Climate, Culture, and Consequences of Sexual Harassment in Science and Engineering

A recent National Academies of Sciences, Engineering, and Medicine report [1] presents a striking assessment of sexual harassment in science, engineering, and medicine (SEM) in the United States. In particular, it is noted that academia has the second highest rate of reported sexual harassment, which falls behind only the U.S. military and is well above the levels experienced in the government and private sectors. Thus, while gains have been made in reducing the gender gap by attracting women to SEM fields, "it appears that women are often bullied or harassed out of the career pathways in these fields" [1, p. 2]. In addition to the pain caused to the victims, there are other important economic costs (such as each science, technology, engineering, and mathematics Ph.D. degree costs approximately US$500,000, which is potentially wasted with early departures) and innovation impacts.

Quality and innovation have long been shown to benefit from diversity in the workforce. Reference [1] also notes that sexual harassment is tied to research integrity, in that it undermines three (accountability, fairness, and stewardship) of the six values that shape it (objectivity, honesty, and openness being the rest) [1, p. 88]. Thus, sexual harassment not only harms the targets, but it also damages the integrity of engineering and science research and results in a costly loss of talent. As a community, we need to act now.

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SEXUAL HARASSMENT IN ACADEMIA

Sexual harassment is a form of discrimination that consists of three types of behavior: gender harassment (verbal/nonverbal ways of conveying hostility or objectification), unwanted sexual attention, and sexual coercion. These behaviors can be either directly targeted at an individual or ambient [1, p. 48]. The inclusion of gender harassment (such as inappropriate jokes or language or comments that denigrate groups or individuals in gendered terms) in this list emphasizes that harmful or illegal sexual harassment does not have to include sexual activity. In fact, while the media often focus on the more salacious cases of unwanted sexual attention or coercion, gender harassment is the most common type of sexual harassment.

Academic SEM fields are not exempt from the types of sexual harassment reported in other workplaces. For example, more than 50% of women faculty and staff and between 20 and 50% of female students have experienced some form of sexual harassment, with the rates depending on the academic field and degree level. While both male and female students experience sexual harassment, the results of the recent survey indicate that female students are much more likely to experience it (25% of females versus 9% of males reporting "yes"). Further, female engineering students are 34% more likely than non-SEM majors to experience harassment perpetrated by faculty or staff. In another study of graduate students, 38% of female participants self-reported sexual harassment from faculty or staff, and 58% described sexual harassment from other students. These results clearly highlight the extent of the sexual harassment problem in higher education. In fact, [1] notes that there were 97 allegations of sexual harassment at institutions of higher education reported in the media in 2017 alone.

There are several aspects of the SEM academic workplace that tend to silence targets of harassment, such as the dependence on advisors/mentors for career advancement and the macho culture that exists in some fields. Also, the behavior of academic "superstars" is "often minimized or ignored," leading to their "receiving preferential treatment and [being] excused for gender-biased and sexually harassing behavior" [1, p. 52]. Furthermore, the "always working" culture of higher education workplaces leads to a blurring of the boundaries between work and personal life, which is difficult for people (often women) with child and elder care responsibilities and therefore not fitting the "ideal worker norm" [1, p. 54].

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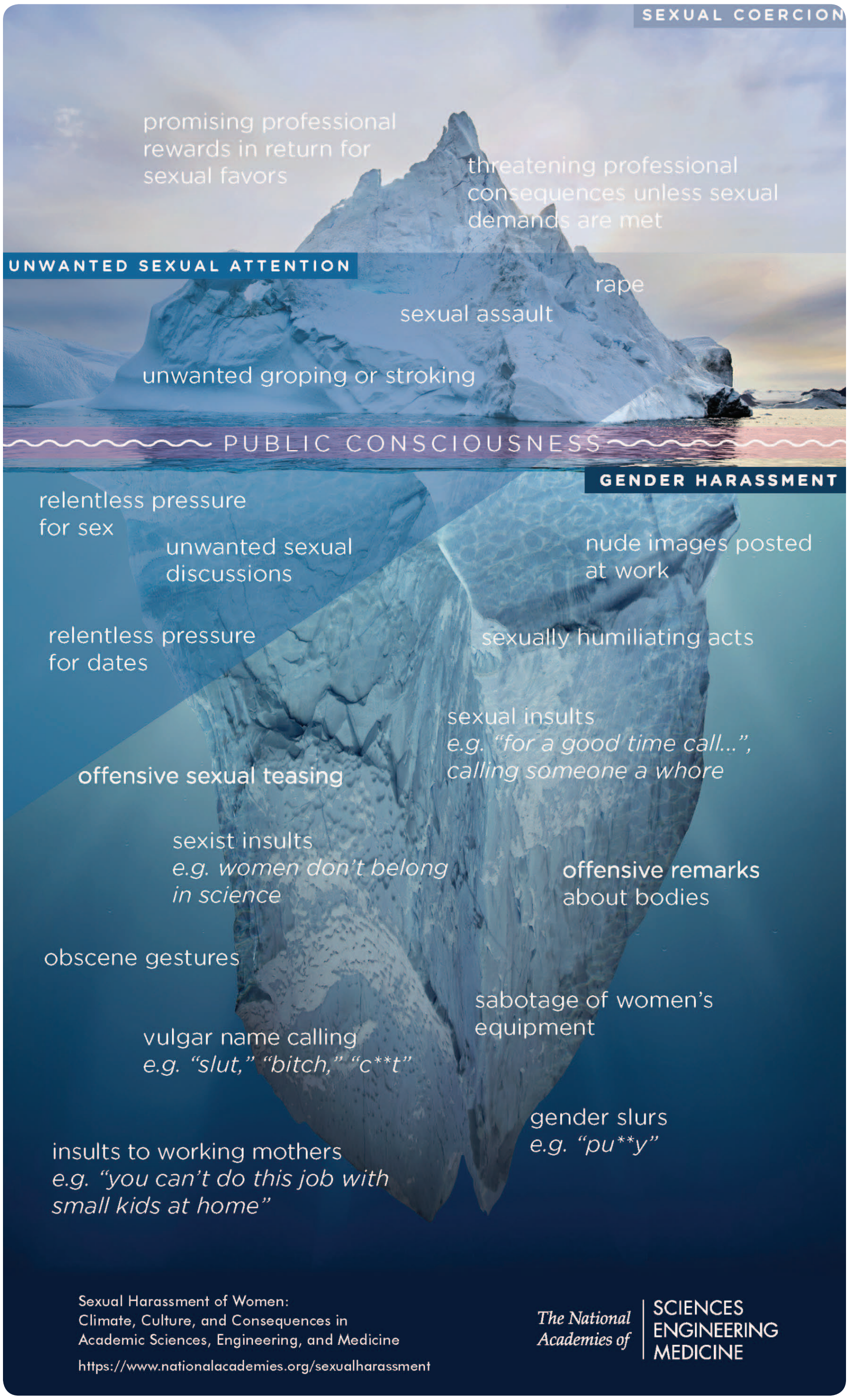
The report also cites numerous factors that create high levels of risk for sexual harassment to occur in SEM academic workplaces [1, p. 4]:

1) There is often a perceived tolerance of sexual harassment in academia.
2) Men outnumber women, and leadership positions are male dominated.
3) The power structure is hierarchical, with power typically concentrated in a single person (such as the advisor).
4) Uninformed campus leadership that may "aspire to reduce or eliminate harassment" but "lack the tools needed to" achieve that goal.



This image displays the public consciousness of sexual harassment and specific sexually harassing behaviors, highlighting the many aspects of gender harassment that are below the surface. (Image © Academy of Sciences. Used with permission.)

RECOMMENDATIONS

The report notes that, despite decades of legal and policy engagement with sexual harassment, significant solutions do not exist for this problem. However, [1] provides numerous recommendations on how to proceed, with a particular focus on both the organizational *climate* and *culture*. The climate (that is, the shared perceptions of the policies and procedures in place) is noted as the single most important factor in determining if there is a high risk of sexual harassment. The culture (that is, the collectively held beliefs, assumptions, and values) typically reflects the norms and values of those in the leadership positions of the organization and sets the tone for the other members. The report highlights that the culture and climate must be addressed together so that changes to improve the climate are consistent with the beliefs and values of the organization.

As such, academic institutions are encouraged to

1) create diverse, inclusive, and respectful environments with the goal of improving the representation of women at every level of the organization, which includes fostering greater cooperation and professionalism at the faculty, staff, and student levels
2) diffuse the hierarchical power structure by introducing mentoring networks or committee-based advising
3) develop supportive systems for those who experience sexual harassment
4) ensure that there is a diverse, effective, and accountable leadership
5) measure and evaluate progress using validated techniques (such as the sexual experiences questionnaire) and publicly share the

results to encourage transparency and signal that the issue is taken seriously.

To address the issue of gender diversity in academia, [1] recommends approaches such as reducing bias in hiring and promotion, explicitly considering leadership applicants' views on improving diversity and inclusion, and evaluating faculty and staff on these criteria in hiring and promotion. The authors note that this last point is contrary to the way that most academic institutions perform their faculty hiring and promotion processes. Implementing this approach is also complicated by the unique employment context of the academy, since faculty have a high degree of autonomy and independence, with many of them having lifelong tenure. However, we should ensure that opportunities are found to reward actions that foster a cooperative culture within our own organizations.

Also, [1] highlights the important roles for professional societies as well. Recommendations include enacting new rules related to conference attendance and codes of conduct. Professional society members might also be asked to acknowledge the professional society's rules and codes of conduct related to sexual harassment during conference registration and annual renewal. For example, see [2] for a recent statement reaffirming the commitment of the IEEE Control Systems Society (CSS) to the IEEE Code of Conduct, IEEE Code of Ethics, and IEEE Nondiscrimination Policy [3].

While it is clear that there are no easy solutions to this problem, I hope that all CSS members will take time to read the report and then commit to helping change both their organizational culture and climate with the goal of creating a healthier working environment for all. Eliminating sexual harassment is everyone's responsibility, and we need to act now.

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REFERENCES

[1] National Academies of Sciences, Engineering, and Medicine, *Sexual Harassment of Women: Climate, Culture, and Consequences in Academic Sciences, Engineering, and Medicine*. Washington, DC: National Academies Press, 2018.

[2] IEEE Control Systems Society. Statement from the IEEE CSS Board of Governors. Accessed on: 12 October 2018. [Online]. Available: http://www.ieeecss.org/general/statement-ieee-css-board-governors

[3] IEEE Policies, section 9.26. Accessed 12 October 2018. [Online]. Available: https://www.ieee.org/content/dam/ieee-org/ieee/web/org/ieee-policies.pdf

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Wald, Massé, or Bellman?

The books by Bellman (1957) and Howard (1960) popularized the study of sequential decision processes; however, this subject had earlier roots.

The modern study of stochastic sequential decision problems began with Wald's work on sequential statistical problems during the Second World War. Wald embarked on this research in the early 1940's, but did not publish in [sic] until later because of wartime security requirements. His book (1947) represents the essence of this theory.

Pierre Massé, director of the 17 French electric companies and minister in charge of the French electrical planning, introduced many of the basic concepts in his extensive analysis of the water resource management models (1946). Statistician Lucien Le Cam (1990), reflecting on his early days at Electricité de France, noted "Massé had developed a lot of mathematics about programming for the future. What had become known in this country (the United States) as "dynamic programming," invented by Richard Bellman, was very much alive in Massé's work, long before Bellman had a go at it."

A description of Massé's reservoir management model appears in Gessford and Karlin (1958).

Arrow (1958, p. 13), in his colorful description of the economic roots of the dynamic stochastic inventory model, comments "… it was Wald's work (rather than Massé's, which was unknown in this country at the time) which directly led to later work in multi-period inventory."

A precise time line with proper antecedants is difficult to construct. Heyman and Sobel (1984, p. 192) note "The modern foundations were laid between 1949 and 1953 by people who spent at least part of that period as staff members at the RAND Corporation in Santa Monica, California. Dates of actual publications are not reliable guides to the order in which the ideas were discovered during this period."

—Martin L. Puterman, *Markov Decision Processes—Discrete Stochastic Dynamic Programming.* Wiley-Interscience; first edition (March 3, 2005), p. 16, 978-0471727828.