. When there are sections of the code of ethics that have been revised or removed, NSPE acknowledges the change on the web version of the BER case but not in the PDF download of the case.

The BER primarily grounds their analysis of the case studies in the NSPE Code of Ethics, specifically the most recent iteration at the time of the case. The NSPE Code of Ethics has gone through several revisions over the years, with the most recent version published in 2019. The current version of the code of ethics is broken down into the rules of practice, which describes the fundamental canons and specific actions associated with each canon, and professional obligations, which describes general behaviors that are expected of an engineer to maintain professionalism. There is some overlap between the rules of practice and the professional obligations, such as both sections prohibiting deceptive acts, but there are differences in the specifics. Continuing with the deceptive acts example, the rules of practice specify that for fundamental canon five, "engineers shall avoid deceptive acts," but the focus in the subsection is that engineers shall not falsify qualifications and shall not attempt to influence the award of a contract from a public authority through direct or indirect means, such as giving a gift in an attempt to sway decision making. The professional obligations state that an "engineer shall avoid all conduct or practice that deceives the public," and the subsections specifically address how engineers communicate with the public [25].

Since both sections address similar issues from different perspectives, the BER acts as an interpreter of the code to determine what sections are most applicable and if any violations are present in a particular case. The BER does not provide critiques of the code; rather, they use it as the framework for their moral decision making. The positionality of the BER interpreting the code and not critiquing is important to note because it contextualizes the BER as a mouthpiece for NSPE and not a truly neutral or objective source of moral judgement. If the NSPE Code of Ethics required engineers to wear polka dots to work, then the BER would interpret any other attire as unethical. Or in the context of this paper, if NSPE says it is unethical for engineers to unionize, the BER provides the reasoning and justification for that stance.

Case 62-5: Don't unionize

The first BER ethics case study that addresses engineers joining labor unions was published in 1962, with case number 62-5. This case raises the question, "is it ethical for an engineer to be a member of a union, or participate in union activity of a coercive nature?" The context provided to this question is that some hypothetical professional engineers are members of a union that has

engaged in strikes against a company, used picket lines, and that a union spokesperson has spoken negatively about the company. They add that some union engineers have "assailed" nonmembers for not joining the union and crossing the picket line. It is important to note that picketing, a form of direct action workers take designed to restrict or halt access to a worksite, is immediately framed by NSPE as harassment of nonmembers [26].

The case then moves into a discussion around engineers joining labor unions generally. The BER acknowledges that NSPE cannot prevent an engineer from joining a union because it is a right protected by law and some employers may have a union shop clause, which requires employees to join the union to work at the company. However, the BER follows this by asserting the business professional notion that professionalism and unionization are "incompatible" with each other.

> The National Society of Professional Engineers, as well as other national engineering organizations, has long-held that professionalism and unionization are incompatible and has discouraged the union approach as a proper method for engineers to seek the elevation of their economic or professional status. In view of the extensive NSPE literature on this subject, it is not necessary to repeat the many reasons for this opposition to unions for engineers. [26]

The BER narrowly construes the reasons engineers may unionize to be simply economic or professional uplift. Such a narrow framing ignores any other reason workers may unionize, such as advocating for safer working conditions, and aligns with how Meiksins and Smith describe that "engineering employers have attempted to present professionalism as an *alternative* to unionism," despite the inabilities of professional societies to erase the realities of organizational employment [3]. Additionally, the BER does not include any references to this "extensive NSPE literature" yet expects the reader to either trust the statement on face value or dig through previous publications to find their reasoning. Since this case was published in 1962, all of the literature they claim to base this opinion on is at least 60 years old and not readily available on the internet.

The case continues by grounding the analysis in the Canons and Rules of NSPE that were current at the time of the case. Specifically, the BER uses the canon "the engineer will act in professional matters for each client and employer as a faithful agent or trustee." This canon in itself is a blatant example of how NSPE seeks to propagate business professionalism through ethics, especially considering how overwhelmingly the clients and employers of engineers they are obliged to be faithful agents or trustees of are the state and large corporations. They claim that "experience has demonstrated, beyond any reasonable doubt, that an engineer with a union-minded attitude cannot and does not regard his relations with his employer as that of a faithful agent or trustee." The BER offers no support for this claim besides a vague reference to "experience" that falls apart when evidenced by the largely business unionist history of engineering unions. Even taking their claim on face value, the orientation is not toward professional autonomy but rather is primarily aimed towards protecting businesses from internal criticism and labor power. Fielder criticizes the agency model of organizational loyalty due to its

lack of respect for individual autonomy and treatment of the employee as simply an extension of the company, or as treatment of the employee as a serf [27].

Case 62-5 concludes by reiterating that union involvement prevents engineers from acting professionally and extends the argument to claim that an engineer cannot ethically engage in strikes, picket lines, or any other form of collective tactics NSPE deems coercive. This claim about the unethical nature of engineers participating in collective action NSPE deems coercive would be included in the 1964 revision of the NSPE Code of ethics (section 1f) [28], as well as subsequent versions until its removal in 2001 [31]. The removal of this section in 2001 came not from a change of heart by the NSPE, but instead because engineers in certain employment contexts are required to participate in a union (later mentioned in Case 3-09).

Case 70-4: Scab for the bosses

The next ethics case reviewed by NSPE's BER that involved union activity is case number 70-4, and it directly addressed the obligations engineers have while their company has striking workers. In this case, the production and maintenance employees of an oil company are on strike causing a disruption to the operation of a refinery. The reasoning behind the strike is not provided. Rather than meeting the bargaining demands of striking workers, the oil company decided to assign engineers to perform some of the duties usually done by the striking workers so some operations can continue. The question raised to the BER is whether it is ethical for engineers to perform what they call "nonprofessional duties" during the strike. Despite how NSPE frames this case, this is a clear example of engineers being used to temporarily replace the striking workers, undermining the power of their collective action. The engineers in this situation would colloquially be referred to as "scabs" because they are temporarily covering up the bleeding wound that is a labor strike. The act of scabbing is generally frowned upon by most people, but NSPE argues that it is actually the engineers' moral obligation to scab in this context [28].

The BER begins their analysis by claiming that an engineer's participation in collective action NSPE deems coercive would normally conflict with an engineer's duty to protect the health and safety of the public in addition to the aforementioned canon regarding being a faithful agent of their employer. They make this claim of a duty to protect health and safety with no supporting evidence of how that applies in this case. It is conceivable that there may be situations where a sudden lack of personnel could cause safety concerns, but there was no indication of this in the case description. On the contrary, strikes require significant planning that the company executives would have some awareness of beforehand. If the strike in this case has the potential to create harm to the public, the company would be at least partially at fault for their lack of preparation and unwillingness to meet the workers' bargaining demands. The BER articulates that public health and safety, or national security is the main reason why crossing the picket line and performing scab work is acceptable. The BER acknowledges that there is not enough information to determine whether public health and safety is jeopardized in this specific case but ignores the fact that they could have included more information if they wanted.

In their reasoning, the BER stops themselves from arguing that engineers have an obligation to perform all non-professional duties asked of them by their employer during a strike and focus on non-professional duties that directly impact public health and safety. Particularly they focus on the continued production of petroleum and minimizing permanent damage to plant facilities. However, they still conclude that engineers can act as scabs in this particular case without providing evidence that public health and safety will be harmed if they do not. By not providing details in this case that would justify their claim, NSPE leaves the interpretation of public health and safety open for interpretation (which alone is not a negative) but frames it in a way that would support the company over the workers by default because of the ethical obligations NSPE's code of ethics places on engineers to assist their employer.

Case 74-3: Don't strike

Case number 74-3 provides a closer examination of the ethics of engineers participating in strikes, specifically if they are included in the same bargaining unit as workers that are not considered professionals. In this case, state employees for the highway department are unionized and engaged in contract negations because the initial collective bargaining agreement is coming to an end. The BER specifies that the professional engineers for the state highway association petitioned to file a separate unionization vote from the other workers, in line with the Professional Provision NSPE lobbied to have included in the Taft-Hartley Act; however, this petition was rejected because state law did not allow separate bargaining units and votes for professional workers. The BER makes sure to express dismay at this fact and claims that without a separate professional vote it is unclear how engineers voted, suggesting that the engineers are uninterested in being in that union. The workers bargained for an "agency shop" clause in their first collective bargaining agreement that recognized their union as the means for the entire bargaining unit to improve their living and working conditions irrespective of union membership status. The agency shop clause required all members of the bargaining unit represented by this union to become a union member or pay a service fee for union representation equal to the price of union dues. This case focuses on the negotiations of the second collective bargaining agreement, wherein the state highway department has offered a lower compensation and benefits package than what union membership could accept, pushing union members to strike. The case centers around the question of if engineers represented by this union (the language implying they themselves are not union members) can ethically participate in or support the strike of their fellow workers [29].

At the time of the publication of this case study, the NSPE Code of Ethics included a directly anti-union section that expressly prohibited engineers from participating in "strikes, picket lines, or other collective coercive action" [29]. This section is a core piece of the BER analysis but was removed from the NSPE Code of Ethics in 2001. The BER frames their justification for this section as an engineer's duty to act as a faithful agent of their employer and that participation in a strike, or similar action, would be placing the engineer's self-interest over their professional obligations to their employer. Framing participation in union activities such as striking as solely for self-interest reflects the highly individualistic orientation found in business professionalism

and a significantly constrained form of unionism that denies the socially productive and generative value of labor actions. Such framing also allows the NSPE to claim their code of ethics reflects a higher standard than is possible to achieve through unionism.

Valle, Bowen, and Riley have discussed how strikes can act as a form of liberatory pedagogy for engineers, where engineers take an embodied approach to developing class consciousness, engaging in methods of collective self-management, and developing conflictual strategies to undo the hierarchical conditions of work they labor under for broader community benefit [9]. Leaning away from such orientations, the BER reasserts the stance in the NSPE code of ethics that striking is unethical. They do offer a limited condition of an engineer being placed in a position of "undue personal jeopardy" as an exception where they may side with their fellow workers and override the imperative to act as a faithful agent or trustee of the employer. The BER provides the example that an engineer would not be expected to cross a picket line if would result in physical injury or other abuses.

The BER frames the relationship between engineers and their fellow workers as inherently antagonistic, such as assuming that the majority of engineers voted to not be represented by their union but were simply outnumbered by the nonprofessional workers. They provide no reasoning behind this assumption but continue to build an argument from it. Based on this unfounded claim, the BER continues to say that engineers who do not participate in the strike may be subjected to some form of retaliation from their fellow workers after the strike has concluded. The BER goes as far to suggest this retaliation on the engineers by union members could be illegal and they would create a "deliberate scheme" to punish the non-supporting engineers by actively sabotaging union bargaining for the professional employees. Fear of reprisal could be a legitimate concern for engineers not supporting the union, but the suggestion that union members and leaders would actively scheme to punish the engineers, in potentially illegal ways, is a purposefully malicious characterization aimed at further dividing engineers and their nonprofessional coworkers.

Case 84-6: Don't support unionized workers

Case number 84-6 presents a scenario where Engineer A is running for state legislature in an area with a large number of people who NSPE describes as "unskilled workers" that are represented by a labor union. A plant with workers represented by this union is currently on strike because there have been three worker deaths within the last year due to industrial accidents, which the union members claim is due to unsafe working conditions and management being indifferent to safety concerns. The engineer running for office visits the picket line and participates, leading to television cameras catching them holding a sign that accuses the company of "callous disregard" to workers' safety. NSPE also clarifies that Engineer A did not visit the plant to investigate the conditions themselves, they only showed up for the picket line. Here, NSPE asks the question, "was it unethical for Engineer A to accuse the company of callous disregard for workers at the plant?" [30].

The BER presents this case as an ethical dilemma between an engineer's right to a political opinion, and civic engagement, with an engineer's duty to objectivity and truthfulness. The BER raises the question of whether the engineer's statements about the working conditions of the plant violated their duty to issue statements in an objective and truthful manner, as dictated by the code of ethics. Additionally, the BER argues that since this engineer is running for public office, the political nature of their statement and the associated media attention must be considered when evaluating if the engineer acted in an objective or truthful manner.

The BER acknowledges it is possible that Engineer A had a legitimate concern for worker safety but criticizes the engineer for not speaking to management about the allegations and for not attempting to mediate the conflict. It seems the BER expected Engineer A, who is not an employee for this company in any capacity, to perform an independent investigation into the deaths of three workers before making any public statements. Such an expectation by the BER makes it clear that they do not view the workers at the plant as a trustworthy source for understanding the safety of their own working conditions nor causes of the deaths of their fellow workers. The BER continues to argue that by supporting the picket line and holding a sign accusing the plant owners and managers of "callous disregard," Engineer A has actually made the conflict worse. According to the BER, by choosing to support the striking workers who are seeking safer working conditions, Engineer A has lost all impartiality and has used the strike for political gain. They claim this violates the code of ethics because "Engineer A was promoting his own interest at the expense of the dignity and integrity of the profession," and disregard the possibility that concerns with health and safety were the paramount reason for the engineer's actions.

One key aspect of this case that the BER does not address in detail is how three workers have died in this plant in the span of a year. One worker death could be considered a tragic accident, but three within a year is significant evidence that there are safety and management issues at this plant, hence the collective decision by the workers to strike. Despite these deaths, the BER is disappointed that a complete stranger, unaffiliated with the company, did not perform external investigation and talk to management before making a claim. On its face, this is a ridiculous expectation from the BER to ask Engineer A and for a plant currently under strike. It also relies on the assumption that management would respond in a manner more trustworthy than that of the workers. In this case, the BER has placed the burden of proof on Engineer A and made it an impossibly high obstacle for him to show genuine support for the striking workers. It is perfectly reasonable to use the evidence of three worker deaths in a short timeframe to form an educated opinion about workplace safety and managerial attitudes towards safety, and to trust the workers to understand their own working conditions.

A major flaw in the BER's argument is that the plant has no reason to allow a random engineer to enter their space, investigate workplace safety, and act as mediator between the unionized workers and the corporate owners. Aside from likely violating US labor law, there is no indication that the workers or corporate owners would welcome such mediation, nor is there any evidence that the engineer is equipped to mediate such a dispute. Even if the company did allow Engineer A to investigate and mediate as the BER suggests, there is no reason to assume

Engineer A would act any differently after the investigation. Arguably, the company is disincentivized from allowing Engineer A to investigate because the results of the investigation are unknown. If Engineer A discovers evidence of managerial negligence leading to harm and death, that would cripple the company's position in the labor dispute. If there were evidence to support the company, the managers would already be leveraging that to resolve the labor dispute before it affects production any further.

It is also ridiculous for the BER to ask Engineer A to perform a professional evaluation of plant safety before he makes an educated opinion on the working conditions and the attitude of management to safety. Engineer A does not work for this company, is not affiliated with the union, and may not even be qualified to do what the BER expects of them in this labor dispute. There is no information given about Engineer A's qualifications and whether they are relevant to this specific plant or to mediating an active strike. The NSPE Code of Ethics says that it is unethical for an engineer to perform duties outside of their area of expertise [25], but the BER decided to ignore that when the context involves an engineer not supporting management in an active labor dispute. Additionally, Engineer A is not acting in a professional capacity when he attends the picket line and holds up protest signs. If Engineer A performed a full evaluation of the plant, as the BER suggested he do, then issues of professional responsibility may be relevant, but that is not the case. The BER acknowledges his non-professional positionality in this case when they dismiss the application of the code of ethics provision that prohibits engineers from participating in strikes or other forms of collective coercive action, claiming that since he is not an employee of the company it does not apply. However, the BER does not apply the same logic in the rest of their argument.

Finally, it is important to address the BER ultimately argues that Engineer A is using the strike for personal and political gain at the expense of the dignity and integrity of the profession. The application of this part of the NSPE Code of Ethics in this case frames engineers as inherently on the side of management and showing personal support for workers does so at the expense of the engineering profession. Engineer A may have gotten some political leverage from their support and television cameras filming his presence there but could only do so at the expense of the engineering profession if the engineering profession is constructed wholly in service to industry. The BER argues that since he did not personally investigate the deaths and talk to management, he was only promoting his own interests, in this case gaining votes for his election. However, they have not described how this damages engineering as a profession despite asserting so. The only damage done is the implied damage to management's position in the labor dispute, which is further evidence of the alignment of industry and engineering via business professionalism NSPE seeks to advance.

The BER could have made a stronger argument by focusing on the perceived conflicts of interest, real or not, present in the engineer's actions. Engineer A has to precariously balance his roles as an engineer, a politician, and an individual when making statements about the strike. It is possible that one of the responsibilities for a role can conflict with the other in a manner that can create a conflict of interest, or at least the perception of one. In this case, Engineer A is offering his support to the striking workers as a politician and an individual but cannot separate himself

from his engineering responsibilities when offering said support. Simply by being an engineer, his public political support can be viewed as professional or technical support as an engineer regardless of Engineer A's disconnect from any engineering in this case. Rather than utilizing the perceived conflict of interest present in this case, the BER makes the much weaker argument that Engineer A is being, in their view, dishonest and damaging the profession with his statement.

Case 03-9: Don't believe unionized workers

The most recent case that has addressed the relationship between engineers and unionized labor was published in 2003 and illustrates the true depths of NSPE's anti-union sentiments. In case number 03-9, Engineer A is the CEO of the company Soilco and relies on soil samples and data collected by field technicians and testing personnel they employ. A local union that represents construction workers that also work with Soilco employees is looking to organize field technicians and testing personnel as well. An important factor here is that this union has a provision in their by-laws that prohibits union members from making derogatory or disparaging remarks about their fellow union members' work. The ethical question that NSPE raises from this scenario is whether it is ethical for Engineer A to sign and seal reports from field technicians who are members of a union that has a bylaw against making derogatory or disparaging remarks about fellow union members or their work [31].

The BER begins their analysis by acknowledging that the language prohibiting engineers from engaging in collective action NSPE deems coercive was removed from their code of ethics and the acknowledgement that issues around professionalism, collective bargaining, and union membership are legitimate and NSPE will continue to refine their policies. Despite this removal, the BER reiterated their belief that unionization prevents engineers from acting as faithful agents for their employer, and therefore it is unethical for engineers to unionize. The BER extends this criticism to also erroneously claim that unionization would place an engineer's self interest in conflict with the safety, health, and welfare of the public, neglecting to consider how faithfully acting as an agent of their employer may also negatively impact the safety, health, and welfare of the public.

The use of the paramountcy clause in this context is astonishing because it suggests that unions are dangerous for society. The argument NSPE is making is that the unionization of field technicians and testing personnel working for Engineer A presents a public safety hazard by again framing unionism as primarily or solely rooted in self-interest and thus in conflict with the safety, health, and welfare of the public. While self-interest and public interest can conflict at times, for anyone in any occupation, the argument that unionization inherently causes this type of conflict rests solely on the business professional ideology of NSPE and is unsupported by evidence. This conflict between worker rights and engineers' obligations to the public were also addressed in case 70-4; however, in 70-4 there was specific context about energy production and plant shut-down procedures that better warranted a discussion around public safety and wellbeing. In the 03-9 case, this context is not present at all and the BER claims that workers

unionizing at the company the engineer is CEO of would cause the engineer to violate the paramountcy clause.

The BER claims that Engineer A would not be able to ethically sign off on reports and data collected by a field technician who is in a union with the previously described non-disparagement clause for fellow union member work. Labor unions tend to place health and safety as core aspects for worker rights, so it is difficult to imagine that even if this fictive clause did exist it would enable unionized workers to disregard safety concerns. Yet, aligning with corporate assaults on labor unions, this is precisely the claim the BER makes. This bylaw is analogous to the professional obligation NSPE advances that "Engineers shall not attempt to injure, maliciously or falsely, directly or indirectly, the professional reputation, prospects, practice, or employment of other engineers." Despite this clear similarity, the BER disparages this bylaw as a "no-rat" clause in their description of the case, a framing unfounded in their description of the union bylaws. Notably absent is a comparison to the NSPE's own analogous non-disparagement professional obligation. The stark double standard NSPE applies to workers deemed hierarchically under engineers is clear given the similarity between the union's non-disparagement clause and NSPE's.

The implications of this case are especially nefarious because it suggests that engineers are unable to work with unionized workers unless union bylaws meet an arbitrary standard set forth by NSPE that does not necessarily need to align with NSPE's own standard for engineers. This is especially damning given that the engineer in question is CEO of the company, and BER sought to impose the business professional ethics of NSPE onto unionized, non-engineer workers. If any of the bylaws of a union can be seen as incompatible with the business professional orientation of NSPE, then they could argue it is unethical for an engineer to work with, much less join in, that union. Given how flexible NSPE is with applying the paramountcy clause to argue unionized workers are a public safety hazard, it would not be hard for them to nitpick any unions bylaws to find an excuse not to work with them. Their argument rests upon disparaging unionized workers, which we argue is not a valid moral argument.

Discussion:

It is clear that NSPE has historically been an anti-union organization and has used their status as leaders in engineering professionalism and engineering ethics to propagate the ideology of business professionalism. The longstanding, fundamental canon of the NSPE code of ethics that engineers should act as faithful agents of employers exemplifies this. Engineering in the US has been historically controlled by capitalists and used to benefit capitalists, leveraging NSPE alongside virtually all other engineering professional societies as major players in culturally solidifying the subservient relationship of engineers to capital. In their mission to support a hierarchy where engineers are seen as above nonprofessional workers, NSPE has successfully lobbied congress to weaken labor rights and strengthened the artificial barrier between engineers and other workers. NSPE has constructed their code of ethics to reinforce their anti-union position and place a professional moral obligation upon engineers to serve industry. The two

main arguments that NSPE advances to justify their assertion that professionalism and unionization are incommensurable are that union involvement prevents an engineer as acting as a faithful agent or trustee for their employer and that there could be some public harm associated with union action. These arguments combine to say that unionization may cause an engineer to put their personal interests over their professional duties, duties that NSPE has created and codified with their code of ethics.

As mentioned previously, the agency model of loyalty that NSPE promotes is fundamentally at odds with their promotion of professional autonomy [26] and results in the creation of a professional engineer who is captured by industry. NSPE argues that for an engineer to be a faithful agent, they need to sacrifice their 'self-interested' right to collectively organize themselves to achieve better living and working conditions. NSPE would rather have engineers rely on the myth of meritocracy and state licensure for individualized material improvement because that allows corporations and capitalists to maintain their control over engineering work and output. This orientation necessarily forecloses upon a recognition that such a hierarchical relationship of work is inherently inequitable and is a profound contributor to harm within society.

Using NSPE's logic, one could argue that an engineer, acting as a faithful agent, should work for the lowest possible pay because that would be in the best interest of the employer and thus morally righteous according to their code of ethics. In case number 74-3, NSPE claims that engineers are not expected to tolerate "undue personal jeopardy" for the sake of professionalism, but framed in a manner to suggest that union members would physically assault engineers who cross a picket line [29]. They do not even entertain the idea that restricting engineers' right to collectively organize could put engineers and the public in jeopardy in a more systematic manner by maintaining the extractive relationships inherent to the capitalist mode of production.

The other main piece of NSPE's moral argument against engineers unionizing is that any form of collective action they deem coercive, such as a strike, could cause some harm to public health, safety, and welfare. This may be a legitimate concern on a case-by-case basis if one assumes striking workers act negligently by disregarding nominal safety concerns at their worksites, but NSPE is faulty in their general association with these risks and union action. As mentioned in the analysis of case number 70-4, there is a legitimate conversation to have about how strikes can safely shut down hazardous worksites, such as oil refineries, and the moral implications of doing so. However, rather than seeking that conversation, NSPE offers a short-term assessment of safety linked to continued plant operations that cannot be used as an excuse to justify blocking all labor action. It is also important to acknowledge potential impacts to public health, safety, and welfare that could arise from a lack of production associated with a strike, such as if the manufacturers of medical equipment were to strike.

As one of the most significant displays of power workers can enact collectively, strikes often come as a last resort to achieve the more dignified and respectful working and living conditions workers deserve. The onus to avert strikes sits with corporate owners, who have the power to avoid strikes by meeting the needs of workers, but they often choose not to because it would diminish the profits they extract and decision-making power they have over workers. As

McAlevey discusses in instances where teachers and nurses go on strike, often to improve the conditions at their worksites for the communities they serve, state administrators and corporate owners frequently attempt to shame these workers as threatening the lives of their patients or learning environments of their students (i.e. jeopardizing public health and safety) [10].

Rather than falling for such argumentation, it can be meaningful to see how workers leverage the power in their ability to bargain collectively with their employer for broader community benefits that their employer otherwise would continue in failing to enact. NSPE has failed to acknowledge the potential harm of a strike exists as a consequence of a failure by corporate owners to meet the needs of workers and their communities because of their subservient position to the needs of corporate owners. The relationship between industrial production and social wellbeing is incredibly complex, so NSPE is negligent when it makes unsubstantiated and over simplified claims that engineers participating in union action would inherently have a negative public impact.

Another key bias and assumption that is present throughout all of these cases is the underlying assumption that NSPE has the correct and only definition of professionalism, or professional employee, and all of their moral arguments are made within the context of their framing of professionalism. As mentioned previously, NSPE alongside many other engineering professional societies and ASEE successfully lobbied congress to separate the bargaining units of professionals from other workers in the Taft-Hartley Act, and thus invented a definition of professionalism based on education and the type of work performed that was in line with their openly anti-union values. There are alternative notions of professionalism, such as that advanced by Riley and Lambrinidou, that eschew business professionalism in favor of ethical principles more clearly aligned with organizing engineers to dismantle hierarchies placed on human difference upheld in the ideology of business professionalism [32].

Conclusion and Implications:

NSPE is the leading organization in terms of codifying guidelines for ethical engineering practice. All of the major engineering professional societies have language in their codes of ethics that reflects the language NSPE has been using for decades. Their influence is most obvious through the proliferation of the paramountcy clause across the industry. Because of their influence, we need to acknowledge that NSPE is not a neutral organization and has an organizational pro-corporate owner, anti-worker bias that has existed since its inception. One of the primary goals of NSPE is to create a sense of “professionalism” that separates engineers from other workers to maintain the hegemonic power of capital. They claim this is done to protect engineers under the guise of meritocracy, but pragmatically it serves to keep engineers from fully utilizing their labor power and organizing with their fellow workers. We should be critical that an anti-labor organization is treated as the beacon of morality in engineering. In a decontextualized vacuum, much of the NSPE Code of Ethics provides decent ethical guidelines for engineers, such as the paramountcy clause. Yet a decontextualized vacuum does not exist, and the real-world contexts of these codes are NSPE’s deeply corporate attitudes, the harmful interpretations

associated with their biases, and the impact that industrial capitalism has on land and life. Functionally, NSPE has acted as an avenue for capital owners to suppress worker solidarity by creating an arbitrary boundary, which they call professionalism, between engineers and their fellow workers.

The selective application of their codes of ethics shows that NSPE has used ethics as a cudgel to keep engineers subservient to capital. As Davis said, “The history of engineering ethics reminds us that ethical standards, like other engineering standards, are not discoveries but useful inventions” [7]. We hope that the history and analysis presented in this paper highlight how the ethical standards invented by NSPE have an overly corporate and capitalist bias at the expense of engineers’ solidarity as workers. While critical, we also hope this paper encourages NSPE to reevaluate their anti-union attitudes and to push towards ethical engineering practice that acknowledges engineers as workers and the benefits unions can provide.

Acknowledgements

This work is based upon research supported as part of the ASPIRE (Advancing Sustainability through Powered Infrastructure for Roadway Electrification) award, an Engineering Research Center program by the National Science Foundation (NSF), grant no. EEC-1941524 and the STEMEdIPRF Postdoctoral Fellowship: Advancing Engineering Education in Universities on Labor and Unions by the NSF, grant no. DGE-2327420. The views and conclusions contained herein are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of NSF, or the U.S. Government.

References:

[1] D. F. Noble, *America by Design: Science, Technology, and the Rise of Corporate Capitalism*. Oxford: Oxford University Press, 1979.

[2] E. T. Layton, *The Revolt of the Engineers: Social Responsibility and the American Engineering Profession*. Baltimore: Johns Hopkins University Press, 1986.

[3] P. Meiksins and C. Smith, "Why American engineers aren't unionized: A comparative perspective," *Theory and Society*, vol. 22, no. 1, pp. 57–97, Feb. 1993. doi:10.1007/bf00993448

[4] M. Wisnioski, *Engineers for Change: Competing Visions of Technology in 1960s America*. Cambridge, MA: MIT Press, 2016.

[5] D. Riley, *Engineering and Social Justice*. Springer, 2008.

[6] S. Goldman, "The social captivity of engineering," in *Critical perspectives on nonacademic science and engineering*, P. Durbin, Ed. Bethlehem, PA: Lehigh University Press, 1991, pp. 121–146

[7] M. Davis, *Thinking like an Engineer: Studies in the Ethics of a Profession*. New York: Oxford University Press, 2011.

[8] P. Meiksins and C. Smith, *Engineering Labour: Technical Workers in Comparative Perspective*. London: Verso, 1996.

[9] J. Valle, C. L. Bowen, and D. M. Riley, "Liberatory potential of labor organizing in engineering education," in ASEE Annual Conference and Exposition, 2021.

[10] J. McAlevey, *No Shortcuts: Organizing for Power in the New Gilded Age*. New York, NY, United States of America: Oxford University Press, 2018.

[11] R. Rieder, SPEEA Union (Society of Professional Engineering Employees in Aerospace). HistoryLink. 2000. https://www.historylink.org/File/2211

[12] A. F. Sturmthal, *White-Collar Trade Unions; Contemporary Developments in Industrialized Societies*. Urbana, IL: University of Illinois Press, 1966.

[13] R. Zussman, *Mechanics of the Middle Class: Work and Politics among American Engineers*. University of California Press, 1985.

[14] G. Strauss, "Professional or employee-oriented: Dilemma for engineering unions," *ILR Review*, vol. 17, no. 4, pp. 519–533, Jul. 1964. doi:10.1177/001979396401700401

[15] “Union affiliation of employed wage and salary workers by occupation and industry - 2023 A01 results,” U.S. Bureau of Labor Statistics, https://www.bls.gov/news.release/union2.t03.htm

[16] P. Meiksins, “The ‘Revolt of the Engineers’ reconsidered,” *Technology and Culture*, vol. 29, no. 2, pp. 219–246, Apr. 1988. doi:10.2307/3105524

[17] R. Heifetz, “The role of professional and technical workers in progressive social transformation,” *Monthly Review*, vol. 52, no. 7, pp. 26–39, Dec. 2000. doi:10.14452/mr-052-07-2000-11_3

[18] A. L. Pawley, “‘Asking questions, we walk’: How should engineering education address equity, the climate crisis, and its own moral infrastructure?” *Journal of Engineering Education*, vol. 108, no. 4, pp. 447–452, Oct. 2019. doi:10.1002/jee.20295

[19] PEI History Committee, *The Complete PEI History of NSPE*. NSPE.

[20] P. H. Robbins, *Building for Professional Growth: A History of the National Society of Professional Engineers, 1934-1984*. Washington, D.C.: NSPE, 1984.

[21] P. Meiksins, “Professionalism and conflict: The case of the American Association of Engineers,” *Journal of Social History*, vol. 19, no. 3, pp. 403–421, Mar. 1986. doi:10.1353/jsh/19.3.403

[22] *The Monad*, vol. 4. Kable Bros. Company, 1919.

[23] L. Garner, “Engineers and Unions,” *Science for the People*, vol. 6, no. 6, pp. 23–27, 1974

[24] M. Zoorob, “Does ‘right to work’ imperil the right to health? the effect of labour unions on workplace fatalities,” *Occupational and Environmental Medicine*, vol. 75, no. 10, pp. 736–738, Jun. 2018. doi:10.1136/oemed-2017-104747

[25] Code of ethics for engineers. National Society of Professional Engineers. 2019. https://www.nspe.org/resources/ethics/code-ethics

[26] National Society of Professional Engineers Board of Ethical Review. Case No. 62-5. National Society of Professional Engineers. 1962.

[27] J. H. Fielder, “Organizational loyalty,” Business and Professional Ethics Journal, vol. 11, no. 1, pp. 71–90, 1992. doi:10.5840/bpej199211122

[28] National Society of Professional Engineers Board of Ethical Review. Case No. 70-4. National Society of Professional Engineers. 1970.

[29] National Society of Professional Engineers Board of Ethical Review. Case No. 74-3. National Society of Professional Engineers. 1974.

[30] National Society of Professional Engineers Board of Ethical Review. Case No. 84-6. National Society of Professional Engineers. 1984.

[31] National Society of Professional Engineers Board of Ethical Review. Case No. 03-9. National Society of Professional Engineers. 2003.

[32] D. Riley and Y. Lambrinidou, “Canons against cannons? Social Justice and the Engineering Ethics Imaginary,” *2015 ASEE Annual Conference and Exposition Proceedings*, pp. 26–32, 2015. doi:10.18260/p.23661