Do We Really Want to Keep the Gate Threshold That High?

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Drawing upon the survey instruments of Lewis and Neville [1], Nadal [2], and Yang and Carroll [3], we conducted an online survey that captured experiences of discrimination and microaggressions reported by 387 recording engineers, producers, and studio assistants living in 46 different countries. Our statistical analyses reveal highly significant and systemic gender inequalities within the field, e.g., cisgender women experience many more sexually inappropriate comments ($p <$ e-14, large effect size) and unwanted comments about their physical appearance ($p <$ e-12, large effect size) than cisgender men, and they are much more likely to face challenges to their authority ($p <$ e-13, large effect size) and expertise ($p <$ e-10, large effect size). A comparison of our results with a study about women's experiences of microaggressions within STEM academia [3] indicates that the recording studio workplace scores 33% worse on the silencing and marginalization of women, 33% worse on gender-related workplace microaggressions, and 24% worse on sexual objectification. These findings call for serious reflection on the part of the community to progress from awareness to collective action that will unlock the control room for women and other historically and systemically marginalized groups of studio professionals.

0 INTRODUCTION

In a podcast entitled *The Midwife of Audio*,[1] mixing engineer Tom Elmhirst defines his role as a facilitator in the process of music delivery that is audio production. This title obviously invokes associations with gender, birth, and social reproduction. Yet women comprise less than 5% of audio engineers according to the Women's Audio Mission [4] and between 5% and 10% of audio engineers according to AES [4]. A recent study investigating gender composition by presentation type at AES Conventions from 2012–2019 shows that very few women and non-binary authors are represented in Invited Papers (1.96%), Keynotes (8.51%), and Workshops (9.73%) [6]. Also, an Annenberg study showed that only 2% of the record producers credited on 2012–2017 Billboard top 100 hits are women, only 0.3% of these producers (2 out of 651) are women from underrepresented

racial/ethnic groups, and no woman producer was *Grammy* nominated from 2013–2018 [7].

To challenge these harsh gender inequalities (among other social discrimination and equity issues), the AES created a *Diversity & Inclusion (D&I) Committee* in Oct. 2017 that "strives to ensure diversity in the AES worldwide and the audio industry as a whole by improving accessibility, welcoming diverse genres, embracing emergent audio fields and research, and radiating inclusiveness to all races, genders and gender identities, physical abilities, ages, and nationalities."[2] With the aim of providing this committee with detailed and global data to inform their future actions, our study elicits music producers', audio engineers', and studio assistants' experiences of social discrimination and microaggressions in the commercial recording studio.

We begin with a literature review that explores aspects of studio work that may contribute to or intensify in-

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[1]https://www.gear-club.net/episodes/2019/tom-elmhirst

[2]http://www.aes.org/community/diversity/

equalities within the field, placing our survey and participants in context. Our methodological approach draws upon microaggression scholarship [8], [9] and intersectionality [10]–[14] to understand how gender, sexual orientation, race/ethnicity, migration, level of ability, and age impact studio professionals' work conditions and prospects of pursuing a successful career. Also, since our survey instrument mirrors one that was used for a study in Science, Technology, Engineering, and Mathematics (STEM) fields [1]–[3], we are able to compare the percentages of women producers, engineers, and assistants who face specific dimensions of gender-related microaggressions in the studio with those from STEM academia to underline the grim reality of our field.

1 LITERATURE REVIEW

1.1 Emotional and Invisible Labor in the Studio

Results from a 2008 online survey of an international cohort of young professional musicians (mean age = 26, n = 16) showed a shared expectation that producers and engineers exhibit strong interpersonal and communication skills. These skills, which "allow trust and honesty in the studio" and "create a good atmosphere for performance," took precedence over technical, listening, and musical skills [15].

Similarly, based on semi-structured interviews with London-based producers and engineers (men, between the ages of 20 and 65, n = 19), Watson and Ward [16] described the intimacy of recording studios as "emotional spaces characterized by *trust* and *tolerance*." They applied sociologist Hochschild's concept of *emotional labor*—the management of feelings and expressions based on the emotional requirements of jobs in the service industry [17]—to understand the job requirements of producers and engineers who, in the commercial recording studio, are "evokers of and witnesses to [musicians'] emotional displays that in most other work-based contexts, or even social contexts, would be considered inappropriate" [16]. To illustrate the scope of this *emotional labor*, producer Afanasieff [18] mentioned the need to be interchangeably like a doctor, spiritual adviser, psychologist, or bartender to help singers overcome their insecurity.

Jarrett's ethnography of jazz and country producers highlighted the position of the 'self-effacing producer' who "inhibits the emergence of 'the producer' as an animated body—a self or subjectivity who breathes life into sound" as opposed to the 'visible' producer, e.g., Phil Spector [19]. Findings from semi-structured interviews in Canada, France, and the USA with six renowned producers with more than 20 years of studio experience showed that they employ self-effacing methods to cope with musicians' sensitivities, including the possibility "to divert aggressiveness towards themselves" [20]. They compared their mission to the one of photographers "who aim to capture the most meaningful moments and then bring them together."

They also identified with "cleaners, servants, captains of a ship, firemen, and midwives," professions that engage

in many forms of *invisible labor*[3] and that are crucial to the functioning of the recording studio yet are elided or "invisible to those who are its beneficiaries." For instance, recording sessions require a great deal of preparation before the musicians arrive [21] and clean-up after the musicians leave (e.g., discarding coffee cups, rolling cables, backing up files). In short, music producers, audio engineers, and studio assistants engage in high levels of emotional and invisible labor that is underappreciated and unacknowledged.

1.2 Intermediaries Between Musicians and the Industry

In addition to developing a *thick skin* [22] and demonstrating resilience in their capacity to handle intimate and uncomfortable situations while performing emotional and invisible labor, studio professionals must follow the rules and conventions of the music industry in pursuing a studio career [23]. These rules and conventions are historically gendered [24], [25] and mirror the *heteropatriarchal*[4] structure of this industry. Indeed, studio professionals act as "cultural intermediaries between production and consumption" [28], thus at the intersection of two male-dominated groups whose expectations and bias reinforce the gendering of the commercial recording studio, i.e., musicians across genres [29], [30] and music industry professionals [22].

Recent work emphasizes that the music industry's *genius system* maintains women and other historically and systemically marginalized groups of studio professionals in undermined and powerless positions [31], [32], to the point that Wolfe advocates for home-studio self-isolation as the healthiest solution for women producers to develop their skills and self-confidence before facing the gendered and heteropatriarchal commercial recording studio [22]. Furthermore the decline of global recording revenues since the early 21st century has resulted in decreased budgets for recording projects, the need for producers to reinvent their profession [33], and the requirement to handle three jobs at once [34]. In this highly competitive industry, studio professionals are likely to be extremely protective of their clients, which further intensifies the exercise of exclusionary gendered power.

1.3 The Power of Controlling Sound

Whether sound recordists identify as 'tonmeisters' [35], 'traditionalists' who focus on capturing music performances, or 'technophiliacs' whose creative process is primarily technology driven [36], their work involves the control of sounds through audio technology. Horning emphasized the centrality and extent of tacit knowledge required to "engineer the performance" [38]. The power of controlling

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[3]http://micemagazine.ca/issue-one/what-invisible-labour-mice-issue-01

[4]Patriarchy is "a system of social structures and practices in which men dominate, oppress, and exploit women" [26]. Heteropatriarchy is a social system ". . .in which heterosexuality and patriarchy are perceived as normal and natural, and in which other configurations are perceived as abnormal, aberrant, and abhorrent" [27].

sound is thus connected with the legitimacy of coaching artists' performances. For instance, an ethnography of digital studios in Bamako (Mali) linked studio owners' access and ability to use technologies that are still rare and new in a low-income country and their legitimacy to coach artists and control the arrangement and composition process [39]. Wolfe [22] argues that the desire to retain control of the *sound* of the artist's voice and *how* that voice is presented is gendered and that "for the male producer to have held these particular creative reins for such a long time has also resulted in [. . .] an unwillingness to not only let go of them but also in a tendency to overlook and or dismiss the artist who takes control of them herself."

From his observations of three recording sessions for the creation of a pop song in a mid-sized studio, Gander spotlighted how the location of the producer's chair ('captain's chair') at the sonic sweet spot underlines the producer's control of space, restricting the musicians' involvement in the production process—judgments and decisions take place in the control room while the musicians are performing in the live room [40]. Minchella stated from a musician's perspective, "Space is so much more than the realm of surveyors and measurement; rather, it is central to our whole experience and is an intrinsic factor in the process of creativity itself" [41]. The link between the control of sound and control of space is somewhat reminiscent of Keightley's study of systemic sexism in Hi-Fi equipment ads in the mid-20th century, e.g., "You are the Sultan with 70 Watts in your harem" [42]. Thus the space of the recording studio is intimately connected to issues of power, gender, and control.

2 THEORETICAL FRAMEWORKS

2.1 Microaggression Theory

The term *microaggression* was originally defined by Pierce, who was a professor of education and psychiatry at Harvard Medical School, to describe brief indignities that convey hostility toward a racialized group [43]. Importantly, *micro* refers to *everyday* rather than being lesser or insignificant [8]. Sue, professor of counseling psychology at Columbia, defined microaggressions as "everyday verbal, nonverbal, and environmental slights, snubs, or insults, whether intentional or unintentional, that communicate hostile, derogatory, or negative messages to target persons based solely upon their marginalized group membership" [9]. Sue and his team recently summarized the impacts of microaggressions on targets, ranging from increased stress, depression, and heavy toll on physical and emotional well-being to impeded learning and problem solving [44].

2.2 Intersectionality

Rooted in the writings of Black feminists and critical race scholars such as Crenshaw [10], Collins [11], [13], McCall [12], and Misra et al. [14], *intersectionality* is a theoretical approach, methodological orientation, and praxis. Rather than focus on a single form of social difference, intersectionality focuses on the 'matrix of domination' [11], and how systems of oppression are interlocking in nature. The guiding premises of intersectionality's "cognitive architecture" include: 1) Race, class, gender, sexuality, ability, and other systems of power are interdependent; 2) intersecting power relations produce complex social inequalities; 3) intersecting power relations shape group experiences; and 4) solving social problems requires intersectional analyses [13]. Specifically our project aims to document "the workings of power relations in producing social inequalities and the social problems they engender" [13] within the commercial recording studio by examining experiences of microaggressions through an intersectional lens.

2.3 Research Questions

RQ1. How do demographic categories such as gender (GEN), sexual orientation (SOR), race/ethnicity (RET), migrant status (MIG), gross national income of country of residence (GNI), disability (DIS), and the continuous demographic variable age (AGE) impact what tasks audio engineers accomplish within the studio (TAS), how well they are paid (DRA), and how often they are properly credited for their work (CRE)?

RQ2. How do demographic categories and variables impact music producers', audio engineers', and studio assistants' experiences of social discrimination and microaggressions in the commercial recording studio?

RQ3. How do women's experiences of microaggressions in the commercial recording studio compare with women's experiences of microaggressions in STEM academia?

RQ4. Within a framework of intersectionality, how do sexual orientation (SOR), race/ethnicity (RET), migrant status (MIG), gross national income of country of residence (GNI), disability (DIS), and age (AGE) intersect with gender (GEN) in impacting these experiences?

3 METHODS

3.1 Survey Instrument Design

Our survey design applies McCall's recommendations to use analytical categories strategically in order to document relationships of inequality among studio professionals ('intercategorical complexity') [12]. We constructed a survey instrument that includes a *demographic portion* and *microaggressions portion* with the option to opt out of the survey once the demographic portion is complete. In the *demographic portion* featuring 17 close-ended and 10 open-ended questions we asked our respondents to self-identify in terms of gender (GEN), sexuality (SOR), race/ethnicity (RET), and disability status (DIS) and to answer questions about their age (AGE), country of origin and country of residence (MIG), years on the job (YOB), remuneration (DRA), how they were properly credited for their work [CRE, on a five-point Likert scale (LS1) from *Almost always* to *Almost never*], whether they received awards, and

which studio tasks they were involved in (TAS, e.g., *Tracking; Mixing; Assisting, Production*).

In the *microaggressions portion* featuring 53 close-ended questions using a five-point Likert scale (LS2) from *Strongly disagree* to *Strongly agree*, we captured studio professionals' experiences of microaggressions in the workplace. These 53 items drew upon 3 distinct survey instruments. Yang and Carroll [3] provided us with a breakdown of how they constructed their survey instrument. We also adapted Lewis and Neville's [1] factors—Assumptions of Beauty and Sexual Objectification (SOB), Silenced and Marginalized (SAM), and Strong Black Woman Stereotype (STE)—and Nadal's [2] Workplace and School Microaggressions (MGEN, MSOR, MRET, MAGE, MCUL, MDIS).

We met with the AES Diversity & Inclusion Committee at the AES Conventions in Milan in May 2018 and New York in Oct. 2018 to implement changes to the survey instrument based on members' feedback. These changes included the possibility for respondents to share specific examples of microaggressions and how their experience of discrimination may have evolved over time. A week before we launched the survey we sent it to our personal network of 100+ studio professionals and asked for feedback. Several changes were integrated, including the addition of two open-ended questions about having witnessed or caused microaggressions in the studio. The survey questions and recruitment material were translated from English into 19 languages. The survey was available on Qualtrics from October 1st, 2019 to January 30th, 2020.

3.2 Respondent Recruitment

Aiming to capture a current and recent *snapshot* of studio professionals' experiences of discrimination in the commercial recording studio, our target population was individuals who had worked as producers, engineers, or studio assistants on other people's music in the last ten years. The primary group we intended to reach was the 12,800 members of the AES (about 9,100 professionals and 3,700 students), the largest professional society devoted exclusively to audio engineering. However, taking into account the realities of AES membership and participation [6], we also administered the survey to other communities of audio practitioners who more or less overlap with AES but who were likely to include more women and non-binary and/or gender non-conforming people, e.g., the Women's Audio Mission (WAM), SoundGirls, Audio Girl Africa, and female:pressure.

Our recruitment strategy involved three main aspects: emails to personal contacts, in-person recruitment of participants, and online dissemination of the survey via formal and informal channels. In-person recruitment took place at the 2019 AES New York Convention with a group of volunteers from a variety of gender and racial/ethnicity groups and at a series of four events organized by AES student chapters promoting the survey in the UK, Germany, and the Netherlands. The survey was disseminated online via emails to AES chapters worldwide and an email on the VDT (Verband Deutscher Tonmeister) listserv and was included in an AES newsletter. Finally posts were made on group social media pages, including Hey Audio Student and Tape Op Magazine. Our goal was to collect a sample of roughly 1,000 respondents from across the globe. We did not expect nor desire to obtain a representative sample of the demographics of audio engineering globally but rather to obtain adequate sample numbers in order to understand the experiences of members of the various demographic categories of interest.

3.3 Demographic Categories and Discrimination

We defined six demographic categories and one continuous demographic variable as the independent variables for statistical analysis. The six demographic categories and their corresponding codes were gender (GEN), sexual orientation (SOR), race/ethnicity (RET), disability status (DIS), migrant status (MIG), and gross national income of country of residence (GNI). Age (AGE) was the final continuous demographic variable.

We defined fourteen dependent variables geared toward understanding the experiences of studio professionals' discrimination. The first five dependent variables were tasks undertaken in the studio (TAS), daily rate when working in the studio (DRA), crediting (CRE), AES membership (AESM), and awareness of the AES Diversity & Inclusion Committee (AESD). Then followed nine microaggression factors, namely Assumptions of Beauty and Sexual Objectification (SOB); Silenced and Marginalized (SAM); Stereotyped (STE); and Workplace Microaggressions around Gender (MGEN), Age (MAGE), Race/ethnicity (MRET), Culture (MCUL), Sexual Orientation (MSOR), and Disability (MDIS).

3.4 A Mixed-Method Analysis Approach
3.4.1 Descriptive Statistics

We adopted a grounded approach [45] in order to code respondents' self-definitions into appropriate strategic categories. Gender (GEN) was coded from respondents' sex assigned at birth and their current gender identity into three categories: trans/non-binary, cisgender woman, and cisgender man. Sexual orientation (SOR) was coded into heterosexual and non-heterosexual (including but not limited to lesbian, gay, bisexual, queer, pansexual, and asexual). Based on responses to two questions that asked participants to specify their race/ethnicity and self-identify whether they were a racial minority in their workplace, categories of race/ethnicity (RET) detailed whether the respondent was a racial minority at their place of work and included: no, yes (BIPOC—Black, Indigenous, People of Color), and yes (white). This was further broken down into two categories: no (either white, or BIPOC and not part of a racial/ethnic minority in their place of work) and yes (both BIPOC and part of a racial/ethnic minority in their place of work). Note that BIPOC participants who did not identify as a racial minority in their place of work would here be included in the 'no' category for RET. Migration status (MIG) was coded

as 'no' if a respondent's country of residence was the same as their country of origin and 'yes' if they differed.

We used the World Bank's classification of the economies of the country of residence into four income groups (GNI): high, upper middle, lower middle, and low. Disability status (DIS) was coded using responses to two questions, i.e., asking participants whether they identify as someone with disabilities and to further self-identify if they selected 'yes' to the previous question. For the purposes of statistical analysis we coded respondents into three categories: no (no disability), yes (yes invisible), and yes (visible). Age (AGE) and years on the job (YOJ) were calculated by subtracting the year of birth and year they started working in the studio, respectively, from 2020.

There are ethical and methodological issues involved in this strategy of categorization and aggregation. For example, the practice of including in one group both participants who are non-binary and those who have a binary gender (man or woman) but are also transgender is inherently problematic [46], [47]. Although the participants who we included in the category of 'trans/non-binary' had a wide variety of individual gender identities and experiences—trans woman, trans man, demigendered, non-binary, genderqueer, genderfluid, non-binary woman, and so on—aggregating allowed us to obtain statistically significant results.

The same issues apply to the other strategic categories we employed. As critical race theorists and feminist scholars have pointed out, "race and gender frequently function as *proxies*: variables that reduce the complexities of biosocial bodily experience to more quantifiable forms of data" [46]. As with any strategic coding, these categories should be understood as permeable containers for complex and nuanced data. Note that in our forthcoming qualitative paper we unpack these strategic categories and analyze how these individuals experience microaggressions and discrimination through an intersectional lens.

The survey contained three questions related to income that were combined in order to calculate an average daily rate (DRA) in USD for each participant. Individuals who free-lanced in music production reported their normal daily rate as a freelancer and participants on payroll reported their normal yearly income, which we converted to a daily income. We normalized these numbers by the total percentage of their income that these participants reported making from audio engineering as opposed to other types of work. In the case of those who were both freelancers and on payroll we took an average value. We converted the currency to USD based on the value of that currency on the closing date of the survey. Six outliers who reported a freelancing daily rate of over 2,000 USD/day were removed, since inspection of their responses indicated that they had misinterpreted the question to refer to either a monthly or yearly income. Finally for the statistical tests we discarded the income information from participants who reported making less than 50% of their income from audio engineering.

For the coding of the Audio Engineering Society membership (AESM) we used the responses to a multiple-choice question on AES membership. The three categories for this variable include: no (never), yes (current member), and yes (former member). Participants were then asked to indicate whether they were aware of the AES Diversity & Inclusion Committee (AESD). Responses were coded based on the coding assigned to AESM and included: no (current AES member), no (non-AES member), no (former AES member), yes (current AES member), yes (non-AES member), yes (former AES member), and N/A for those who skipped the question or left it blank.

3.4.2 Statistical Analyses

One-way Kruskal-Wallis tests and ANOVAs were used to relate demographic categories to CRE, DRA, AESM, and AESD. A logistic regression was used to relate AGE to TAS and χ^2 tests for independence and cross tabulations were used to relate demographic categories other than AGE to TAS. Effect sizes for these χ^2 tests were estimated using Cramer's V.

For each of the nine microaggression factors we took the average of all subsidiary questions in order to obtain an aggregate score for that factor. For each combination of demographic category and microaggression factor aggregate score we subsequently ran both one-way Kruskal-Wallis tests and one-way ANOVAs, followed by a Dunn's multiple comparison post-hoc test. Type III (sigma-restricted) sum of squares error terms were used for all ANOVAs. Use of ANOVAs was justified by making the approximation that Likert-scale measurements can be treated as continuous [48]. In the cases where the Kruskal-Wallis tests disagreed with the ANOVA findings, we reported the findings from the more conservative non-parametric Kruskal-Wallis test. We estimated the effect size for each test using bootstrapped η^2 values, referring to Cohen's [49] criteria for boundaries on low, medium, and large effect sizes.

For the continuous variable AGE, we ran a linear regression against each of the aggregate scores. Effect size was estimated using R^2 statistics, again referring to Cohen for boundaries on effect size categories [50].

While aggregate scores were used to understand the overall impact of demographic categories upon microaggression factors, we were also interested in which of the specific microaggression statements were highly associated with demographic categories (e.g., the microaggression 'I have been told I was too sassy and straightforward' with its implications of racial stereotyping). As such we ran a second round of Kruskal-Wallis tests and ANOVAs on the disaggregated microaggressions data.

3.4.3 Comparison With STEM Study

To compare our findings with those obtained by Yang and Carroll [3], who measured the experiences of women working within STEM academia, we reproduced their calculations. However, while our survey tool employed a 5-point Likert scale ranging from *Strongly disagree* to *Strongly agree*, theirs employed a 7-point scale on the same range, with their score of 4 (*Neither agree nor disagree*) corresponding to our score of 3 (*Neither agree nor disagree*).

Table 1. Demographic breakdown of strategic categories

Demographic Categories	Cisgender Man	Cisgender Woman	Trans/Non Binary	Total
Total	**275**	**86**	**26**	**387**
Low GNI	10	0	2	12
Lower Mid GNI	9	4	0	13
Upper Mid GNI	42	14	2	58
High GNI	214	68	22	304
Immigrant	46	12	5	63
Both BIPOC & part of racial/ethnic minority in place of work	18	11	2	31
Non-heterosexual	47	44	19	110
Person with disabilities	15	12	5	32
AES member	108	30	6	144
Aware of AES D&I Committee	61	14	7	82

3.4.5 Intersectional Analyses

To explore how the demographic categories intersect with gender in experiences of microaggressions in the studio, we ran two-way ANOVAs with Type III sum of squares error to test for the following interactions: GEN/SOR, GEN/RET, GEN/DIS, GEN/MIG, and GEN/GNI. To investigate the intersection between GEN/AGE, we ran an ANCOVA with hierarchical error terms.

4 RESULTS

4.1 Descriptive Statistics

A total of 1,141 participants started the survey. We analyzed only the data from participants who completed the *demographic portion* (GEN, SOR, RET, DIS, MIG, GNI, AGE, TAS, CRE, DRA, AESM, and AESD) of the survey in its entirety, resulting in 387 usable responses, 373 of which included usable age data (Table 1). Out of these 387 participants, 281 completed the *first microaggressions portion* (SOB, SAM, and STE) and 234 completed the *second microaggressions portion* (MGEN, MSOR, MRET, MDIS, MCUL, and MAGE). Despite not reaching our goal in terms of participation, proportionally more participants from underrepresented populations than are present in the profession at large allowed us to obtain meaningful results from the data nevertheless.

4.1.1 GEN, SOR, RET, DIS, MIG, GNI, AGE

Out of the 387 participants who filled out the *demographic portion*, 71% (n = 275) of participants were cisgender men, 22% (n = 86) were cisgender women, and 7% (n = 26) were transgender/non-binary. We received responses from approximately 15% more cisgender women than have been estimated to comprise the overall gender makeup of AES [4]. Also, 17% (n = 47) of cisgender men, 44% (n = 38) of cisgender women, and 73% (n = 7) of trans/non-binary participants identified as non-heterosexual.

Out of the 387 participants, 8% (n = 31) were both BIPOC and part of a racial/ethnic minority in their place of work—45% of whom had migrated from their country of birth—while 89% (n = 344) did not identify as part of a racial/ethnic minority in their place of work. Finally
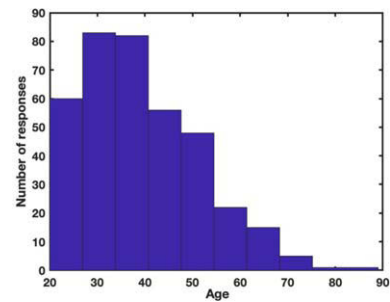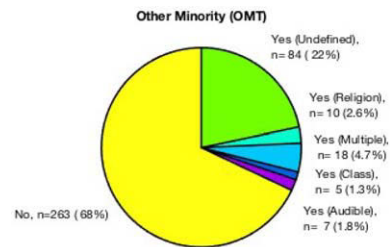

Fig. 1. AGE demographics of survey respondents, n = 373.

Fig. 2. Other minority statuses reported by study participants not included in the analysis undertaken in this study.

3% (n = 12) were white but also identified as a racial minority in their place of work. In the statistical analysis that follows, this cohort was combined with the group that did not identify as a racial minority in their workplace.

Our sample was international, comprising data from participants born in 36 countries of origin and residing in 46 countries of residence, 94% from upper middle and high-income GNI countries (Table 1). Out of the 387 participants, 16% (n = 63) reported living in a country different from the one they were born in. Of these, 22% identified as both BIPOC and part of a racial/ethnic minority in their place of work. Three times as many cisgender men from low and low-middle income GNI countries participated in the survey, as did cisgender women or transgender/non-binary people (2% difference).

Out of the 387 participants, 8% (n = 32) identified as having a disability. Of these individuals just over half reported having a visible physical disability while the rest reported having an invisible physical or non-physical disability.

The mean age that the participants started working in audio engineering was 25 [± 5] years old. There was no significant difference in this value with respect to gender. The youngest participant was 20 years of age and the oldest was 89 years of age (Fig. 1).

Participants were given a space to indicate whether they identified as part of a minority in their place of work other than the demographic categories included in the survey (Fig. 2). We did not include the demographic categories featured in the responses to this question in our statistical analysis because either the number of respondents was very small (for *audible minority*, *religious minority*, and *class minority*) or because while the participants answered that they were part of another minority group they did not specify what kind. Additionally, while we included a question

about Indigenous status in the survey, we did not include the results in our statistical analysis because this question was misinterpreted (sometimes in ways that seemed intentionally provocative or anti-Indigenous) by a large number of participants.

4.2 Tasks, Incomes, and Credits

4.2.1 Tasks (TAS)

Statistically significant differences in the distribution of tasks accomplished in the studio (TAS) were found for gender (GEN), sexual orientation (SOR), disability (DIS), and AGE (Table A1). Overall, cisgender women were 25% more likely to answer *assisting* than cisgender men; however when we included only participants under the age of 30 in the analysis, we found the result to not be statistically significant, indicating that this finding was mainly due to the small number of older women who participated in the survey. Cisgender men were 21% more likely to answer *mastering* than cisgender women; this result was independent of age ($p < $ e-2).

Heterosexual participants were 17% more likely to answer *mastering* ($p < $ e-2), 11% more likely to answer *producing* ($p = 0.05$), 9% more likely to answer *mixing* ($p < $ e-2), and 17% less likely to answer *assisting* ($p < $ e-2) than non-heterosexual participants; these results were independent of age.

Participants who did not identify as having a disability were more likely to respond *mixing* than participants with an invisible or visible disability (19% and 16%, respectively, with $p = 0.01$).

Age had a significant impact on how often participants responded *mixing* (increased with age, $p < $ e-8), *mastering* (increased with age, $p < 0.05$), and *assisting* (decreased with age, $p < $ e-18).

4.2.2 Incomes (DRA)

Both gender and age were significantly associated with differences in daily rate (GEN, $\eta^2 = 0.07$ [0.01:0.10], medium effect size; AGE, $R^2 = 0.14$, medium effect size). Cisgender men making over 50% of their income from audio made an average of 74 ± 4 USD/day, while trans/non-binary people made an average of 56 ± 13 USD/day and cisgender women made an average of 51 ± 7 USD/day. Daily rate increased with age at a rate of 3.74 USD/day per year (Fig. 3, Table 2).

4.2.3 Crediting (CRE)

Gender, race/ethnicity, disability, migrant status, and age were found to be significant predictors of being properly credited for work (CRE) (Fig. 4). Cisgender women were twice as likely as cisgender men to report being *almost never* properly credited and half as likely to report being *almost always* properly credited (Tables 2 and A2; $\eta^2 = 0.06$ [0.02:0.12], medium effect size). Participants who were both BIPOC and part of a racial/ethnic minority in their place of work were just under twice as likely as participants who were not to report *almost never* being properly

credited and under half as likely to report being *almost always* properly credited ($\eta^2 = 0.02$ [0.002:0.06], small effect size).

Participants with an invisible disability were almost four times more likely than participants without a disability to respond *almost never* and one-fifth as likely to respond *almost always* being properly credited for their work ($\eta^2 = 0.02$ [0.005:0.07], small effect size). Participants who had emigrated were 10% more likely to respond *almost never* or *rarely* and 10% less likely to respond *almost always* being properly credited than those who had not emigrated ($\eta^2 = 0.02$ [0.001:0.06], small effect size). Older participants reported being properly credited significantly more often than younger participants ($R^2 = 0.02$, small effect size). Additionally two-way analysis of GEN/AGE vs. CRE revealed that there was a significant interaction term for GEN*AGE. While the overall effect of increasing age was to positively affect how often participants were properly credited, the intersection of gender and age had a small additional mediating effect—in the case of cisgender participants this effect was negative, while for trans/non-binary participants it was positive.

4.3 AES Membership

The only significant predictor of AES membership (AESM) was GNI of country of residence (Tables 2 and A2). Participants from low and lower-middle income GNI countries were significantly less likely to be AES members than participants from upper-middle and high-income GNI countries (Table A2). Only 55% of current AES members who took part in the survey were aware of the AES D&I committee. None of the demographic categories we tested were significant predictors of knowledge of the AES D&I committee.

Of the participants who indicated that they had never been a member of AES, about 33% provided a reason why. Reasons included already being members of the VDT, considering becoming members in the future, not being interested in joining AES, not being able to afford a membership, stating that the membership was not worth the return on investment, participating in AES but not as a member, not being able to register for a membership on the AES website, and not knowing what AES is. For participants who were formerly members of AES but no longer active, about 85% explained why. Some cited fiscal reasons for not continuing their membership, such as not being able to afford dues, not having a return on investment, and not being interested in the benefits. Several respondents indicated that they had an AES student membership during their studies but did not renew it after their graduation.

Other reasons given for not having a current membership included letting their membership lapse/forgetting to renew, not being a part of the audio industry anymore, and having a grievance with the society (i.e., not feeling supported, issues with exclusion, and too oriented toward technical or social aspects). Lastly eight respondents included comments on their answer to their awareness of the Diversity & Inclusion
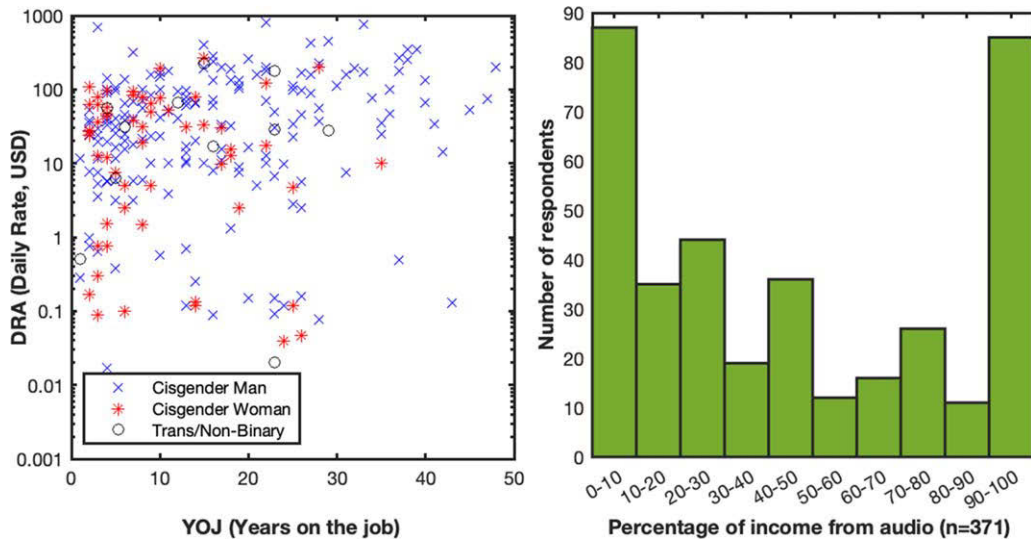
Fig. 3. Left: daily rate (DRA, USD/day) vs. years on the job. Right: percentage of their income that participants reported making from audio engineering.
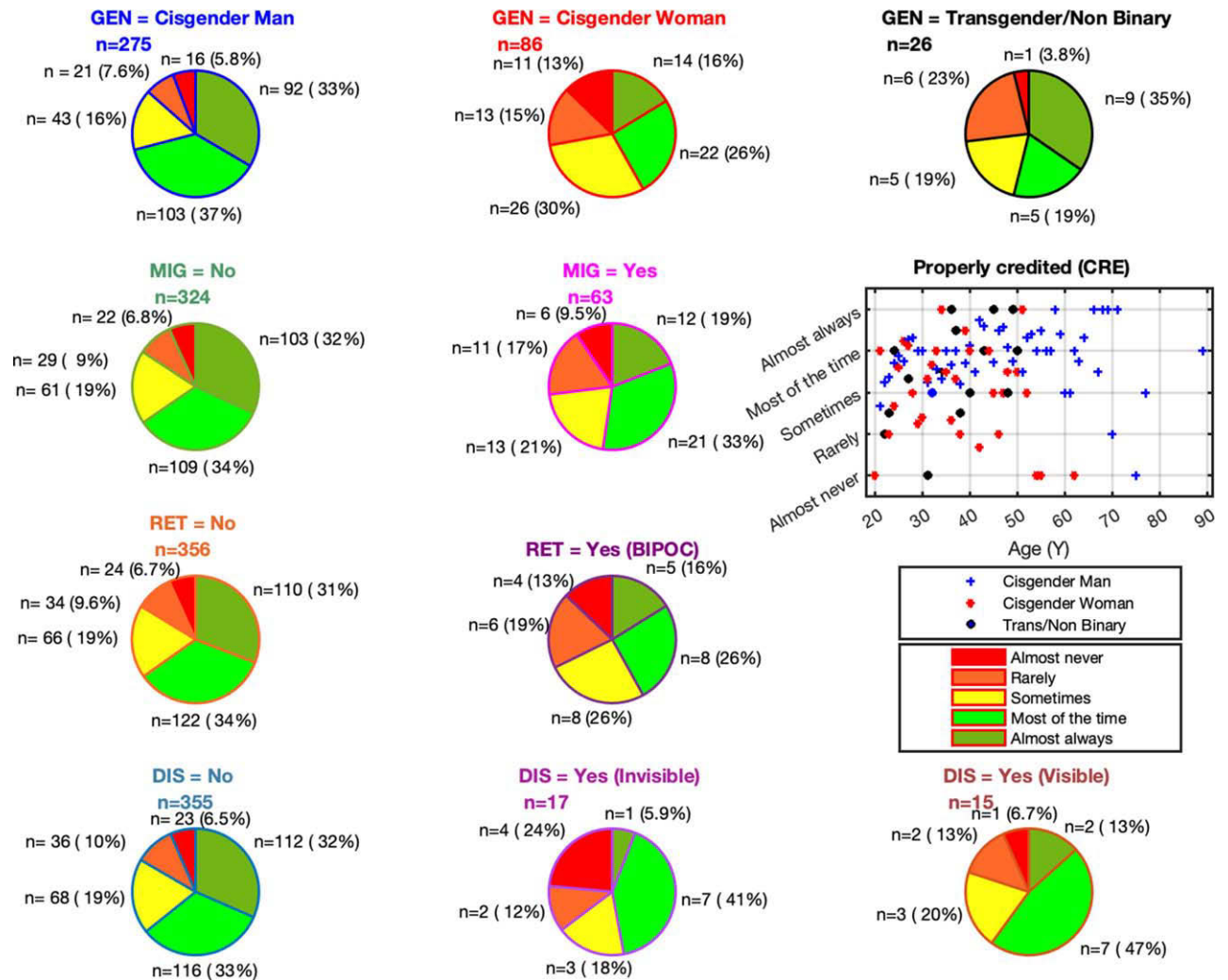

Fig. 4. Demographic factors associated with difference in CRE. For AGE subplot, markers represent the mean response for a given gender at a given age.

Table 2. P-values for χ^2 values (one-way Kruskal-Wallis tests; GEN/SOR/RET/DIS/MIG/GNI) and R^2 values (linear regressions; AGE), color coded by effect size. Entries with background in dark gray/red indicate large effect size ($\eta^2 >= 0.1379$ or $R^2 > 0.26$), entries in medium gray/orange indicate medium effect size ($\eta^2 >= 0.0588$ or $R^2 > 0.13$), entries in light gray/yellow indicate small effect size ($\eta^2 >= 0.0099$ or $R^2 > 0.02$). Non-significant entries are in white with gray text. Slope entry color indicates direction of relationship of dependent variable with AGE (light gray/pink positive, dark gray/blue negative)

		N	GEN	SOR	RET	DIS	MIG	GNI	AGE	
			p (χ^2)						p(R^2)	Slope
Daily rate	DRA	135	0.01	0.96	0.09	0.47	0.43	0.29	5.86E-06	3.74
Properly credited	CRE	373	1.05E-03	0.11	0.005	0.01	0.01	0.64	0.01	0.01
AES membership	AESM		0.27	0.43	0.31	0.24	0.29	0.05	0.49	2.19E-3
Aware of D&I committee	AESD		0.43	0.34	0.92	0.39	0.26	0.15	0.50	4.46E-3
Sexual objectification	SOB	283	1.20E-16	5.05E-04	0.14	1.68E-03	1.00	0.34	0.01	-0.01
Silenced and marginalized	SAM	284	1.26E-13	0.03	0.03	0.01	0.44	0.20	8.68E-05	-0.02
Stereotyped	STE	281	4.96E-11	0.15	0.56	0.02	0.81	0.03	0.14	-0.01
Gender W.M.	MGEN		3.15E-25	3.15E-05	0.01	0.02	1.00	0.99	4.26E-03	-0.02
Age W.M.	MAGE		2.28E07	0.04	0.64	0.08	0.96	0.24	4.73E-04	-0.03
Sexual orientation W.M.	MSOR	234	1.06E--06	2.99E-08	0.10	0.00	0.66	0.50	0.11	-0.01
Cultural W.M.	MCUL		0.02	0.73	0.09	0.01	0.01	0.02	0.97	-2.10E-4
Disability W.M.	MDIS		4.35E-04	0.07	0.34	2.26E-04	0.78	0.68	0.01	-0.02
Racial W.M.	MRET		0.05	0.52	0.01	0.04	0.51	0.01	0.42	-3.99E-3

committee (three who answered 'no' and five who answered 'yes'). Of the 'no' responses, reasons included not being aware of the committee, not being aware of the society, and not supporting the committee's endeavors. Of the 'yes' responses, two were from active committee members, two wrote in support of the committee, and one acknowledged its existence.

4.4 Microaggression Statistical Analyses
4.4.1 Gender (GEN)

Of the demographic categories considered in this analysis we found that gender was by far the strongest predictor of experiences of discrimination and microaggressions in the recording studio (Table 2), having large and medium effects upon aggregate scores for all microaggression factors except Race/Ethnicity Workplace Microaggressions (MRET). Four microaggression factors displayed large effect sizes for GEN: Assumptions of Beauty and Sexual Objectification (SOB, $\eta^2 = 0.25$ [0.19:0.38]), Silenced and Marginalized (SAM, $\eta^2 = 0.21$ [0.13:0.30]), Stereotyped (STE, $\eta^2 = 0.17$ [0.10:0.26]), and Gender Workplace Microaggressions (MGEN, $\eta^2 = 0.48$ [0.44:0.67]), corresponding to an explained variance of 25%, 21%, 17%, and 48%, respectively.

For microaggression factors SOB, SAM, STE, MGEN, MAGE, and MSOR, the aggregate scores for cisgender women and trans/non-binary participants were significantly higher than those of cisgender men but not significantly different from one another. However trans/non-binary participants responded similarly to cisgender men for MDIS while cisgender women reported experiencing significantly more microaggressions from this factor. The opposite was true for MCUL, where cisgender women and cisgender men did not respond significantly differently from one another but where trans/non-binary participants reported higher incidences (Table A2).

4.4.2 Sexual Orientation (SOR)

Non-heterosexual participants reported experiencing significantly more microaggressions from factors SOB, SAM, MGEN, MAGE, and MSOR than heterosexual participants (Tables 2 and A2). The most influenced factors associated with SOR were MSOR ($\eta^2 = 0.13$ [0.07:0.28], medium/large effect size) and MGEN ($\eta^2 = 0.07$ [0.03:0.18], medium effect size).

4.4.3 Race and Ethnicity (RET)

Participants who were both BIPOC and part of a racial/ethnic minority in their place of work reported experiencing significantly more microaggressions from factors SAM, MGEN, and MRET than participants who were not (Tables 2 and A2). The most influenced factors associated with RET were MGEN ($\eta^2 = 0.03$ [0.0003:0.06], small effect size) and MRET ($\eta^2 = 0.03$ [0.007:0.18], small effect size).

4.4.4 Migrant Status (MIG)

Participants who had migrated were significantly more likely to experience Culture Workplace Microaggressions (MCUL) than participants who had not (Tables 2 and A2; $\eta^2 = 0.03$ [0.003:0.13], small effect size).

4.4.5 Gross National Income of Country of Residence (GNI)

Participants living in low and lower-middle income countries experienced significantly more microaggressions for factors STE, MCUL, and MRET than those living in upper middle and high-income countries (Tables 2 and A2). The most influenced factor associated with GNI was MRET ($\eta^2 = 0.03$ [0.001:0.11], small effect size).

4.4.6 Disability (DIS)

Participants with an invisible disability were significantly more likely to experience microaggressions from

Table 3. Comparison with Yang and Carroll's study [3] of experiences of microaggressions in STEM academia.

Percentage of women respondents whose answers within a microaggression factor resulted in an average of *'Neither agree or disagree'* or over.				
Study	SOB	SAM		MGEN
Yang & Carroll	31%	47%		44%
Current	55%	80%		77%
% Difference	+24%	+33%		+33%
Percentage of women respondents who answered at least once *'Agree'* or above within a microaggression factor				
Study	SOB	SAM	STE	MGEN
Yang & Carroll	73%	76%	76%	68%
Current	82%	93%	87%	82%
% Difference	+9%	+17%	+11%	+14%

factors SOB, SAM, STE, MGEN, MSOR, MCUL, and MRET than participants with no disability (Tables 2 and A2). Additionally participants with either visible or invisible disabilities were significantly more likely to experience Disability Workplace Microaggressions (MDIS, $\eta^2 = 0.07$ [0.04:0.16], medium effect size).

4.4.7 Age (AGE)

Age had a significant negative association with experiences of microaggressions from factors SOB, SAM, MGEN, MAGE, and MDIS (Table 2). For these factors, increasing age was associated with a decrease in reported experiences of microaggressions. The most influenced factors associated with AGE were SAM ($R^2 = 0.05$, small effect size) and MAGE ($R^2 = 0.05$, small effect size).

4.5 Comparison With STEM

We compared our findings with those reported by Yang and Carroll's study [3] and found that cisgender women working in the studio reported experiencing more microaggressions and discrimination than cisgender women working in STEM academia (Table 3). Specifically, 24%, 33%, and 33% more cisgender women working in the studio responded with an average of *Neither disagree nor agree* or over for microaggression factors SOB, SAM, and MGEN, respectively. Also, 9%, 17%, 11%, and 14% more of the cisgender women we surveyed had experienced one or more microaggressions from factors SOB, SAM, STE, and MGEN, respectively.

4.6 Intersection Analyses

We found significant simultaneous effects and interactions with gender for all demographic categories: GEN/SOR (Fig. A1), GEN/RET (Fig. A2), GEN/MIG (Fig. A3), and GEN/GNI (Fig. A4), GEN/DIS (Fig. A5), and GEN/AGE (Fig. A6). Microaggressions with simultaneous effects (figure titles in black) were unidirectionally impacted by both demographic categories. For example cisgender women and trans/non-binary participants reported experiencing the microaggression 'People have imitated the way that I speak' more than cisgender men, and non-

heterosexual participants experienced this microaggression less than heterosexual participants (Fig. A1).

Microaggressions with an interaction term (purple and orange figure titles) showed more complex relationships to the demographic variables, e.g., 'I have been disrespected,' for which there was a significant term for GEN (cisgender men were the least likely to experience this microaggression) but none for SOR. However non-heterosexual cisgender women and trans/non-binary people reported experiencing this microaggression more than their heterosexual counterparts, whereas non-heterosexual cisgender men reported experiencing the microaggression less than heterosexual cisgender men—a dynamic captured by the GEN*SOR interaction term.

4.6.1 Intersection GEN/SOR

In the majority of cases where there was a simultaneous effect of GEN and SOR, non-heterosexual participants experienced the microaggression in question more than their heterosexual peers, and this difference was bigger for cisgender women and trans/non-binary people than cisgender men. However for the microaggressions 'People have imitated the way that I speak' and 'I have been told I was too sassy and straightforward,' non-heterosexual participants experienced these microaggressions less than heterosexual participants. Non-heterosexual cisgender women and trans/non-binary people experienced the SAM microaggressions 'I have been disrespected' and 'People have challenged my authority' more than their heterosexual peers whereas the opposite was true for cisgender men.

Finally, for the SOB microaggression 'People have made sexually inappropriate comments,' non-heterosexual cisgender participants experienced this microaggression less than heterosexual cisgender participants, whereas non-heterosexual trans/non-binary participants experienced it more than heterosexual trans/non-binary participants. *P*-values and effect sizes for the two-way ANOVA results for GEN/SOR can be found in Table A3, APPENDIX A.

4.6.2 Intersections GEN/RET, GEN/MIG, GEN/GNI

Participants who were both BIPOC and part of a racial/ethnic minority in their place of work experienced the MCUL microaggression 'People have treated me differently from other cultural groups' more often than those who were not. Cisgender men and trans/non-binary participants who were both BIPOC and part of a racial/ethnic minority in their place of work experienced the STE microaggression 'I have been told I was too independent' more than their peers who were not, while the opposite was true for cisgender women.

Participants who had migrated were more likely than those who had not to experience the STE microaggression 'People have made me feel exotic' but less likely to experience the SOB microaggression 'People have assumed I was sexually promiscuous.' They were also more likely to experience the MCUL microaggressions 'People have assumed my work would be inferior to people of other cultural origins,' 'People have been unfriendly or unwel-

coming toward me because of my cultural origin,' and 'My opinion has been overlooked in a group discussion because of my cultural origin'; this effect was greater for cisgender women than cisgender men or trans/non-binary people.

Participants from low and lower-middle GNI countries were more likely than those from upper-middle and high GNI countries to have experienced the microaggressions 'People have imitated the way that I speak,' 'People have treated me differently than people of other cultural groups,' and 'People have treated me differently than people of other racial groups,' and less likely to have experienced the microaggressions 'People have made sexually inappropriate comments' regardless of gender. Cisgender participants from low and lower-middle GNI countries were more likely than those from upper-middle and high GNI countries to have experienced the microaggressions 'I have been disrespected,' 'People have challenged my authority,' 'I have been ignored because of my cultural origin,' 'I have been ignored because of my race,' and 'People have been unfriendly or unwelcoming towards me because of my level of ability,' whereas trans/non-binary participants from low and lower-middle GNI countries were less likely to have experienced these microaggressions.

Finally cisgender women from low and lower-middle GNI countries were more likely than those from upper-middle and high GNI countries to have experienced the microaggressions 'My opinion has been overlooked in a group discussion because of my sexual orientation' and 'People have assumed my work would be inferior to people of other levels of ability,' whereas the opposite was true for cisgender men and trans/non-binary participants. Note that there were only two trans/non-binary respondents from lower GNI countries, so further investigation is required to generalize these results for transgender and non-binary people.

4.6.3 Intersection GEN/DIS

Participants with visible or invisible disabilities experienced the microaggressions 'People have objectified me based on my physical features,' 'I have received unwanted comments about my physical appearance,' 'I have received unwanted comments about my hair and/or makeup,' 'People have tried to "put me in my place,"' and 'I have been told I was too emotional' more than participants without disabilities. Participants with invisible disabilities were more likely than those with visible disabilities to report the first three of these microaggressions while the opposite was true for the last two.

Cisgender men with invisible disabilities were more likely than any other group to report the microaggression 'People have made me feel exotic.' Along with trans/non-binary people with invisible disabilities, they were also more likely to report 'People have been unfriendly or unwelcoming towards me because of my cultural origin' or 'People have been unfriendly or unwelcoming towards me because of my race'—but the very low number of invisibly disabled trans/non-binary respondents to these questions (n=1 for the first and n=2 for the sec-

ond) means it is difficult to generalize these results for the trans/non-binary case.'

4.6.4 Intersection GEN/AGE

Seven microaggressions showed simultaneous effects for both GEN and AGE, four from factor SAM and three from factor Age Workplace Microaggressions (MAGE). Younger cisgender women and trans/non-binary people reported experiencing these microaggressions more than older cisgender men. Older cisgender women also reported experiencing the microaggressions 'People have made me feel exotic' and 'My professional expertise has been questioned,' whereas middle-aged participants of all genders reported experiencing the microaggression 'People have been unfriendly or unwelcoming towards me because of my cultural origin' while younger and older participants did not.

5 DISCUSSION

5.1 Limitations

In this survey, we strategically used intercategorical complexity [12] to document social inequalities between different social groups within the commercial recording studio. From our perspective we use quantitative methods as a tool to advocate for change within the audio industry. This is akin to gear or technology in the studio. Although there are economic, social, and historical reasons that have resulted in gear and technology being racialized and gendered in particular ways, similar to methods, this does not exclude marginalized groups from using these tools in productive ways [14].

The biggest limitation of our survey is the low number of BIPOC participants. As an all-white research team of non-binary people and cisgender women, it is important to seriously examine this limitation of our dataset. First, it is possible to argue that the racial and ethnic make-up of our survey merely reflects the white supremacist heteropatriarchal nature of the audio industry. However we know the industry is also male-dominated and this did not stop women and non-binary people from participating.

Second, perhaps we can say that the underrepresentation of BIPOC is the result of recruitment issues. Several BIPOC AES student members assisted with our recruitment efforts (both in-person at the 2019 NY AES Convention and virtually through their social networks). However we know that recruitment practices can reflect systemic inequities. For example in medical research a study showed that Black respondents are less trusting of investigators than white respondents [51]. Similar issues of distrust may have been at play in our recruitment process.

Third, perhaps it is the nature of the methods themselves. We know that many theories, structures, and methods in academia show the bias of racism and white supremacy [52] and are also colonialist in nature [53], [54]. We suggest that BIPOC may have purposefully chosen not to participate in our survey as a result of this history and due to ongoing racist and colonial legacies within the academy. In conclu-

sion, further studies investigating how BIPOC experience microaggressions in the recording studio are needed.

5.2 'Under Pressure': Emotional and Invisible Labor

Our findings point to an apparent contradiction between studio professionals' ability to regulate their own emotions in order to provide the trust and tolerance necessary to help musicians perform at their best [15], [16], [18]–[20], and the lack of trust and tolerance that trans/non-binary people, cisgender women, younger people, BIPOC, people with disabilities, and sexual minorities face when working in the studio. The adverse effects of emotional labor such as displaying accepted rather than real emotions may explain this contradiction. Indeed, the accompanying experience of emotional dissonance is associated with negative outcomes within the workplace, including emotional exhaustion, decreased organizational attachment, and burnout [55], all of which are predictors of *workplace incivility* [56]–[59].

While our findings show that women and other equity-deserving groups are less credited and compensated for their studio contributions, we also found that just under 15% of cisgender men reported being *Almost never* or *Rarely* credited for their work, and regardless of demographic category, the majority of studio professionals made an income of well under 100 USD/day, with an increase of about 40 USD/day of their general revenues every ten years. Perceived job insecurity has been shown to be a motivating factor for workplace incivility [59], and experiencing incidences of workplace incivility is a predictor of instigating workplace incivility oneself [57]. This suggests that some studio professionals who silence, belittle, harass, or insult their peers may be responding to their own frustration and insecurities related to the precarious and invisible nature of their labor.

5.3 Dangers of Heteropatriarchy in the Studio

Following the highly significant impact of gender, our analysis indicates that age is the second most important factor influencing experiences of discrimination and microaggressions in the commercial recording studio. This mirrors the heteropatriarchal structure of the studio that requires young professionals to develop a 'thick skin' [22] and embrace the rules and conventions of the workplace to pursue a career in this informal industry [23]. While masculinity is not intrinsically harmful and can be associated with positive and prosocial traits such as helpfulness, courage, and responsibility [60], some typically masculine workplace behaviors such as competitiveness, assertiveness, and ruthlessness can become toxic when they are performed in "socially destructive" and dominating ways [61]. In male-dominated and competitive fields, toxic masculinity presents itself through extreme behaviors of competition and control, often an attempt to "prove manhood" at work [61], [62].

One of the outcomes of male-dominated toxic workplace cultures are 'queen bee behaviors,' which are "a response to the discrimination and social identity threat that women may experience in male-dominated organizations" [63]. This phenomenon leads women "to achieve career success in the field by derogating other women while simultaneously emphasizing their own career commitment and masculine qualities" [64]. This may explain the finding from a recent study exploring the factors contributing to gender imbalance in the audio industry that shows how women employees were less likely than men employees to believe that women would be suitable for technical and managerial roles [65].

This may also provide insight toward interpreting a result from another gender bias study that explored the experience of women in the music industry, which found that the 7% of the surveyed women who listed their occupation as 'music production and recording' reported a higher level of job satisfaction than average [25], [66]. These observations suggest that structural changes are needed to avoid the 'thick-skinned resignation' [22] that results from the 'queen bee' [63], [64] and 'tokenism' [67] phenomena.

5.4 Toxic Masculinity as Gate Threshold

Together our statistical results demonstrate how harsh and toxic the climate of the commercial recording studio can be for women, trans/non-binary people, BIPOC, immigrants, disabled people, non-heterosexual people, and younger people working in the field. As previously noted the association between masculinity and audio technology has insidious implications ranging from Hi-Fi addictions that repulse spouses within the home [42] to the mobilization of gear fetishism that excludes women from the workplace. 'Audiomania' may also be accompanied by a certain risk aversion for new technologies [36] and is reflected in 'informal demarcations among audio engineers,' such as knowing how to roll cables over/under or being able to hear autotune artifacts [68]. Our findings contradict and challenge the 'genderless' central mission of audio engineering and music production, which has been conceived of as the use of technology in the service of art [69], i.e., to 'catch a vibe' [22] or 'elicit emotions' [16].

Within the last ten years the audio community has succeeded at standing up for sonic subtleties and musical details by fighting for level harmonization against the Loudness War [70]. We advocate for the next community move to consist of releasing the gate of toxic masculinity to include the artistry of women and other historically and systemically marginalized groups of studio professionals. We argue that this progress would also positively impact the artistic quality of the work, e.g., in an interview by Fournet, producer Geffen reflected that "many of the male producers she started out with are now working in the industry, but very few of them are dedicated to projects that are really meaningful to them" [71].

6 TOWARD STRUCTURAL CHANGE

Building upon intersectional [10]–[14] and microaggressions scholarship [1]–[3], [8], [9] we have sought to offer a macro-level snapshot of experiences of discrimina-

tion within the commercial recording studio. Our research highlights how heteropatriarchy structures all aspects of the recording studio from experiences of microaggressions and discrimination, to inequalities in terms of pay and credits.

During the course of this research we encountered a critique suggesting that investigating discrimination in audio engineering from the perspective of microaggressions might have the paradoxical effect of 'making things worse,' either by indicating that women and other equity-deserving groups within the field are not 'tough enough' to succeed within the competitive world of audio engineering and music production, or that conducting a survey of this kind reproduces the inequalities that it seeks to document. To this, we can only point to the poor representation of women and other historically and systematically marginalized groups within the industry [4], [6], [7] and ask the question: how could it get worse?

We also encountered the response, 'Look at that famous engineer who is a woman/transgender person/racial minority: they did just fine.' While we recognize and celebrate the achievements of those who have been able to make a name for themselves despite facing the barriers described in this study, we would like to see a future where historically underrepresented groups can thrive in the studio without having to be absolutely exceptional and without the accompanying baggage of trauma that was so eloquently captured in our open-ended responses.

We are currently working on a qualitative study based on the open-ended survey responses that will highlight how marginalized individuals experience toxic workplace cultures in their daily lives, involving experiences of harassment, discrimination, and challenges to expertise, and the outcomes of these experiences, which include both adaptation behaviors and leaving the business. We believe that our research benefited hugely from sociological and psychological perspectives that informed us what is happening in the commercial recording studio. These research results should help design future actions to address the wide range of issues that we have identified. We also hope that this collaborative project will provide a baseline picture of the work climate in the studio and inspire more interdisciplinary studies to examine other audio workplaces such as R&D laboratories, live events, sound design studios, or video game companies.

7 ACKNOWLEDGMENT

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A.1: Additional Tables and Figures

Table A1. P-values for TAS analysis, color-coded by effect size. No large or medium effect sizes were found. Entries in light gray/yellow indicate small effect size (Cramer's V > 0.07 or 0.1). Non-significant entries are in white with gray text. Slope entry color indicates direction of relationship of dependent variable with AGE (light gray/pink positive, dark gray/blue negative).

	N	GEN	SOR	RET	DIS	MIG	GNI	AGE P(t)	AGE Slope
		p (χ²)						P(t)	Slope
ALL AGES									
Tracking	387	0.25	0.07	0.15	0.09	0.83	0.94	0.06	-0.02
Editing		0.43	0.18	0.96	0.08	0.19	0.09	0.07	-0.02
Mixing		0.70	9.68E-3	0.20	0.01	0.12	0.98	0.02	-0.03
Mastering		2.09E-3	3.67E-3	0.35	0.21	0.67	0.90	0.02	0.02
Producing		0.34	0.05	0.34	0.28	0.12	0.77	0.84	0.00
Assisting		2.06E-5	3.05E-3	0.05	0.73	0.95	0.56	8.16E-19	-0.13
Other		0.52	0.36	0.95	4.49E-04	0.90	0.01	0.93	0.00
AGE < 30									
Tracking	98	0.75	0.04		0.01				
Editing		0.33	0.32		0.38				
Mixing		0.96	0.02		0.42				
Mastering		0.04	0.01		0.12				
Producing		0.30	0.01		0.36				
Assisting		0.09	0.01		0.64				
Other		0.24	0.38		2.23E-03				

(Left vertical label: Task accomplished in the studio (TAS))

Table A2. Dunn's post-hoc test findings for one-way Kruskal-Wallis tests on aggregate microaggressions scores. δ is equal to the score for demographic category 2 minus the score for demographic category 1 – so for example, the δ value reported for CM/CW indicates the score for cisgender women minus the score for cisgender men. For Likert-scale questions, a δ of 1 indicates a difference of one point. For DRA, δ>0 indicates more often being properly credited. For microaggressions factors, δ>0 indicates more often experiencing microaggressions from that factor. For AESM, δ>0 indicates more often being an AES member. For AESD, δ>0 indicates more often being aware of the AES D&I Committee. Significant differences are in gray, non-significant differences are in white with gray text. Abbreviations: CM=cisgender man; CW=cisgender woman; TNB=trans/non binary; H=heterosexual; NH=non-heterosexual; RN=Either white, or BIPOC and not part of a racial/ethnic minority in place of work; RY=Both BIPOC and part of a racial/ethnic minority in place of work; ND=non-disabled; ID=invisible disability; VD=visible disability; MN=lives in country of birth; MY=lives in country other than country of birth; L=low/lower middle income country; H=upper middle/high income country.

	UNIT	N	GEN δ: CM/CW	GEN δ: CM/TNB	GEN δ: CW/TNB	SOR δ: H/NH	RET δ: RN/RY	DIS δ: ND/ID	DIS δ: ND/VD	DIS δ: ID/VD	MIG δ: NM/MY	GNI δ: L/H
	USD	138	-58.60	-49.40	9.20	19.24	-66.21	-61.47	71.77	133.24	3.46	45.35
	LS1		-0.68	-0.49	0.19	-0.18	-0.65	-0.91	-0.36	0.54	-0.45	0.08
AESM	N->Y	387	0.16	0.05	-0.11	-0.06	0.15	0.26	0.26	0.00	0.10	0.33
AESD	N->Y		-0.25	-0.17	0.08	-0.23	-0.19	0.50	-0.29	-0.79	0.25	0.64
SOB		283	1.14	1.23	0.08	0.50	0.34	1.14	0.52	-0.62	-0.02	-0.18
SAM		284	1.04	1.04	0.00	0.31	0.51	0.96	0.42	-0.54	0.13	-0.33
STE		281	0.82	1.01	0.18	0.17	0.20	0.79	-0.10	-0.90	0.07	-0.67
MGEN		234	2.30	1.61	-0.69	0.92	0.87	1.27	0.50	-0.77	0.03	0.17
MAGE			1.05	1.03	-0.01	0.43	0.12	1.06	0.34	-0.72	-0.02	-0.39
MSOR			0.42	1.02	0.60	0.82	0.22	0.78	0.57	-0.20	0.05	0.02
MCUL			0.16	0.58	0.42	-0.02	0.47	1.12	0.20	-0.93	0.52	-0.67
MDIS			0.61	0.76	0.15	0.37	0.38	1.57	0.95	-0.63	0.01	-0.21
MRET	LS2		0.11	0.42	0.32	0.01	0.88	0.94	0.24	-0.70	0.21	-0.72

Table A3. P-values for *f*-statistics from 2-way ANOVA of GEN/SOR for intersection analysis, color coded by effect size. Entries with background in dark gray/red indicate large effect size ($\eta^2 >= 0.1379$), entries in medium gray/orange indicate medium effect size ($\eta^2 >= 0.0588$), entries in light gray/yellow indicate small effect size ($\eta^2 >= 0.0099$). Non-significant entries are in white with gray text.

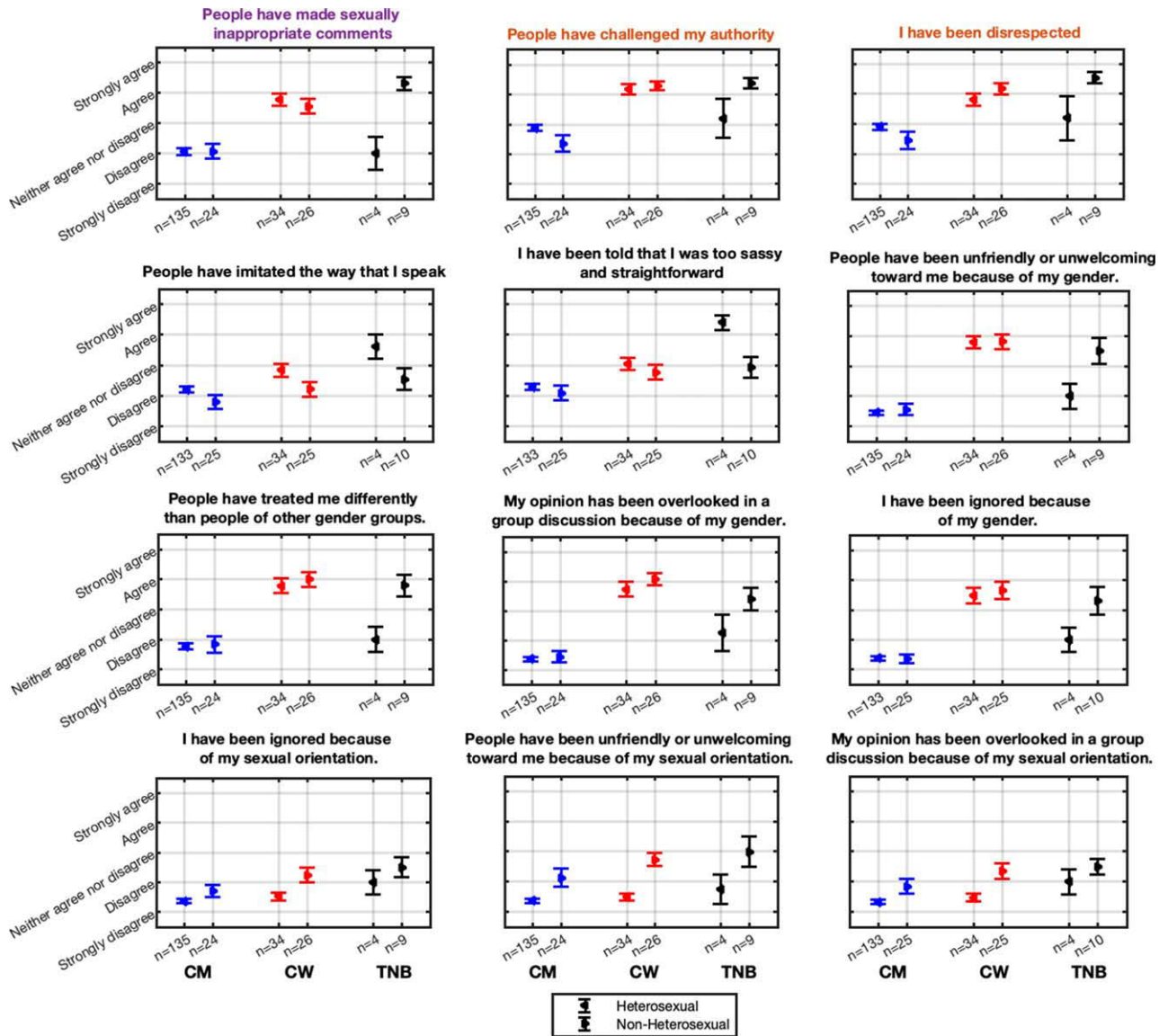|			N	GEN	SOR	GEN*SOR
						p (f)
	SOB	I have received unwanted comments about my physical appearance	282	5.11E-11	0.34	0.62
		I have received unwanted comments about my hair and/or make-up	283	7.07E-09	0.82	0.44
		I have received unwanted comments about my skin tone	283	0.09	0.54	0.91
		People have objectified me based on physical features	282	4.02E-19	0.07	0.05
		People have made me feel unattractive because of my physical appearance	283	4.79E-06	0.40	0.26
		People have made sexually inappropriate comments	281	1.36E-12	0.01	4.22E-03
		People have assumed I was sexually promiscuous	282	4.11E-06	0.97	0.75
	SAM	People have imitated the way that I speak	284	2.84E-03	9.68E-03	0.66
		People have assumed I speak a certain way	283	1.16E-03	0.15	0.65
		I have felt unheard	281	4.55E-13	0.33	0.24
		My comments have been ignored	283	5.21E-09	0.18	0.47
		People have challenged my authority	282	1.73E-14	0.30	0.03
		I have been disrespected	283	7.18E-10	0.12	0.02
		People have tried to "put me in my place"	282	5.35E-09	0.74	0.06
		I have felt excluded from networking opportunities	282	4.55E-04	0.92	0.58
		People have assumed I did not have much to contribute to the session	281	1.88E-10	0.73	0.31
		My professional expertise has been questioned	281	3.15E-11	0.70	0.32
	STE	I have been told that I was too assertive	280	2.26E-03	0.16	0.75
		I have been told that I was too emotional	278	1.38E-09	0.60	0.78
		I have been told that I was too independent	280	7.70E-04	0.21	0.79
		People have assumed that I was going to be nurturing and caring	279	3.64E-06	0.12	0.17
		I have been told that I was too sassy and straightforward	281	1.93E-05	0.02	0.23
		People have made me feel exotic	277	3.86E-07	0.32	0.85
Workplace Microaggressions	MGEN	People have been unfriendly or unwelcoming toward me because of my gender.	233	2.97E-30	0.02	0.06
		My opinion has been overlooked in a group discussion because of my gender.	234	5.83E-35	0.02	0.21
		I have been ignored because of my gender.	234	1.31E-25	0.04	0.15
		People have assumed that my work would be inferior to people of other genders.	232	1.63E-31	0.20	0.62
		People have treated me differently than people of other gender groups.	232	5.40E-18	0.02	0.09
	MAGE	People have been unfriendly or unwelcoming toward me because of my age.	232	1.26E-06	0.20	0.43
		My opinion has been overlooked in a group discussion because of my age.	233	2.11E-04	0.35	0.37
		I have been ignored because of my age.	233	0.02	0.68	0.08
		People have assumed that my work would be inferior to people of other ages.	230	2.94E-05	0.38	0.74
		People have treated me differently than people of other age groups.	232	1.27E-04	0.83	0.48
	MSOR	People have been unfriendly or unwelcoming toward me because of my sexual orientation.	232	0.02	5.96E-07	0.29
		My opinion has been overlooked in a group discussion because of my sexual orientation.	231	0.01	1.88E-03	0.43
		I have been ignored because of my sexual orientation.	233	0.01	0.01	0.50
		People have assumed that my work would be inferior to people of other sexual orientations	232	1.38E-03	0.18	0.21
		People have treated me differently than people of other sexual orientation groups.	230	0.35	3.78E-04	0.83
	MCUL	People have been unfriendly or unwelcoming toward me because of my cultural origin.	233	0.10	0.29	0.89
		My opinion has been overlooked in a group discussion because of my cultural origin.	233	0.08	0.19	0.62
		I have been ignored because of my cultural origin.	232	0.04	0.73	0.93
		People have assumed that my work would be inferior to people of other cultural origins.	231	0.33	0.48	0.93
		People have treated me differently than people of other cultural groups.	230	6.54E-03	0.30	0.66
	MDIS	People have been unfriendly or unwelcoming toward me because of my level of ability.	234	0.02	0.14	0.62
		My opinion has been overlooked in a group discussion because of my level of ability	232	9.03E-03	0.25	0.66
		I have been ignored because of my level of ability	230	0.03	0.87	0.96
		People have assumed that my work would be inferior to people of other levels of ability.	232	6.18E-03	0.83	0.68
		People have treated me differently than people of other levels of ability.	232	0.02	0.72	0.76
	MRET	People have been unfriendly or unwelcoming toward me because of my race.	232	0.48	0.09	0.82
		My opinion has been overlooked in a group discussion because of my race.	233	0.19	0.70	0.78
		I have been ignored because of my race.	233	0.09	0.36	0.77
		People have assumed that my work would be inferior to people of other races	230	0.49	0.46	0.78
		People have treated me differently than people of other race groups.	231	0.05	0.58	0.52

Fig. A1. Microaggressions with a simultaneous effect for GEN/SOR (black titles) and/or a GEN∗SOR intersection term (dark gray/purple indicates both simultaneous effect and interaction term; light gray/orange indicates only intersection term).
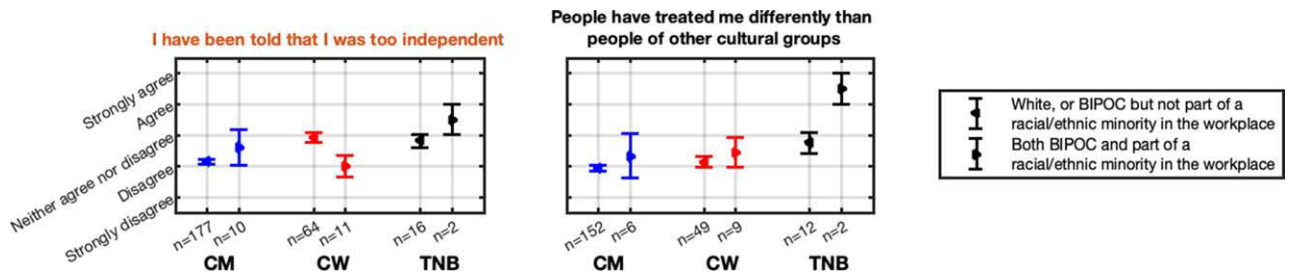

Fig. A2. Microaggressions with a simultaneous effect for GEN/RET (black title) or a GEN∗RET intersection term (light gray/orange title).
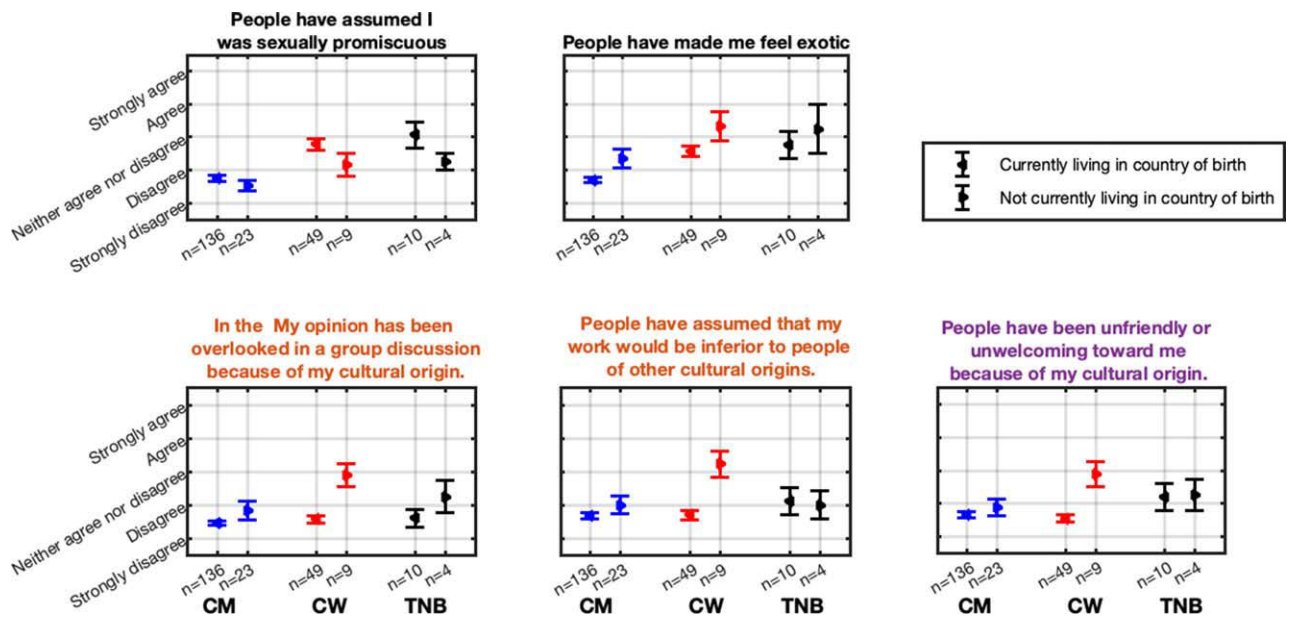
Fig. A3. Microaggressions with a simultaneous effect for GEN/MIG (black titles) and/or a GEN∗MIG intersection term (dark gray/purple indicates both simultaneous effect and interaction term; light gray/orange indicates only intersection term).
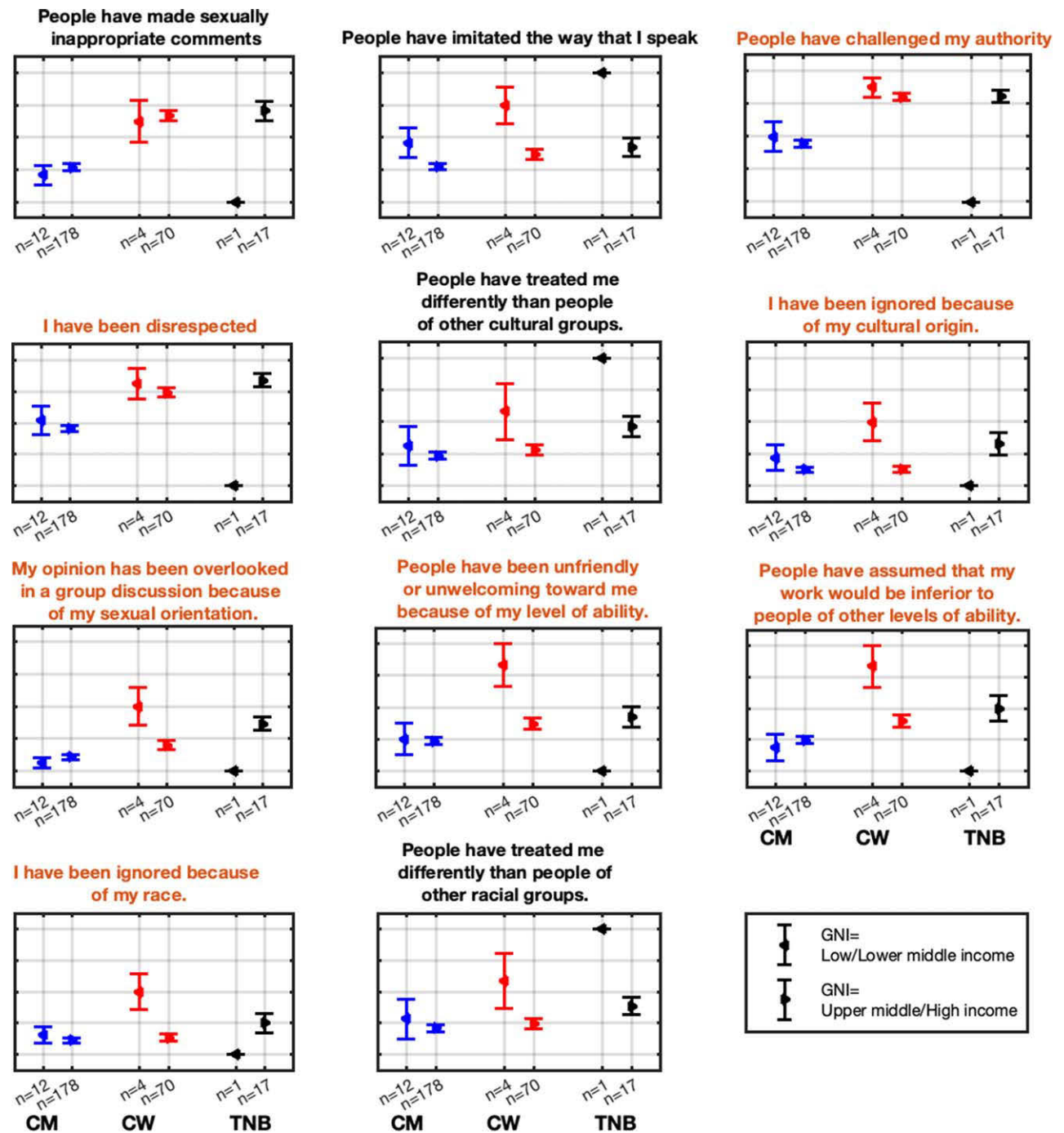
Fig. A4. Microaggressions with a simultaneous effect for GEN/GNI (black titles) or a GEN∗GNI intersection term (light gray/orange titles). No microaggression had both a simultaneous effect and an intersection term for GNI.
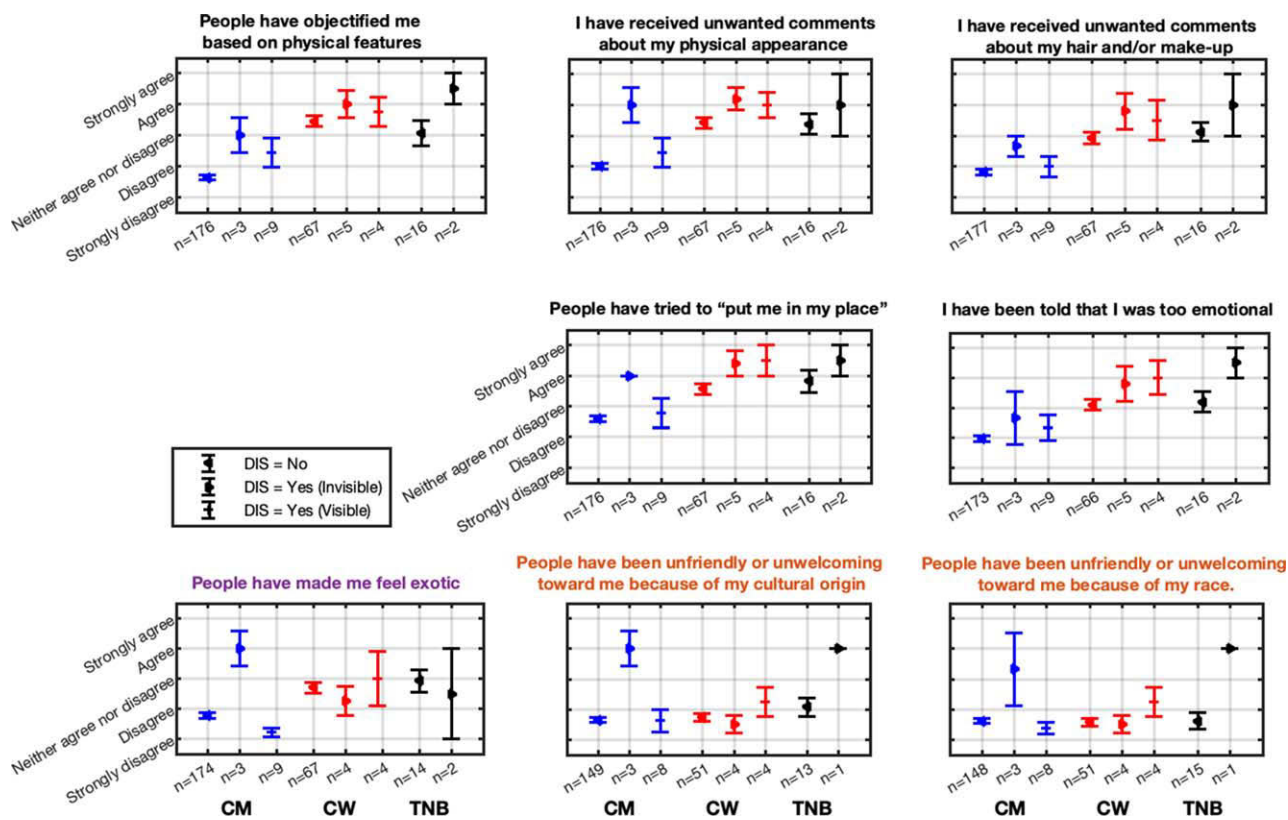
Fig. A5. Microaggressions with a simultaneous effect for GEN/DIS (black titles) and/or a GEN∗DIS intersection term (dark gray/purple indicates both simultaneous effect and interaction term; light gray/orange indicates only intersection term). Note that no trans/non-binary participants identified as having a visible disability.
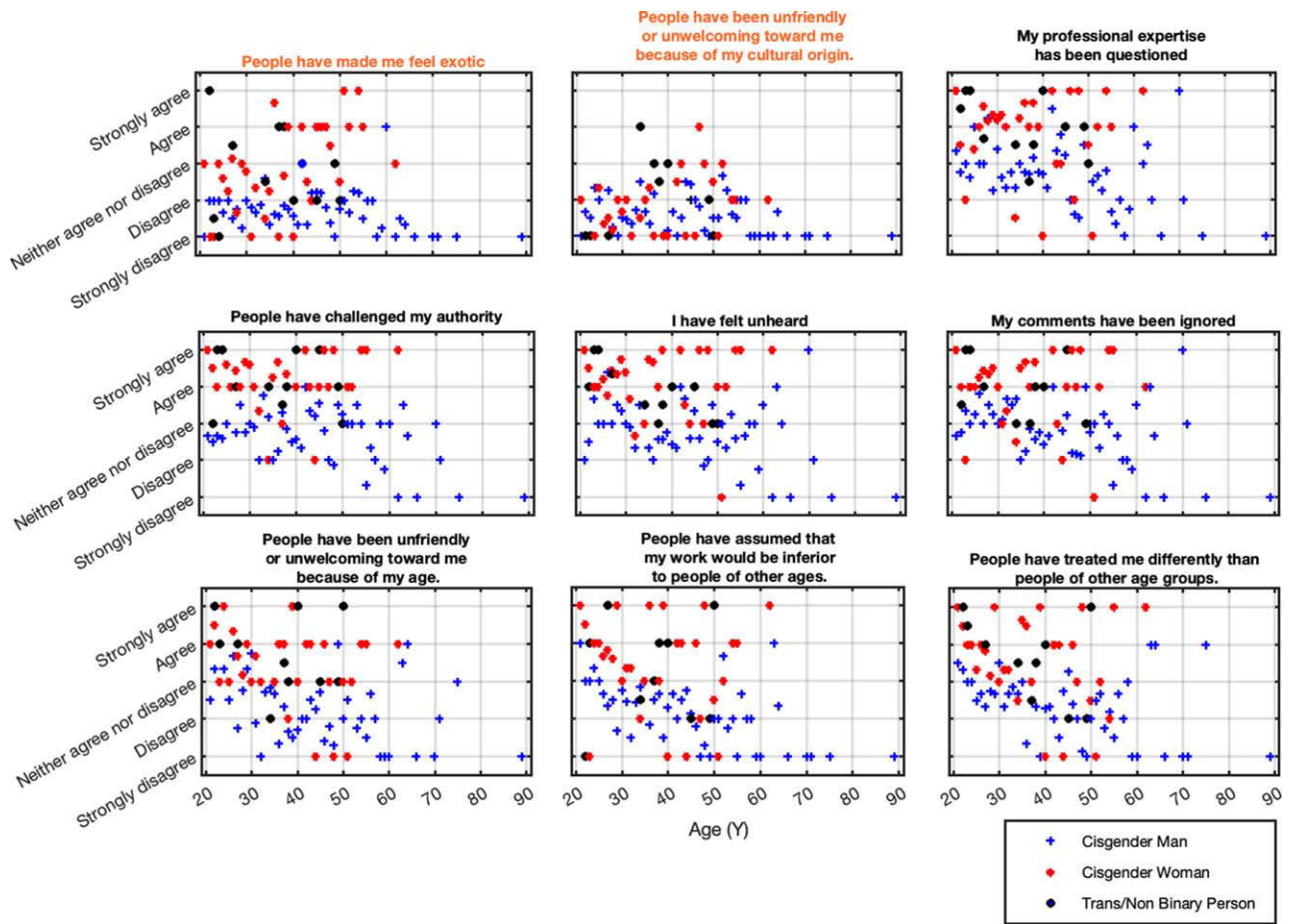
Fig. A6. Microaggressions with a simultaneous effect of GEN/AGE (black titles) or a GEN∗AGE intersection term (gray/orange titles). No microaggression had both a simultaneous effect and an intersection term for AGE. Markers represent the mean response for a given gender at a given age, e.g., at age 50, a single cross represents the mean score for cisgender men of age 50, a star for cisgender women of age 50, and a dot for trans/non-binary people of age 50.

THE AUTHORS

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Grace Brooks is an experimental musician, live sound engineer, and PhD candidate in the School of Information Studies at McGill University. They are conducting an interdisciplinary research project linking tacit knowledge and gender performativity in professional practice.

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In addition to this project about Gender in the Studio, Amandine Pras is leading The West African Audio Network funded by SSHRC, in partnership with AFRINUM directed by Emmanuelle Olivier and funded by ANR. Her research explores, from a global perspective, how the democratization of digital audio technology that disrupted large-format analog studios and the Western business model of the recording industry has generated extended music performance techniques and innovative audio practices. She completed her PhD thesis in Information Sciences at McGill on best practices for musical recording in the digital era. Since her graduation from the Paris Conservatoire and her participation in the Audio Recording Engineer Practicum at the Banff Centre, she has pursued a career as a freelance music producer and audio engineer. She has released albums with

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Monica Lockett is an undergraduate student in Sociology at the University of Lethbridge. A journalist by trade, she received a diploma in Communication Arts from Lethbridge College and has worked in northern Alberta as a radio news reporter and anchor. Her research experience and interests focus on the intersections of protest, journalism, and political duty; how journalists conceive of their professional role and identity; and analyzing qualitative experiences of microaggression and discrimination in audio recording studios.