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Publication Date

2023-05-01

DOI

10.1016/j.techsoc.2023.102245

Peer reviewed

Technology in Society 73 (2023) 102245

Contents lists available at ScienceDirect

Technology in Society

journal homepage: www.elsevier.com/locate/techsoc

The gendering of tech selves: Aspirations for computing jobs among Jewish and Arab/Palestinian adolescents in Israel

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ARTICLE INFO

Keywords:
Gender
Computing
STEM
Education
Israel

ABSTRACT

This study uses original survey data to compare aspirations for computing jobs ("tech aspirations") between students in Arabic- and Hebrew-language school sectors in Israel. Analogous to "paradoxical" patterns previously documented in cross-national studies, results show a smaller gender gap in tech aspirations in schools serving the more socioeconomically precarious Arab/Palestinian population. The strongest predictor of tech aspirations is students' personal identification with computing workers, but this "tech identity" cannot account for sectoral differences in the aspirations gender gap because it is stronger for boys than girls in both school sectors. Although mathematics affinity and academic instrumentalism are both greater in the Arabic-language school sector, these social-psychological variables also have limited power to explain sectoral differences in tech aspirations. The belief that computer science is for boys, by contrast, positively affects tech aspirations of Jewish but not Palestinian boys, suggesting that variability in the tech gender gap may partly reflect group-specific effects of gender stereotyping. Results underscore the importance of an intersectional approach for understanding the social-psychological drivers of STEM aspirations and how they vary across social groups.

1. Introduction

Men's dominance of computing and other mathematically-intensive fields is so extreme in the affluent West that it is often assumed to be natural and universal [1–4]. Recent comparative research nonetheless reveals a great deal of variation across time and space in the gender composition of these fields. The observed differences are often described as "paradoxical," because rather than increasing with socioeconomic modernization, women's representation in mathematically-intensive fields – and girls' and women's aspirations to work and study in these fields – is often stronger in less affluent, non-Western settings [5–8].

Although contextual differences in the gendering of science, technology, engineering, and mathematics (STEM) are by now clearly established, the reasons for this variability are not well understood. This is important, because access to lucrative STEM fields may increase women's ability to provide for themselves and their families and because diverse life experiences and perspectives can help improve and democratize the technologies that increasingly shape our world [2,9].

Using original survey data from five Arabic- and four Hebrew-language high schools, the present study explores contextual differences in Israeli girls' and boys' relative aspirations to work in a computing job ("tech aspirations"). We attend in particular to the context-specific operation of four social-psychological factors that are commonly invoked in the literature on educational inequalities: interest in mathematics, instrumentalist values, identification with tech workers, and beliefs about the masculine nature of computing. The Israeli state school system is a useful case for studying contextual effects on student outcomes because it combines a highly standardized national curriculum with strong sectoral differentiation. By comparing two distinct state school sectors – one serving the more affluent Jewish majority, and one serving the more socioeconomically precarious Arab/Palestinian[1] minority – we are able to reduce the unmeasured heterogeneity in the structure of educational institutions and national labor markets that often complicates cross-national comparisons.

Our results show a significantly larger gender gap in tech aspirations in the Hebrew-than the Arabic-language school sector, holding constant students' academic achievement and parental education. Across all students, the strongest predictor of tech aspirations is personal

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[1] The common signifier for this population in the Israeli public discourse is "Arab Israelis," but some Arabs/Palestinians in Israel consider this to be diminishing or patronizing, and not acknowledging of Palestinian identities. We therefore use Arab/Palestinian [10].

https://doi.org/10.1016/j.techsoc.2023.102245
Received 8 December 2022; Received in revised form 6 April 2023; Accepted 7 April 2023
Available online 8 April 2023

identification with computing workers ("tech identity"), but neither tech identity, nor mathematics affinity, nor academic instrumentalism can account for the smaller gender gap in the Arab/Palestinian than in the Jewish-serving school sector. Of the social-psychological factors considered, only the belief that computer science is for boys ("tech gender stereotyping") has any power to explain sectoral differences.

The next section provides a brief overview of previous research on contextual variability in the gendering of computing and information technology pursuits. We then describe the Israeli high school system, and discuss how comparison of its Arabic- and Hebrew-language sectors may help understand the uneven gendering of tech aspirations.

2. Gendered tech in comparative perspective

Information technology and computing (hereafter "tech") are among the best-paid and most secure career paths in the contemporary West, and they are among the most extremely gender segregated [4,9]. The highly skewed gender composition of tech occupations and degree programs in advanced industrial societies has been linked to a history of discrimination and the gender-differentiated orientations, beliefs and skillsets that have grown out of that history [11].

But tech is not equally gendered everywhere and always. We know from historical and comparative studies that computing was once considered a "feminine" pursuit [12], and that the STEM gender gap tends to be considerably smaller in less economically developed societies, including in some Muslim-majority countries [5,8,13,14]. The observed cross-national patterns, sometimes described as paradoxical [15], challenge common understandings of gender stratification as a unidimensional entity that increases uniformly as societies modernize [16]; Inglehart 2018). Patterns are more easily reconciled with multidimensional conceptualizations, and with research evidence that some forms of gender inequality increase with societal affluence while others decrease [7,17,18].

One explanation for the observed pattern of cross-national variation could be that affluent societies allow women and girls more latitude to realize (innate) preferences for non-STEM pursuits, because the risks of foregoing lucrative careers are lower in environments characterized by greater material security. This interpretation is so far not supported by available evidence, since research shows that gender gaps in *aspirations* for mathematically-related pursuits are also larger in more affluent societies [6,14,19]. This finding raises questions about reasons for contextual differences in the "aspirations gender gap," the topic of this paper.

Comparative scholars have suggested some possible social-psychological mechanisms that may drive societal variation in the gendering of STEM aspirations. One argument is that the dominance of self-expressive (over instrumental) values in affluent "postmaterialist" cultures increases the salience of gender stereotypes in the development of curricular and career affinities [14]. Assuming a reciprocal positive feedback loop between gender stereotypes and gendered outcomes [20]; [21], we would then expect both more gender stereotyping of STEM fields and more gender segregation of STEM in highly affluent societies. This expectation is supported by cross-national studies, which show stronger masculine stereotyping of mathematics and academic talent in more affluent countries, and a positive association between gender-essentialist stereotypes and the gendering of STEM aspirations and STEM outcomes at the country level [7,22];[23]. Social psychological research suggests, moreover, that strong gender segregation of science and technology sectors is likely to be self-reproducing, because people are more likely to identify with fields in which they feel a sense of belonging and cultural fit [24–26].

Original survey data collected in nine Israeli state schools allow us to explore these social-psychological mechanisms within a single national high-school system with a highly standardized common curriculum. We compare predictors of tech aspirations among students enrolled in two distinct school sectors – one serving the more affluent Jewish majority population and one serving the more economically precarious Arab/Palestinian minority population. With these multilevel data, we can measure contextual differences in the tech-aspirations gender gap holding constant student differences in parental education and academic achievement. We are thus able to distinguish processes occurring at the student-level (e.g., stronger tech aspirations among students with socioeconomically precarious family backgrounds) from processes occurring at higher levels of aggregation (e.g., stronger tech aspirations among students exposed to school cultures shaped by socioeconomic precarity).

3. The Israeli educational and societal context

Aspirations for tech jobs have not been studied extensively in Israel, but recent studies of STEM course-taking have shown patterns analogous to the "paradoxical" cross-national results, namely smaller gender gaps in high schools serving the poorer and socially marginalized Israeli-Palestinian minority [27–29]. We use survey data from four Hebrew- and five Arabic-language state schools, to interrogate, first, whether the gender gap in tech aspirations follows a similar pattern to the previously documented gender gap in course-taking, and second, what explains contextual variability in the aspirations gender gap. We focus on four social-psychological drivers of tech aspirations that are among the most commonly offered explanations for gender segregation of scientific and technical fields in the West [30]: interest in mathematics, instrumentalist career focus, identification with tech workers, and beliefs about the masculine nature of computing.

The Israeli secondary school system is a useful case for studying contextual variability in tech attitudes and aspirations because of its bifurcation into distinct state sectors that share a highly standardized national curriculum and testing regime. The state school system is highly segregated in Israel, with approximately 95% of Arab/Palestinian students attending Arabic-language high schools, which have fewer resources but follow the same curriculum as the Hebrew-language state high schools serving the secular Jewish population. Comprising about 21% of Israel's population, Israeli Palestinians are 85% Muslim, the rest Christian and Druze. Compared to Jewish majority students, Arab/Palestinian students attend more poorly funded schools and experience much higher rates of family poverty and lower levels of parental education and academic achievement (Blass 2017). Although about 5% of Arab/Palestinian students attend Hebrew-language high schools in "mixed cities," our sample does not include any of these schools. Survey respondents who attend Hebrew- and Arabic-language schools can reasonably be assumed, therefore, to identify as Jewish and Arab/Palestinian, respectively.

Israeli high school curricula are tightly regulated by the Ministry of Education. Students in all state schools take the same national matriculation examinations and follow curricula in mathematics, natural sciences and technology that are the same except in the language of instruction. Israel's high school computer science curriculum is extensive and has origins dating back to the 1980s [31]. Tenth-, eleventh- and twelfth-grade students take two or three higher-level elective subjects, one of which may be computer science – usually combined with higher-level mathematics. For those with the requisite backgrounds, computing skills may be further developed during military service, which is compulsory for young Jewish men and women, but not Arab/Palestinian citizens.

High school graduates with advanced high school specializations in technology are overrepresented in science and technology fields of study in higher education, and they enjoy the highest income levels in the Israeli labor market [32,33]. The Israeli tech sector has enjoyed remarkable growth in recent decades, mainly due to increasing foreign investment. Wages are significantly higher in tech than in other sectors of the Israeli economy (for a recent review see Ref. [34].

Against the backdrop of the Israeli-Palestinian conflict, a strong pronatalist culture constructs Jewish-Israeli motherhood as a national

mission [35,36], with middle-class Jewish women generally expected to combine intensive caretaking and large families with significant educational and occupational careers. Not surprisingly, discourse about work-family conflict – in particular, the inherent difficulties of juggling tech careers with the demands of motherhood – is pervasive in contemporary Israeli society, and tech workplaces in particular [37,38]. For Israeli-Palestinian women living in remote high-poverty communities with limited public child-care resources and few employment opportunities, combining a career with marriage and motherhood is especially difficult. A recent longitudinal study of Israeli-born women by Budig, Kraus, and Levanon indeed shows stronger motherhood penalties on employment and earnings for Muslim than Jewish women, except among the most highly educated (2023). Fertility rates are somewhat higher among Arab/Palestinian than Jewish women, and labor market participation and university attendance rates are considerably lower, although increasing recently [39–41].

In the next section, we consider how the gendering of tech aspirations may differ across Israeli schools serving Jewish and Arab/Palestinian high school students.

4. Interrogating the gender gap in tech aspirations

We pose the following research questions, first about the existence of a "tech-aspirations gender gap," and second about the underlying social psychological mechanisms.

Q1. Does the gender gap in aspirations to work in a computing jobs ("tech-aspirations gender gap") differ between Jewish and Arab/Palestinian high school students in Israel?

Previous research suggests more gender-segregated STEM course-taking in Hebrew- than Arabic-language schools, but it is unknown whether this pattern extends beyond school and into the realm of occupational aspirations. Given the relatively low labor force participation rates of Israeli-Palestinian women and the very strong male dominance of core tech jobs in Israel, it is possible that occupational aspirations are more gender segregated than course-taking in the Arabic-language school sector.

Q2. What explains variability in the tech-aspirations gender gap between Jewish and Arab/Palestinian high school students in Israel?

If the gendering of tech aspirations differs across Israeli school sectors, the next question is what accounts for these contextual differences. Drawing on research and theoretical insights from the existing literature, we interrogate four possible social-psychological mechanisms: interest in mathematics ("math affinity"), career focus ("academic instrumentalism"), identification with tech workers ("tech identity"), and beliefs about the masculine nature of computing ("tech gender stereotyping"). We are interested in the main effects of these traits on students' tech aspirations, and in how their effects vary across school contexts – for example, whether influences of math affinity or tech gender stereotyping are stronger (or weaker) in Arab/Palestinian-than Jewish-serving schools.

Math Affinity (Q2A): Can differences in affinity for mathematics account for contextual variability in the tech-aspirations gender gap? Women's underrepresentation in STEM fields is commonly attributed to natural gender differences in aptitudes and affinities. By these "gender-essentialist" accounts, men are naturally more inclined than women toward abstract analytical tasks (including mathematically-intensive STEM fields), and women are naturally more inclined toward tasks involving interpersonal relations and nurturance [42,43]. Assuming an even distribution of gendered affinities in Israel, we might expect that any natural feminine preference for non-mathematical work would be more easily realized in more affluent (Jewish) environments, where the economic risks of foregoing lucrative career paths are lower.

Academic Instrumentalism (Q2B): Can differences in academic instrumentalism account for contextual variability in the tech-aspirations gender gap? Modernization scholars have linked economic security to "post-materialist" value systems, which place weaker emphasis on existential material concerns and stronger emphasis on individual self-realization as the basis for curricular and career choice [44]. In the Israeli context, this would suggest less instrumentalist career values in schools serving the more materially secure Jewish population. Within this Hebrew-language school sector, self-expressive, non-instrumental values might be especially strong among girls, because they may be less likely than boys to imagine themselves as primary family providers and feel freer to pursue lower-paid, feminine-gendered career paths that they imagine to be more compatible with intensive mothering.

Tech Identity (Q2C): Can differences in personal identification with computing workers ("tech identity") account for contextual variability in the tech-aspirations gender gap? Social psychological studies have shown that interest in tech and related fields is greater among persons who understand themselves to belong to or anticipate "fitting" into STEM social environments and workspaces [24,25,45–47]. This sort of "self--to-prototype matching" implies weaker tech aspirations among persons whose self-concepts are most discrepant from their image of the typical Israeli tech worker [48]. We explore effects of identity congruence on tech aspirations, attending in particular to how these effects vary by gender and between Arabic- and Hebrew-language schools.

Tech gender stereotyping (Q2D): Can differences in beliefs about male gendering of computing account for contextual variability in the tech-aspirations gender gap? In affluent Western societies, computing and other mathematically-intensive fields are commonly understood to be intrinsically masculine [2,3,49,50]. Evidence is mounting that these sorts of stereotypes bias people's understandings of their own aptitudes and affinities and influence achievement and aspirations in stereotype confirming ways [51,52]; [23]; [53,54]. Research also shows that gender-STEM stereotypes vary across time and place and are stronger in the affluent West [5,7,12]. This suggests stronger masculine stereotyping of tech among Jewish than Palestinian students in Israel, which might manifest in different tech-aspirations gender gaps.

5. Data and methods

We collected original survey data from ninth-grade students (aged 14–15 years) in nine Israeli state schools during the second half of the 2020–2021 school year. Remedial and special-education students were not included. The nine state schools are nested in two sectors: four Hebrew-language (serving Jewish students) and five Arabic-language (serving Arab/Palestinian students). Within each sector we sampled schools with varying socioeconomic compositions, based on Ministry of Education metrics.[2]

Students used a personal computer or smartphone to complete surveys anonymously in class. The questionnaire was approved by the Chief Scientist Unit of the Israeli Ministry of Education, with parents and students each provided opportunities to opt out. The average school response rate was about 80%. Ninth-grade data are optimal for the present analysis, because students' aspirations are measured prior to enrollment in advanced subjects (in grades 10–12), but while enrollment decisions are being actively considered and discussed in school and at home.

We estimate a series of logistic regression models predicting students' aspirations for a tech job. Our binary dependent variable, "tech aspirations," is measured with an open-ended question asking students what type of work they hope to do at age 30. Responses were coded to

[2] We do not consider Jewish state-religious high schools, which add religious subjects to the national curriculum, or ultra-orthodox Jewish schools, which do not adhere to the national curriculum and are not, strictly speaking, state schools. These excluded schools are all single-gender. Previous research suggests that the masculine gendering of STEM subjects in religious schools is more extreme than in the state sector [38].

the International Standard Classification of Occupations, ISCO, with tech occupations (=1) defined as sub-major group 25, "Information and Communications Technology Professionals" (ISCO minor group codes 251 or 252).

To account for the tech-aspirations gender gap, we consider four social psychological variables. *Math affinity* is measured as disagreement or strong disagreement with the statement that "math is boring."[3] *Academic instrumentalism* is measured on a 2–8 scale, as sum of two survey items: "important to choose electives that will help me get a good job" (1–4, strongly disagree to strongly agree) and "important to choose electives that will help me get accepted to preferred university subjects" (1–4). *Tech identity* is measured using a dummy (0/1) variable indicating self-perceived qualities "similar" or "very similar" to those of computer programmers, and tech *gender stereotyping* is measured as agreement that "computer science is more for boys" (=1, vs. more for girls or neither = 0).

Differences between Jewish and Arab/Palestinian students in the tech-aspirations gender gap are measured with a gender-by-school sector interaction term. All models also include the main effect of student gender and fixed school effects to control for unmeasured differences across schools, including within-sector differences in school affluence.[4] Also included are controls for parental SES (coded 1 if at least one parent completed a university degree) and mathematics and English grades (each coded 1 for students who reported grades of 91–100 on their last report cards – the approximate equivalent of an A or A-grade in the United States).[5] We control for English grades based on the argument that a competitive advantage in verbal ability (rather than a disadvantage in mathematics ability) may draw girls and women away from STEM fields [55]. Since the language of instruction differs across sectors, we measure verbal skills based on achievement in English, a required subject in both sectors.

Differences between Arab/Palestinian and Jewish adolescents in the tech-aspirations gender gap might be explained by sectoral differences in the *prevalence* of social psychological orientations, or by sectoral differences in *how these orientations relate* to tech aspirations. The first would be captured by simple additive effects on tech aspirations; the second would be captured by interaction effects. For example: An "additive" relationship with tech identity might be observed if differences in the size of the tech-identity gender gap between Palestinian and Jewish students produced corresponding Palestinian-Jewish differences in the tech-aspirations gender gap (through uniformly positive effects of identity on aspirations). An "interactive" relationship between tech identity and tech job aspirations might be observed if tech identity were more relevant to tech aspirations in more affluent, self-expressive Hebrew-language school contexts. Equal gender gaps in tech identity in Hebrew- and Arabic-language schools might then produce unequal gender gaps in aspirations. Additive and interactive relationships are explored through a series of nested and non-nested models.

6. Results

Table 1 shows student mean scores broken down by gender and school sector. The first column shows that approximately 15% of sampled high school students report aspirations to work in a tech job at age 30. Values vary strongly by gender, with boys more likely than girls to report these aspirations in both sectors. Gender differences are considerably larger among Jewish than Arab/Palestinian students, as has been found for STEM course-taking [56]; [28,29]. Interestingly, we find no difference across sectors in the share of girls with tech aspirations (6%), while boys are much less likely to report tech aspirations if they attend an Arabic-language school (18% vs. 36%). Our multivariate analyses interrogate these group differences.

Table 2 presents a first series of regression models. The positive gender-by-sector interaction coefficient in model 1 confirms what we saw in Table 1 – that the tech-aspirations gender gap is significantly larger among Jewish students. This coefficient shows that the boy-to-girl odds of tech aspirations are nearly three times higher in Hebrew-than Arabic-language schools (exp.1.08 = 2.94), even after controlling for parental education and student grades. This result is consistent with previous cross-national research suggesting stronger gendering of mathematically-intensive fields in societies characterized by broad-based material security.

Parental education shows no significant association with tech aspirations. This null effect may reflect countervailing class effects, with girls from less privileged family backgrounds more likely to aspire to financially secure careers but also more likely to be exposed to gender stereotypes at home [57]; see also [58]. Although previous research has shown that national mathematics test scores are strong predictors of STEM course-taking in Israel [29], we find no effect of self-reported mathematics grades. This may be because mathematic proficiency

Table 1
Means by school sector and gender.

		Hebrew-language Schools (358 students, 4 schools)			Arabic-language Schools (554 students, 5 schools)		
	Total	Boys	Girls	All	Boys	Girls	All
Tech Job Aspirations (=1)	0.15	0.36	0.06	**0.21**	0.18	0.06	**0.11**
Affinity for Math (=1)	0.65	0.53	0.49	**0.51**	0.76	0.74	**0.75**
Academic Instrumentalism (2–8)	6.98	6.68	6.76	**6.72**	7.07	7.19	**7.14**
Tech Identity (=1)	0.39	0.59	0.19	0.39	0.58	0.27	0.40
Tech gender stereotyping (=1)	0.30	0.45	0.33	**0.39**	0.21	0.28	**0.25**
High Mathematics Grade (=1)	0.33	0.25	0.28	**0.26**	0.40	0.35	**0.37**
High English Grade (=1)	0.37	0.46	0.42	**0.44**	0.34	0.31	**0.32**
Parent with University Degree (=1)	0.69	0.81	0.79	**0.80**	0.68	0.57	**0.61**
Girl (=1)	0.56	0	1	0.52	0	1	0.59
Arabic-language school sector (=1)	0.61	0	0	0	1	1	1

N = 912 students with listwise deletion of missing values. Bolded values indicate statistically significant mean differences between Arabic- and Jewish-language school sectors ($p < 0.001$).

[3] We use a single indicator to measure math affinity ("liking math"), because this concept is well-captured by students' assessment of its "boringness." Previous research has shown that the predictive validity of multiple- and single-item psychological measures do not differ much for unidimensional constructs with relatively narrow meanings [71]. Sensitivity tests confirm this for the present study. Our survey includes one item that is closely-related to the "math is boring" item: "we learn interesting things in math" (coded on the same 1–4 scale). Conclusions from Tables 2 and 3 are unchanged when our original math affinity dummy is replaced with an index that combines "math is interesting" scores with (reverse-coded) "math is boring" scores (Cronbach's alpha = .77).

[4] Models were estimated using Stata's LOGIT command with eight dummy variables to distinguish the nine schools (N = 912 students after listwise deletion of cases with missing values). Main effects for sector were omitted because they are collinear with the fixed school effects. Very similar results were obtained in mixed-effects models (MELOGIT) with random school effects.

[5] Conclusions are unchanged in models with mathematics and English grades measured on 1–5 quintile scales.

Table 2
Models predicting Israeli adolescents' aspirations for tech jobs, 2021-22.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Girl (=1)	−1.20*** (0.30)	−1.19*** (0.30)	−1.23*** (0.30)	−0.59 (0.32)	−1.21*** (0.30)	−0.63 (0.32)
Girl × Arabic School Sector	1.08* (0.47)	1.08* (0.47)	1.08* (0.47)	1.15* (0.50)	1.06* (0.47)	1.11* (0.51)
High Math Grade (=1)	0.30 (0.23)	0.28 (0.24)	0.23 (0.24)	0.08 (0.25)	0.30 (0.23)	0.09 (0.26)
High English Grade (=1)	0.55* (0.23)	0.55* (0.23)	0.52* (0.23)	0.44 (0.24)	0.56* (0.23)	0.44 (0.24)
University Parent (=1)	−0.11 (0.24)	−0.11 (0.24)	−0.14 (0.24)	−0.01 (0.26)	−0.11 (0.24)	−0.01 (0.26)
Affinity for Math (=1)		0.08 (0.23)				−0.20 (0.25)
Instrumentalism (2–8)			0.18* (0.08)			0.08 (0.09)
Tech Identity (=1)				2.22*** (0.27)		2.21*** (0.28)
Gender Tech Stereotyping (=1)					0.13 (0.23)	0.19 (0.25)
Fixed School Effects	YES	YES	YES	YES	YES	YES
Pseudo r^2	0.17	0.17	0.17	0.28	0.17	0.28

Note: Values are multiplicative coefficients (standard errors) from logistic regression models. Data are from classroom surveys of ninth-grade students; N = 912 students in 9 schools with listwise deletion of cases with missing values. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

affects aspirations differently than course-taking, or because grades are not strongly correlated with nationally standardized test scores.[6] Students reporting high English grades are somewhat more likely to aspire to tech careers. Supplementary analyses showed no interactions of parental education or grades with gender or school sector, and results are unchanged with controls for number of books at home and number of siblings.

The remaining models in Table 2 explore the explanatory power of math affinity, academic instrumentalism, tech identity, and tech gender stereotyping, first individually (models 2–5) and then combined (model 6).

Contrary to the idea that women's underrepresentation in STEM can be attributed to gender differences in affinity for mathematics, this variable shows no significant effect in model 2, and its inclusion does not change the gender-by-sector coefficient – meaning that it cannot account for sectoral differences in the gender gap. This result is not surprising given descriptive results in Table 1: Although Arab/Palestinian students are significantly more likely to report affinity for mathematics, the gender gap in math affinity is small in both sectors.

In model 3, we find that academic instrumentalism – agreement that electives should be chosen to maximize future job and university prospects – is positively related to aspirations for tech jobs. But the gender-by sector coefficient again remains unchanged, and the effect of instrumentalist values on tech aspirations is eliminated in the full model (6). Although Table 1 indicates significantly more instrumentalist views among students in the less affluent Arabic-language school sector, as suggested by postmaterialist theory [44] and previous research in Israel [59], both sectors show small gender gaps in instrumentalism.

Consistent with research showing the crucial importance of cultural "fit" [24,46], identification with tech workers is the strongest overall predictor of tech aspirations, based on model fit statistics. Model 4 shows that students who reported being similar or very similar to computer programmers were more than nine times more likely to aspire to a tech job (exp. 2.22 = 9.21). The robustness of this relationship is confirmed in model 6, which includes all social-psychological variables simultaneously. Inclusion of the tech identity variable causes attenuation of the aspirations gender gap, due to stronger tech identities among boys than girls in both sectors (Table 1), but sectoral differences in gendered aspirations remain significant.

The final social psychological variable, tech gender stereotyping, shows no significant association with tech aspirations in model 5. Students who affirm that computer science is "more for boys" are not significantly more or less likely to aspire to a future tech job. As we will see, however, the predictive power of tech stereotyping increases when its effect is allowed to vary interactively by gender and sector. It is notable, moreover, that tech gender stereotyping is significantly stronger in the more affluent Hebrew-language school sector (Table 1), reminiscent of the positive country-level relationship between societal affluence and gender math stereotypes documented by Ref. [7].

In Table 3, we add interaction terms to allow effects of the four social psychological variables to vary by gender and school sector. Each column of Table 3 shows main and interaction terms for one of the four predictors.[7] The final column shows a significant three-way interaction of tech gender stereotyping with school sector and student gender. This implies that masculine stereotyping of tech has sector-specific effects on the aspirations gender gap, increasing its size in the Jewish sector and decreasing its size in the Arab/Palestinian sector.

This interactive relationship is graphed in Fig. 1, which shows a much larger tech-aspirations gender gap in Hebrew-than Arabic-language schools in general, but an intensification of this sectoral difference among those who affirm that computer science is more for boys. Interestingly, Arab/Palestinian boys are not more likely to aspire to tech

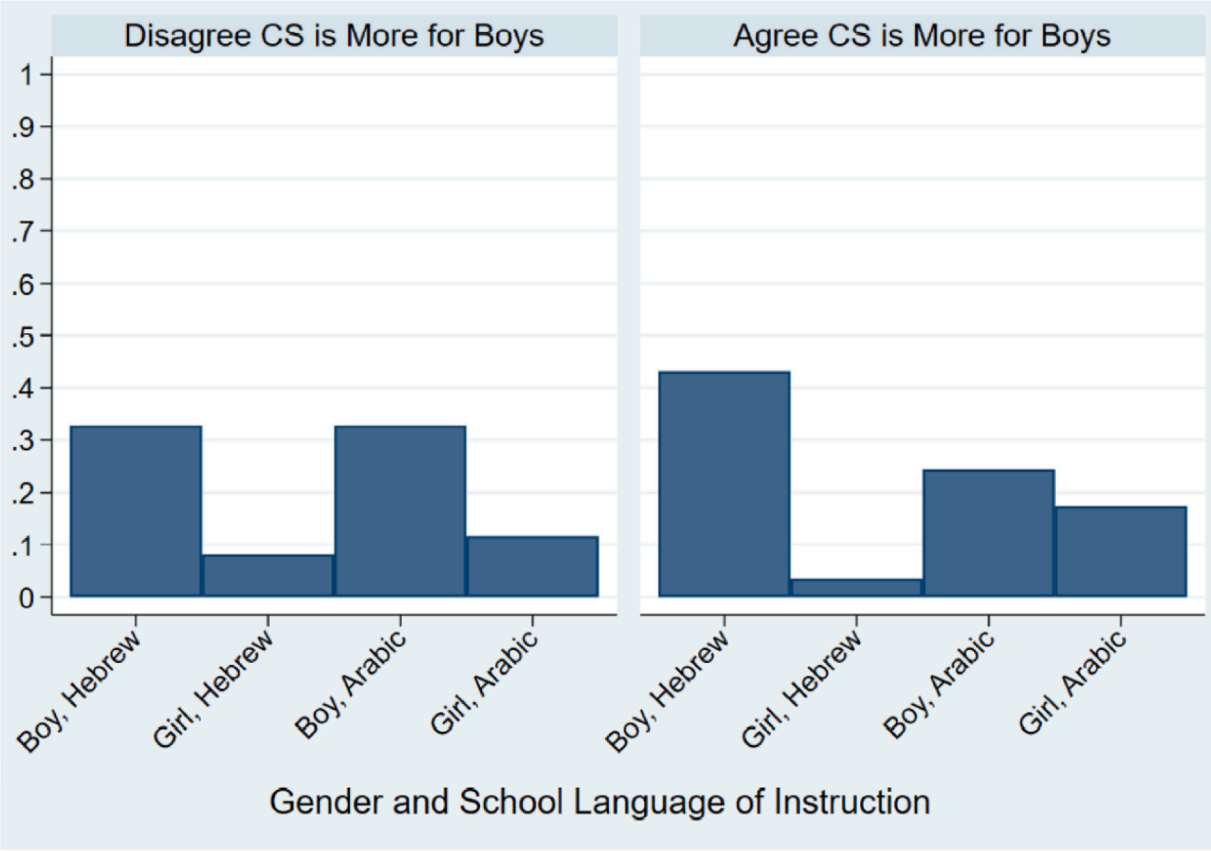
Table 3
Models predicting Israeli adolescents' aspirations for tech jobs in 2021–22, with 3-way interactions.

Explanatory Variable (X)	X = Math Affinity	X = Academic Instrumentalism	X = Tech Identity	X = Gender Tech Stereotyping
Girl (=1)	−1.93** (0.59)	−1.16*** (0.30)	0.76 (1.09)	−1.39*** (0.34)
Arabic School Sector × Girl	1.20 (0.96)	1.64* (0.66)	2.82* (1.29)	0.42 (0.54)
X	0.44 (0.97)	0.24* (0.12)	3.97** (1.32)	−1.86 (1.02)
X × Arabic Sector	−0.99 (0.54)	−0.19 (0.20)	1.62 (1.11)	−0.94 (0.63)
X × Girl	1.21 (0.87)	0.76 (0.57)	0.45 (0.83)	−1.41 (0.87)
X × Arabic Sector × Girl	−0.26 (1.11)	−0.96 (0.62)	−1.96 (1.42)	2.35* (1.14)
Fixed School Effects	YES	YES	YES	YES
Student-level Controls	YES	YES	YES	YES
Pseudo r^2	0.18	0.18	0.29	0.18

Note: Values are selected multiplicative coefficients (standard errors) from logistic regression models. Controls include parental education and student grades, as well as fixed school effects. The complete set of coefficients is shown in Appendix table A1. Data are from classroom surveys of ninth-grade students; N = 912 students in 9 schools. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

[6] Students in Arabic-language schools score lower on standardized mathematics tests [72], but they report higher mathematics grades on the present survey. This may be attributable to some combination of grade inflation and more positive attitudes toward mathematics in the Arabic-language schools (Table 1).

[7] The full models are shown in appendix table A1.



Note: Values are predicted probabilities computed from the final model of Table 3. N=912 (635 disagreeing, 277 agreeing that computer science is more for boys).

Fig. 1. Probability of Aspiring to a Tech Job, by Gender Stereotyping of Computer Science (CS)

careers if they believe in the masculinity of tech. It could be that masculinity in this case means *Jewish masculinity*, due to cultural associations of computer science with Jewish-Israeli military service, and the strong overrepresentation of Jewish men in the tech industry [60,61].

The non-significance of the other interactions in Table 3 imply that relationships of math affinity, academic instrumentalism, and tech identity with tech aspirations are more generic – i.e., they do not vary by gender or by school sector. A partial exception may be math affinity, which shows a near-significant interaction with school sector, suggesting that affinity for mathematics may better predict math aspirations among Jewish students than among Arab/Palestinian students ($p < 0.10$). A slight boy advantage in math affinity might therefore be more likely to produce a gender gap in tech aspirations in the (more post-materialist) Jewish society. This would be consistent with arguments about the greater salience of self-expressive values ("doing what you love") in cultural contexts shaped by broad-based material security [44].

7. Conclusion

The main purpose of this study is to interrogate the social-psychological drivers of contextual variability in the gendering of tech fields. Building on cross-national analyses that have compared countries with different levels of gender liberalism [15] and differently gendered STEM orientations [22], we use original survey data to compare the gendering of STEM aspirations across ethno-religiously distinct school sectors within a single national educational system. We are thereby able to hold constant differences across countries and educational systems that often confound cross-national studies.

Results show that the gender gap in Israeli ninth-graders' aspirations for jobs in computing and information technology ("tech") is considerably larger in high schools serving the Jewish majority than in those serving the Arab/Palestinian minority. This finding evokes parallels with cross-national analyses showing smaller STEM gender gaps in less affluent societies [6,8] and within-country studies showing smaller STEM gender gaps in colleges with smaller percentages of white students in the United States [62].

Not surprisingly, the strongest overall predictor of Israeli adolescents' aspirations for a career in computing is identification with tech workers ("tech identity"). Students who reported feeling similar to computer programmers were more than nine times more likely to report aspiring to a tech job than students who did not. Although causation undoubtedly runs in both directions, this strong association supports arguments that a sense of belonging, or "fitting in," is crucial to recruitment and retention of women and other underrepresented groups in STEM fields [24,45,46,63].

Variation in tech identity cannot explain contextual differences in the STEM gender gap, however. This is because girls in both Arab/Palestinian and Jewish school sectors are less likely than boys to identify with tech workers, and because effects of tech identity on aspirations do not vary by gender or sector. Affinity for mathematics and academic instrumentalism are also unable to account for contextual differences in the tech-aspirations gender gap, although both traits are stronger among Palestinian than Jewish students.

Tech gender stereotyping is the only social-psychological indicator with some power to explain the observed cross-sectoral variability. Although the belief that computer science is "for boys" shows no

significant association with students' tech aspirations *overall,* it does have *group-specific* effects that emerge when the relationship is allowed to vary interactively with gender and school sector. Specifically, we find that believing in the masculine nature of computer science increases tech aspirations of Jewish but not Arab/Palestinian boys. This relationship requires further investigation. As suggested above, it may be attributable to the cultural association of computer science with Jewish military service and the better tech career opportunities open to Jewish men. More generally, we would suggest that the male-labeling of Israeli tech fields reflects a hegemonic masculinity that is specifically *Jewish* and therefore less personally salient to Arab/Palestinian students. This underscores the importance of an intersectional approach for understanding the social-psychological drivers of STEM aspirations, and the multiple masculinities (and femininities) that may shape the gendering of occupational fields across contexts [64,65].

Results support arguments that exposure to different sociocultural environments during the formative adolescent years is likely to influence high school students' career aspirations. The different gendering of student aspirations and course-taking that results from different school exposures constitutes the school environment that shapes attitudes, aspirations, and abilities of subsequent student cohorts. In other words, the social psychological variables considered here constitute both inputs and outcomes in school-to-student feedback loops that produce distinct institutional gender regimes. Of course, Jewish and Palestinian students bring to school many preexisting beliefs about gender and about tech, and they face very different constraints and opportunity structures in Israeli society. Future research, including in-depth interviews and participant observation, should explore the interplay of tech gender cultures in schools, families, and the broader Jewish and Arab/Palestinian communities. Contextual variability in the linkage between career aspirations and career outcomes warrants further research as well. While previous U.S.-based research indicates that aspirations are generally highly predictive of occupational outcomes [66], the strength of this relationship likely varies across social groups with different access to public child-care resources, and different opportunities for higher education and professional employment

The uneven gendering of STEM fields revealed here and elsewhere suggests that variability in gender segregation is more complex and multifaceted than is typically represented by unidimensional modernization accounts. While it is by now well established that women's representation in tech does not increase with economic development, more research is needed to isolate the macro-level forces driving contextual variability in this and other forms of gender inequality. Previous comparative research on the STEM gender gap suggests possible causal effects of socioeconomic precarity (versus material security), individualist (versus collectivist) cultural values, and institutional differences in school tracking policies [67]; [27,54].

Understanding the sociocultural factors that reduce STEM access of women and other historically marginalized populations is not only important for advancing basic social justice and equity. Research shows that diversifying scientific and technical fields can promote national prosperity, productivity, innovation, and the development of more broadly accessible and democratic technology [68]; [69,70].

Author statement

Authors are listed alphabetically.

Data availability

The data used are available on request from the authors, pending permission from the Israeli Ministry of Education.

Acknowledgments

We thank Gila Manevich Malul, Dalal Assadi, Nusiba Abo Riash, and Carmel Blank for important contributions to data collection and data preparation and to the broader comparative project. This work was supported by the Binational Science Foundation (BSF grant #2018156).
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Appendix

Table A1
Models Predicting Israeli Adolescents' Aspirations for Tech Jobs in 2021–22, with 3-way Interactions

	1	2	3	4
Girl (=1)	−1.928** (0.588)	−1.157*** (0.300)	0.755 (1.091)	−1.394*** (0.339)
Girl × Arabic School Sector	1.197 (0.964)	1.643* (0.656)	2.815* (1.287)	0.415 (0.544)
Math Affinity (=1)	0.444 (0.968)			
Math Affinity × Arabic Sector	−0.992 (0.535)			
Math Affinity × Girl	1.210 (0.870)			
Math Affinity × Arabic Sector × Girl	−0.255 (1.107)			
Instrumentalism (2–8)		0.242* (0.119)		
Instrumentalism × Arabic Sector		−0.191 (0.200)		
Instrumentalism × Girl		0.761 (0.566)		
Instrumentalism × Arabic Sector × Girl		−0.963 (0.618)		
Tech Identity (=1)			3.974** (1.320)	
Tech Identity × Arabic Sector			1.616 (1.105)	
Tech Identity × Girl			0.451 (0.827)	
Tech Identity × Arabic Sector × Girl			−1.958 (1.415)	
Tech Stereotyping (=1)				−1.861 (1.018)
Tech Stereotyping × Arabic Sector				−0.940 (0.625)
Tech Stereotyping × Girl				−1.407 (0.871)
Tech Stereotyping × Arabic Sector × Girl				2.354* (1.141)
High Math Grade (=1)	0.277 (0.239)	0.244 (0.236)	0.0951 (0.251)	0.289 (0.234)
High English Grade (=1)	0.560* (0.227)	0.498* (0.229)	0.431 (0.241)	0.583* (0.227)
University Parent (=1)	−0.105 (0.243)	−0.129 (0.242)	−0.0200 (0.258)	−0.119 (0.240)
School Fixed Effects (ref = Arabic1)				
Arabic2	−2.061** (0.687)	−1.819** (0.663)	−1.470* (0.692)	−1.794** (0.669)
Arabic3	−0.445 (0.435)	−0.333 (0.426)	−0.356 (0.458)	−0.349 (0.427)
Arabic4	−0.942* (0.395)	−0.963* (0.394)	−0.978* (0.421)	−0.956* (0.403)
Arabic5	−0.947* (0.425)	−0.958* (0.424)	−0.830 (0.453)	−0.995* (0.433)
Hebrew1	0.0149 (0.551)	0.806* (0.405)	2.369* (1.122)	0.479 (0.436)

(*continued on next page*)

Table A1 (*continued*)

	1	2	3	4
Hebrew2	−0.280 (0.602)	0.458 (0.473)	2.132 (1.147)	0.118 (0.505)
Hebrew3	−1.848* (0.728)	−1.082 (0.633)	0.475 (1.238)	−1.404* (0.649)
Hebrew4	−0.780 (0.569)	0.0142 (0.434)	1.659 (1.135)	−0.389 (0.470)
Constan	−0.430 (0.488)	−0.988** (0.382)	−3.910*** (1.070)	−0.964* (0.389)
Pseudo R^2	0.18	0.18	0.29	0.18

Note: Values are multiplicative coefficients (standard errors) from logistic regression models. Data are from classroom surveys of ninth-grade students; N = 912 students in 9 schools with listwise deletion of cases with missing values. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

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