A Survey of Cybersecurity Professionals' Perceptions and Experiences of Safety and Belonging in the Community

Samantha Katcher
Tufts University, MITRE

Cybersecurity is a growing field!

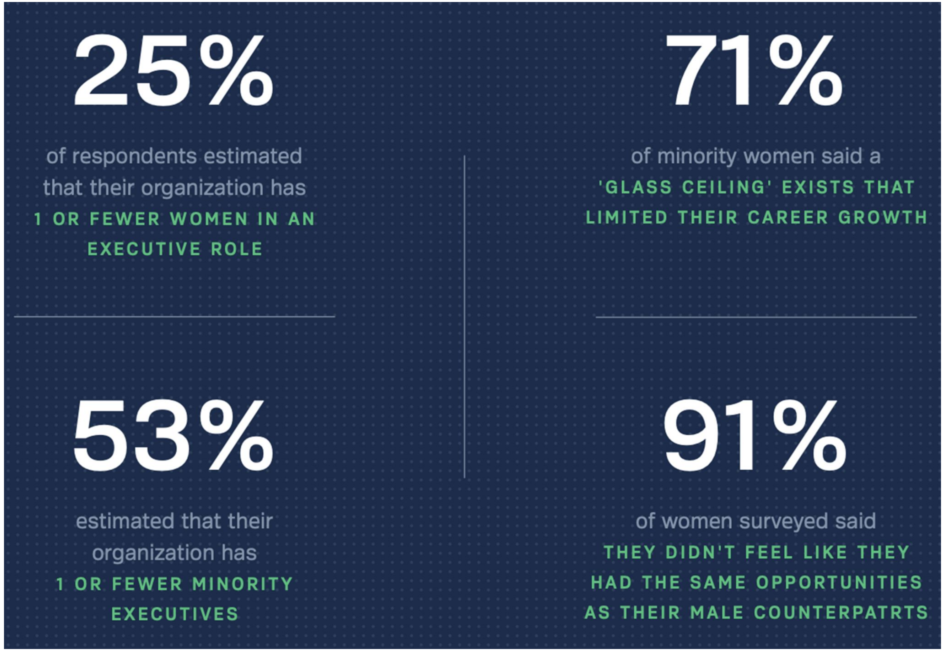
Cybersecurity is hiring!

MAY 12, 2021

Executive Order on Improving the Nation's Cybersecurity

BRIEFING ROOM ▸ PRESIDENTIAL ACTIONS

Lack of Diversity: Feelings of Belonging



Marginalized Populations: Women, BIPOC, LGBTQ+

https://www.synack.com/diversity-report/

Lack of Diversity: Feelings of Belonging

2023 IEEE Symposium on Security and Privacy (SP)

Vulnerability Discovery for All: Experiences of Marginalization in Vulnerability Discovery

Kelsey R. Fulton*, Samantha Katcher†, Kevin Song‡,
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nd Privacy (SP) | 978-1-6654-9336-9/23/$31.00 ©2023 IEEE | DOI: 10.1109/SP46215.2023.10179478

***Abstract*—Vulnerability discovery is an essential aspect of software security. Currently, the demand for security experts significantly exceeds the available vulnerability discovery workforce. Further, the existing vulnerability discovery workforce is highly homogeneous, dominated by white and Asian men. As such, one promising avenue for increasing the capacity of the vulnerability discovery community is through recruitment and retention from a broader population. Although significant prior research has explored the challenges of equity and inclusion in computing broadly, the competitive and frequently self-taught nature of vulnerability discovery work may create new variations on these challenges. This paper reports on a semi-structured interview study (N = 16) investigating how people from marginalized populations come to participate in vulnerability discovery, whether they feel welcomed by the vulnerability discovery community, and what challenges they face when joining the vulnerability discovery community. We find that members of marginalized populations face some unique challenges, while other challenges common in vulnerability discovery are exacerbated by marginalization.**

I. Introduction

As organizational reliance on technology — and incidence of cyberattacks from both criminal and nation-state attackers — continues to increase, so does demand for security review, intended to ensure early identification and mitigation of vulnerabilities. The White House's recent executive order on Improving the Nation's Cybersecurity, which emphasizes "modernizing federal government cybersecurity" and "enhancing software supply chain security" as priorities, highlights the

vulnerability reports produced by the vulnerability discovery community are typically dominated by a few highly-active participants [6]–[9], meaning that in practice there is very limited diversity of perspectives in security reviews. Further, a recent hacker survey by Synack found participants from marginalized populations were less likely to feel they belong in the vulnerability discovery workforce [10], indicating there are challenges for members of marginalized populations not only in joining the vulnerability discovery workforce, but also in remaining active participants.

This lack of diversity indicates an equity problem: limited opportunities for people from marginalized populations to participate in bug bounties and/or to transition into potentially lucrative, in-demand careers in information security more broadly. The lack of diversity is also a problem for vulnerability discovery as a field: many eyes with varied perspectives are necessary to avoid blindspots and discover as many potential vulnerabilities as possible before a malicious party does [11]. With the U.S. government sponsoring initiatives to close workforce shortfalls [12], it is essential to better understand barriers to entry and continued participation faced by marginalized security experts in order to improve recruitment and retention and avoid further entrenching current demographic disparities.

Of course, struggles to diversify the workforce are not unique to vulnerability discovery; this is a long-running challenge facing science, technology, engineering, and mathematics (STEM) disciplines in general [13] and computer

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Perceptions of Belonging & Social Experience (RQ1)

Subcommunity Participation (RQ2)

Supportive and Unsupportive Experiences (RQ3)

Survey Questions

Psychological Safety[1]
Belonging Uncertainty[2]
Vuln Discovery Self Efficacy[3]

Perceptions of Belonging

RQ1

[1]Edmondson. *Psychological safety and learning behavior in work teams*. Administrative Science Quarterly. 1999
[2]Walton and Cohen. *A question of belonging: race, social fit, and achievement.* Journal of Personality and Social Psychology. 2007
[3]Votipka et al. Building and validating a scale for secure software development self-efficacy. *CHI* 2020.

Survey Questions

Psychological Safety
Belonging Uncertainty
Vuln Discovery Self Efficacy

Perceptions of Belonging — RQ1

Social Experiences[4]
Hate and Harassment[5]

Experiences of Belonging — RQ1

[4]Grey et al. *Enemies and friends in high-tech places: the development and validation of the Online Social Experiences Measure.*"Digital Health 5. 2019.
[5]Thomas et al. *Sok: Hate, harassment, and the changing landscape of online abuse*. IEEE S&P. 2021.

Survey Questions

Psychological Safety
Belonging Uncertainty
Vuln Discovery Self Efficacy

Perceptions of Belonging

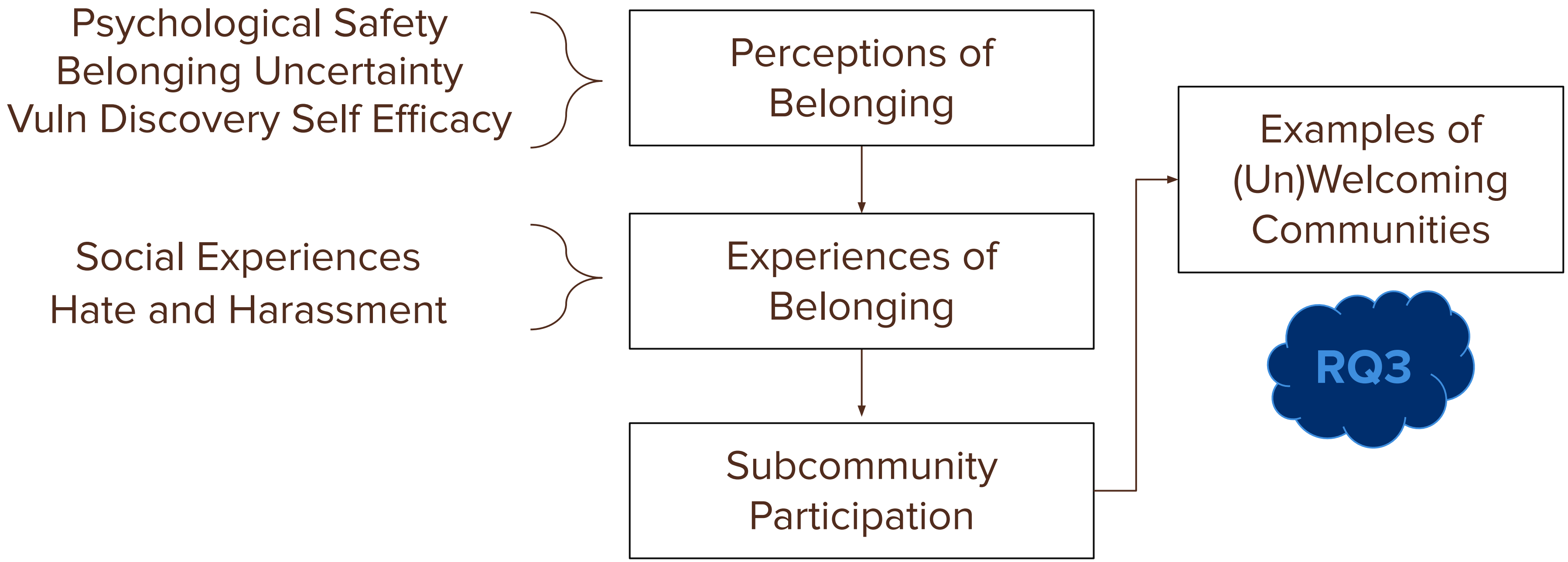
Social Experiences
Hate and Harassment

Experiences of Belonging

Subcommunity Participation

RQ2

Survey Questions



The Survey and Recruitment

- 15 minute survey on Qualtrics
- Recruited utilizing experts in our network and through social media, emails, handing out business cards at conferences, and through a Qualtrics panel


Security Community Survey
Tufts Security & Privacy Lab

Survey: **http://go.tufts.edu/sec_community**
Details: http://go.tufts.edu/sec_details
We want to hear how your close friends, colleagues, and the broader community impact your experiences.
15 Min Survey – Raffle for $50 Amazon

Samantha Katcher – Samantha.Katcher@tufts.edu
Graduate Researcher, Tufts University

Participant Demographics

- 342 participants
- 57% men, 37% women
- 63% white, 11% Black, 13% Latine
- (N=279) located in the US
- (N=234) took a programming course in HS
- (N=178) senior / leadership technical roles

Perceptions of Belonging & Social Experience (RQ1)

Subcommunity Participation (RQ2)

Supportive and Unsupportive Experiences (RQ3)

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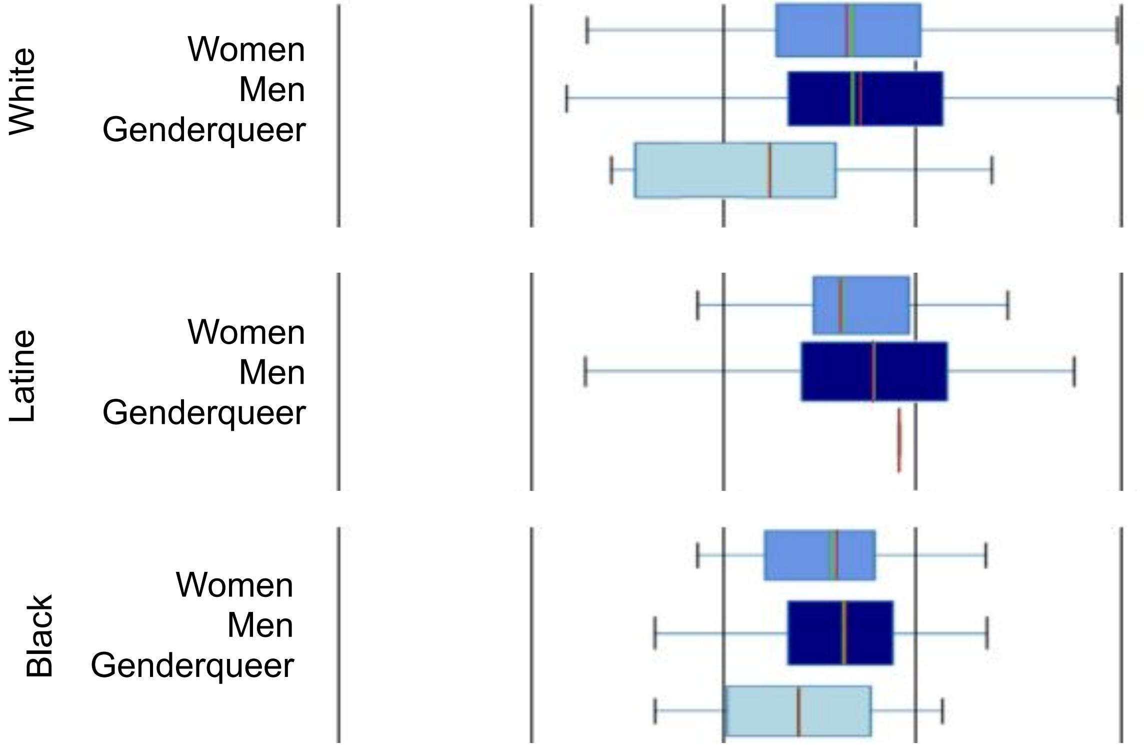
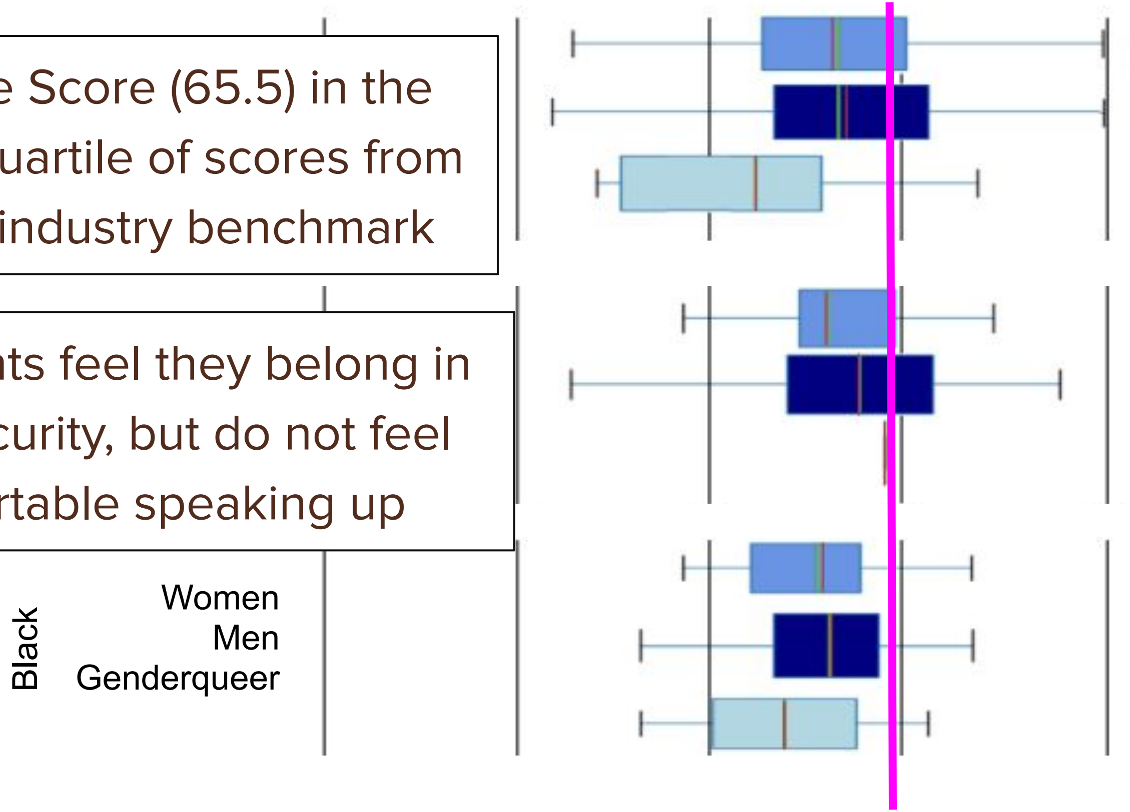
Psychological Safety was low for everyone



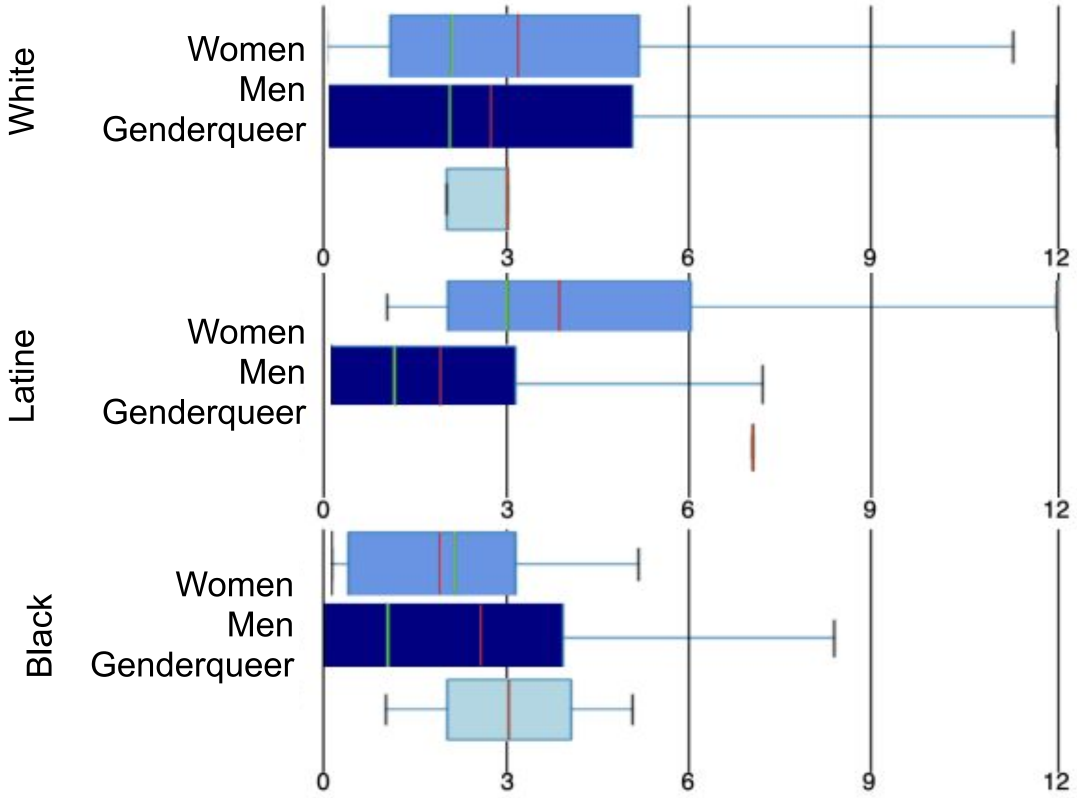
Psychological Safety was low for everyone

Average Score (65.5) in the bottom quartile of scores from a cross industry benchmark

Participants feel they belong in cybersecurity, but do not feel comfortable speaking up



Severe harassment was more common among women



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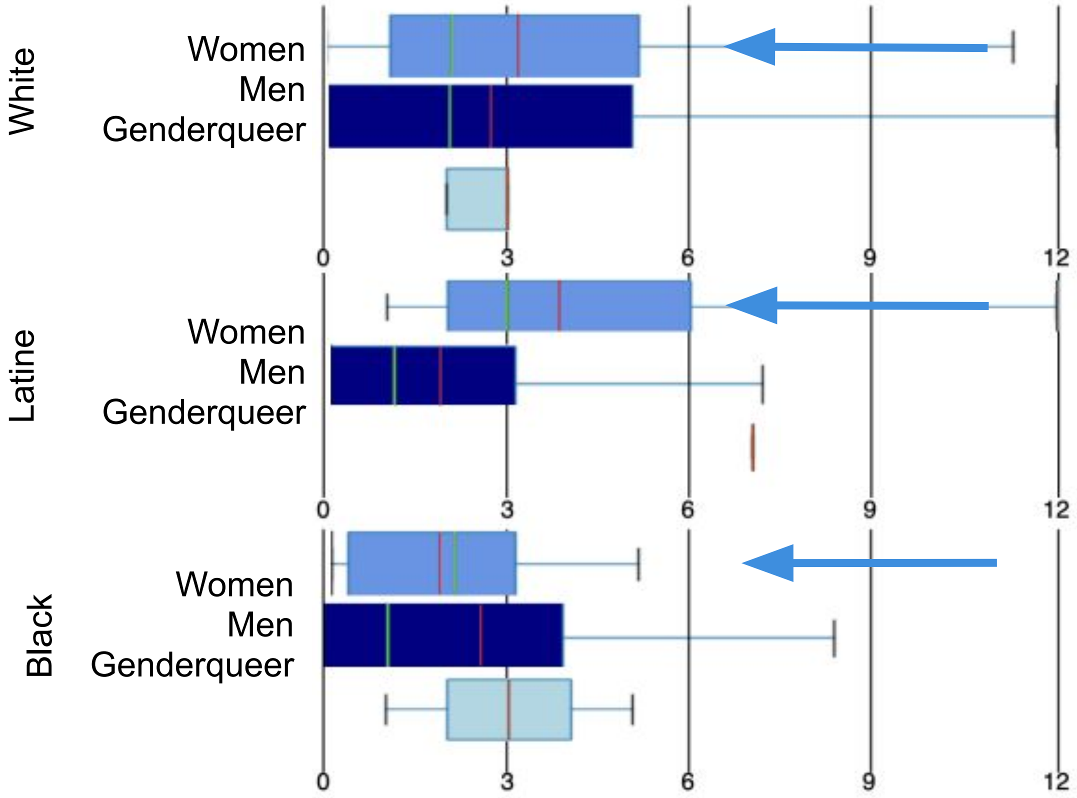

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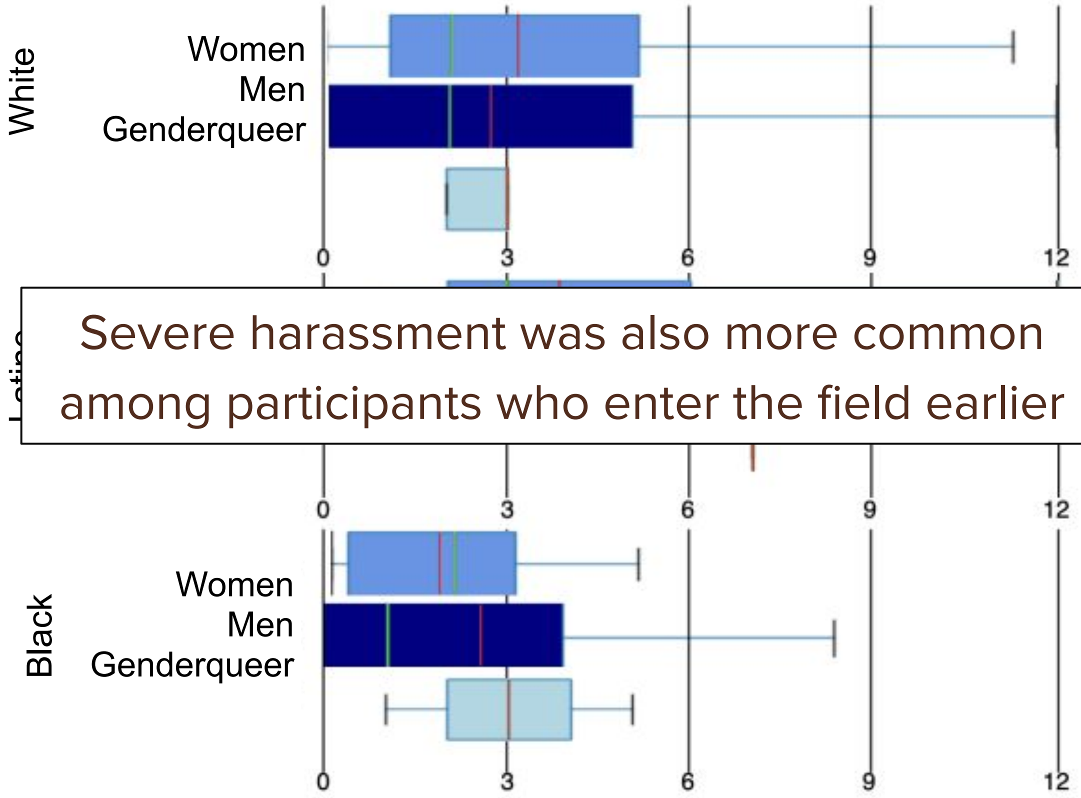


Severe harassment was also more common among participants who enter the field earlier

Perceptions of Belonging & Social Experience (RQ1)

Subcommunity Participation (RQ2)

Supportive and Unsupportive Experiences (RQ3)

Supportive and Unsupportive Experiences (RQ3)

- Women experienced more unsupportive, negative identity-based incidents
  - “I had a project with a colleague who is not anywhere near as technical as I am, yet he consistently tried to micromanage my technical work, and sometimes told me I was doing things wrong even though he didn’t know what he was talking about.”
- Men more often reported never having an unsupportive experience
- There were multiple mentions of toxic experiences toward all genders
  - “A somewhat close friend I had made through a cybersecurity forum had made quite a few uncomfortable sexual remarks which made me question if cybersecurity as a whole was like this or if it was an isolated case.”

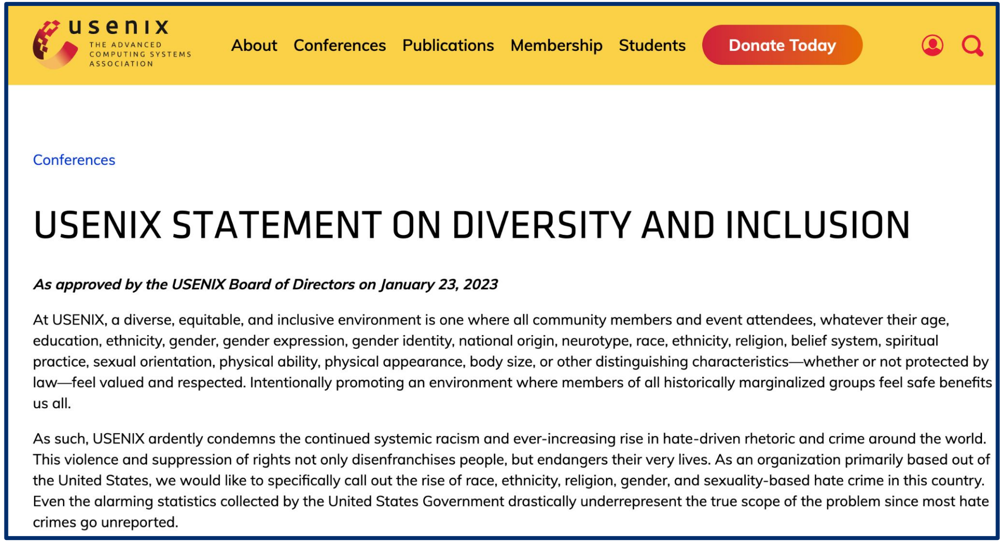
Discussion

- There is a clear gender disparity in community experiences
- Psychological safety is low for everyone

Recommendations for Improving Organizational Culture

- Set the stage

SHARE THE MIC IN CYBER
INCLUSIVE BY DESIGN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USENIX STATEMENT ON DIVERSITY AND INCLUSION

As approved by the USENIX Board of Directors on January 23, 2023

At USENIX, a diverse, equitable, and inclusive environment is one where all community members and event attendees, whatever their age, education, ethnicity, gender, gender expression, gender identity, national origin, neurotype, race, ethnicity, religion, belief system, spiritual practice, sexual orientation, physical ability, physical appearance, body size, or other distinguishing characteristics—whether or not protected by law—feel valued and respected. Intentionally promoting an environment where members of all historically marginalized groups feel safe benefits us all.

As such, USENIX ardently condemns the continued systemic racism and ever-increasing rise in hate-driven rhetoric and crime around the world. This violence and suppression of rights not only disenfranchises people, but endangers their very lives. As an organization primarily based out of the United States, we would like to specifically call out the rise of race, ethnicity, religion, gender, and sexuality-based hate crime in this country. Even the alarming statistics collected by the United States Government drastically underrepresent the true scope of the problem since most hate crimes go unreported.

Edmondson. *The fearless organization: Creating psychological safety in the workplace for learning, innovation, and growth.* 2018

Recommendations for Improving Organizational Culture

- Set the stage
- Invite participation and be explicit
  - This is the responsibility of all members of the community
- Be transparent and respond productively
  - Enforce real safety: physical, digital, and psychological

Edmondson. *The fearless organization: Creating psychological safety in the workplace for learning, innovation, and growth.* 2018

Summary

- There is a clear gender disparity in community experiences
- Psychological safety is low for everyone
- More work is needed to change the culture so cybersecurity is inclusive and supportive for EVERYONE!

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