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The Gender-Equality Paradox in Chess Participation Is Partially Explained by the Generational-Shift Account but Fully Inconsistent With Existing Alternative Accounts: A Partial Concession and Reply to Napp and Breda (2023)

Allon Vishkin
Technion–Israel Institute of Technology

Abstract

Napp and Breda (2023) raised three arguments against the generational-shift account of the gender-equality paradox (GEP) in chess participation. First, using finer operationalizations of the age structure of players, they showed that it partially but not fully accounts for the GEP in chess participation. I find merit in these analyses and conclusion. Second, they argued that the country-level age structure is unrelated to the GEP in chess participation, which undermines the generational-shift account of the GEP. In contrast, I provide new analyses to show that the two are related after adjusting for the U-shaped relation between gender equality and female chess participation. Finally, they argued that previous explanations of the GEP are viable for explaining the GEP in chess participation. In contrast, I argue that the global increase in the proportion of female players is incompatible with previous explanations of the GEP, and I provide new analyses to support this.

Keywords

chess, cross-cultural differences, gender equality, open materials

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Napp and Breda (2023) concur that there is a gender-equality paradox (GEP) in chess participation but argue that evidence for the proposed mechanism, that the paradox is driven by the smaller presence of a younger generation in more gender-equal countries (the generational-shift account), is limited. First, they used fine-grained analyses of the age structure of players to demonstrate that the age of players partially accounts for the association between gender equality and female participation, qualifying Vishkin's (2022) finding of full mediation. Second, they argued that the country-level age structure is unrelated to the GEP in chess participation. Third, they argued that previous explanations of the GEP can account for the GEP in chess participation. I concede their first point, but new analyses described below lead me to disagree with their latter two points.

Reanalysis 1: Country-Level Age Structure

In my generational-shift account, I argued that the GEP may be driven by the larger presence of a younger generation in countries lower in gender equality and proceeded to show that the relation between gender equality and female participation in chess is accounted for by the *mean age of chess players*. One argument that Napp and Breda presented against this account is that the *country-level age structure*, such as the median age of each country, does not explain the association

Corresponding Author:
Allon Vishkin, Technion–Israel Institute of Technology, Faculty of Data and Decision Sciences
Email: allonv@technion.ac.il

between gender equality and female chess participation. However, Vishkin (2022) established that there is both a linear and a U-shaped quadratic relation between gender equality and female participation in chess, and the latter is composed of both a significant positive trend and a significant negative trend. Previous work has shown that different mechanisms are likely to underlie the positive trend and the negative trend of a U-shaped quadratic relation, such as in the association between arousal and performance (Hebb, 1955). Similarly, I explicitly suggested that a different mechanism for each trend might be associated with the mean age of players (Vishkin, 2022, p. 283): The negative trend between gender equality and female chess participation (comprising the GEP) might be driven by the aforementioned mechanism of an older population in more gender-equal countries, whereas the positive trend might be driven by the presence of patriarchal institutions that restrict the activities of young women. Thus, the country-level age structure should account for the association between gender equality and female chess participation only where the GEP is evident. Specifically, for the trend where the GEP is evident, I expected the country-level age structure to be correlated with both the predictor (gender equality) and the outcome (proportion of female players). I further expected that, particularly in this trend, the mean age of players would be correlated with the country-level age structure, which would show that it was an appropriate proximal measure of the country-level age structure, as employed in Vishkin (2022). Below, I test these predictions by distinguishing between the two trends.

Open practices statement

As reported in Vishkin (2022), data on chess players were accessed on December 16, 2020, from the World Chess Federation website (https://ratings.fide.com/download.phtml). Analysis code for this study has been made publicly available via the Open Science Framework and can be accessed at https://osf.io/gct5d/. This article has received the badge for Open Materials. More information about the Open Practices badges can be found at http://www.psychologicalscience.org/publications/badges. The design and analysis plans for the study were not preregistered.

Method

Data set. I used the same data set as Vishkin (2022). To render the results and discussion comparable with the results and discussion in the Napp and Breda study, I selected, as they did, only the 91 countries with at least 1,000 players.

Statement of Relevance

Gender differences are frequently larger in countries with greater political and economic gender equality. The findings comprising this gender-equality paradox (GEP) are a cause for concern among educators and policymakers. A previous article (Vishkin, 2022) and an insightful commentary on it (Napp & Breda, 2023) agree that there is a GEP in chess participation, but they disagree regarding its underlying cause. I argued for a novel generational-shift account, according to which the GEP in chess is driven by the larger proportion of younger people in less gender-equal countries. Napp and Breda presented three arguments against this account. I concede their first point and provide new evidence inconsistent with their other points. I conclude that the GEP in chess participation is partially explained by the generational-shift account but is still entirely inconsistent with previous accounts of the GEP.

Measures.

Gender equality. I used the same two measures of gender equality as in the Vishkin (2022) study: the Global Gender Gap Index (GGGI; World Economic Forum, 2019) and the Gender Inequality Index (GII; United Nations Development Programme, 2020).

Country-level age structure. Following Napp and Breda, I retrieved the median age in each country from the Central Intelligence Agency World Factbook (retrieved November 6, 2022). I was unable to locate a statistic for the percentage of the population younger than 20 years, which Napp and Breda used. In addition, I retrieved two variables explicitly mentioned by Vishkin (2022) in reference to the age structure variables potentially underlying a greater generational shift in some countries more than in others: birth rates and life expectancy.

Results

I distinguished between countries that were part of the positive trend between gender equality and female participation and countries that were part of the negative trend between gender equality and female participation, on the basis of the inflection points in Figure A1c (based on the GGGI) and Figure A1d (based on the GII) in the Supplemental Material of the work by Vishkin (2022). These figures implemented Simonsohn's (2018) two-line test to evaluate significant sign changes

in U-shaped relationships and divide the data points according to the two trends. Then, I tested the extent to which the age structure in each country was associated with the mean age of players, gender equality, and proportion of female chess players for each of these two groups. Among those countries that are part of the negative trend between gender equality and female participation (where the GEP occurs), I expected an older age structure (higher median country age, lower birth rate, and higher life expectancy) to predict an older mean age of players, higher gender equality, and lower proportion of female players. Furthermore, I expected this pattern to emerge in contradistinction to the pattern among countries that are part of the positive trend between gender equality and female participation (where the GEP reverses). Results for each prediction across six correlations (across two inflection points and three different measures of country-level age structure) confirmed the three predictions (see Table 1, with findings confirming the hypotheses marked in bold). Specifically, for those countries that are part of the trend reflecting a GEP in chess participation, an older country-level age structure was associated with a higher mean age of players in five of six correlations (and one nonsignificant), and no such pattern emerged among countries that are part of the reverse trend. Furthermore, for those countries that are part of the trend reflecting a GEP in chess participation, an older country-level age structure was associated with greater gender equality in five of six correlations (and one nonsignificant)—although a similar trend emerged among countries that are part of the reverse trend. Finally, for those countries that are part of the trend reflecting a GEP in chess participation, an older country-level age structure was associated with a lower proportion of female players in four of six correlations (and two nonsignificant), and five of these six correlations differed from the direction and magnitude of this association relative to those countries that are part of the reverse trend. Overall, these findings are consistent with the predictions that country-level age structure is associated with mean age of players, gender equality, and proportion of female players after the quadratic effect of gender equality on female chess participation is accounted for.

Discussion

Different mechanisms underlie positive versus negative trends in U-shaped relations. The lack of an association between countries' age structure and the GEP in chess participation in the findings by Napp and Breda is due to not distinguishing between the positive and negative trends in the U-shaped relation between gender equality and female chess participation. When this distinction was made, which was suggested by Vishkin (2022), country-level age structure was associated with the mediator used by Vishkin to test the generational-shift account (mean age of chess players), gender equality, and female participation among those countries demonstrating a GEP. These findings redress a critique raised by Napp and Breda regarding the generational-shift account of the GEP in chess participation.

Reanalysis 2: Can Alternative Accounts Explain the GEP in Chess Participation?

Vishkin (2022) argued that previous explanations of the GEP are inconsistent with the GEP in chess participation, and therefore, findings must be due to a novel mechanism. Accounts that the GEP results from social construction (e.g., preserving gender distinctiveness by using gender stereotypes more; Breda et al., 2020; Charles & Bradley, 2002, 2009; Vishkin et al., 2022) or that the GEP results from the greater expression of innate gender preferences in more gender-equal countries (e.g., Schwartz & Rubel-Lifschitz, 2009) both predict that as countries become more gender equal over time,[1] the proportion of women in male-dominated fields should decrease (see Vishkin, 2022, p. 278). Contrary to this expectation, the proportion of female chess players in younger age cohorts was higher in 89 of 91 countries, which I interpreted as indicative of increased female participation in chess over time.

Napp and Breda argued that results may be fully consistent with previous accounts of the GEP and presented two suggestions for this. First, they suggested that there might be two forces at play: one strong force pushing the increased representation of women across the entire globe—women potentially "increased their participation in sports and hobbies in all domains" (p. 1409)—and social construction of gender differences or expression of innate preferences as a countervailing force. This suggestion lacks parsimony by assuming the existence of two opposing forces to explain a linear relation.

Napp and Breda's second suggestion was that the higher proportion of female players in younger age cohorts found by Vishkin (2022) may reflect higher female dropout rates in older age cohorts rather than increased female participation over time. I addressed this possibility by tracking the rates of participation of female players from 2001 to 2022 as well as the representation of younger female players over the same years.

Method

The World Chess Federation includes near-monthly player lists beginning in January 2001 (www.ratings.fide.com/download.phtml; accessed November 10, 2022).

Table 1. Correlations Between Mean Age of Chess Players, Gender Equality, and Proportion of Female Chess Players, With Demographic Variables Assessing Country-Level Age Structure, Separately for Countries Showing a Gender-Equality Paradox and Countries Not Showing a Gender-Equality Paradox, Based on Two Alternative Inflection Points

	Show gender-equality paradox in chess participation (n = 66)			Do not show gender-equality paradox in chess participation (n = 21)		
Using Inflection Point 1	r	p	95% CI	r	p	95% CI
Mean age of chess players, with:						
Median country age	**.50**	**< .001**	**.294, .662**	**–.10**	**.664**	**–.510, .346**
Birth rate	**–.32**	**.009**	**–.522, –.085**	**.06**	**.785**	**–.379, .482**
Life expectancy	**.54**	**< .001**	**.342, .691**	**–.19**	**.407**	**–.575, .262**
Gender equality (GGGI), with:						
Median country age	**.25**	**.040**	**.013, .467**	.15	.509	–.299, .548
Birth rate	–.15	.231	–.378, .096	–.08	.717	–.498, .361
Life expectancy	**.41**	**.001**	**.190, .596**	**–.17**	**.467**	**–.559, .284**
Proportion of female players, with:						
Median country age	**–.38**	**.002**	**–.572, –.155**	**.33**	**.148**	**–.122, .665**
Birth rate	**.26**	**.033**	**.023, .475**	**–.28**	**.212**	**–.638, .168**
Life expectancy	**–.52**	**< .001**	**–.677, –.317**	**.34**	**.133**	**–.109, .672**
	Show gender-equality paradox in chess participation (n = 56)			Do not show gender-equality paradox in chess participation (n = 35)		
Using Inflection Point 2	r	p	95% CI	r	p	95% CI
Mean age of chess players, with:						
Median country age	**.39**	**.003**	**.140, .591**	**–.07**	**.681**	**–.396, .268**
Birth rate	–.14	.316	–.386, .131	.01	.967	–.327, .340
Life expectancy	**.39**	**.003**	**.138, .590**	**.10**	**.581**	**–.244, .417**
Gender equality (GII), with:						
Median country age	**–.59**	**< .001**	**–.737, –.384**	–.70	< .001	–.835, –.471
Birth rate	**.47**	**< .001**	**.237, .653**	.66	< .001	.421, .815
Life expectancy	**–.69**	**< .001**	**–.803, –.515**	**–.45**	**.007**	**–.681, –.138**
Proportion of female players, with:						
Median country age	**–.18**	**.190**	**–.421, .089**	**.17**	**.337**	**–.176, .474**
Birth rate	–.02	.866	–.284, .241	–.11	.537	–.426, .234
Life expectancy	**–.39**	**.003**	**–.596, –.147**	**.02**	**.909**	**–.315, .351**

Note: Inflection Point 1 is from Figure A1c in the Supplemental Material of the Vishkin (2022) study. Inflection Point 2 is from Figure A1d in the Supplemental Material of the Vishkin (2022) study. Findings in line with hypotheses are marked in bold. CI = confidence interval, GGGI = Global Gender Gap Index, GII = Gender Inequality Index.

The first few years contain data for players with standard ratings only (vs. rapid or blitz). Therefore, I computed the proportion of female players in January of every year, from 2001 to 2022, within the list of players with standard ratings. The lists ranged from 28,938 active players in 2001 to 188,388 active players in 2021. Furthermore, I computed the proportion of female players younger than 29 years, relative to all female chess players, for every year from 2002 to 2022 (data for age were missing in 2001). I selected age 29 years as a cutoff for young players because that was the mean age of the sample in the Vishkin (2022) study. Finally, I computed the proportion of female players younger than 29 years, relative to all players (male and female) younger than 29 years.

Given that each monthly player list is a unique data set, one concern is that the monthly lists may not be comparable. Indeed, in the ReadMe file prepared by Jeff Sonas as part of the Sonas-FIDE 200-month data set (e.g., Stafford, 2018), he noted that player lists were standardized by the World Chess Federation only from 2008—prior to that, they consisted of duplications. Therefore, in the Supplemental Material, I graphed results for all years available, but below, I report only those results from 2009.

Results and discussion

Vishkin (2022) presented evidence that female players are more represented in younger age cohorts and interpreted this as evidence that female chess participation has increased over time, a finding that is inconsistent with other accounts of the GEP. The authors of the commentary disagreed with our interpretation of these cross-sectional findings because of alternative explanations, such as higher dropout rates among female players. An analysis of female representation across time reveals that the proportion of female players increased from 7.5% in 2009 to 9.8% in 2022 (see Fig. S1 in the Supplemental Material available online). Furthermore, consistent with the generational-shift account, the proportion of young female players relative to all female players increased from 74.5% in 2009 to 77.5% in 2022 (see Fig. S2 in the Supplemental Material). Finally, and most critically, the proportion of young female players relative to all young players (male and female) increased from 19.4% in 2009 to 21.9% in 2022. So, the increased proportion of female players in younger age cohorts represents a real phenomenon over time beyond dropout rates. The increase in female chess participation over time is thus inconsistent with previous accounts of the GEP.

Conclusion

In conclusion, as argued by Napp and Breda, the GEP is not fully accounted for by the generational-shift account. However, the age structure of a country is related to female chess participation, and previous explanations of the GEP are not viable accounts of the GEP in chess participation.

Transparency

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Declaration of Conflicting Interests

The author(s) declared that there were no conflicts of interest with respect to the authorship or the publication of this article.

ORCID iD

Allon Vishkin https://orcid.org/0000-0002-9655-7449

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This research meets the ethical guidelines and legal requirements of the author's institution.

Supplemental Material

Additional supporting information can be found at http://journals.sagepub.com/doi/suppl/10.1177/09567976231202461

Note

1. The GGGI and GII indices show that gender equality increases monotonically over time in most countries (see also Dorius & Firebaugh, 2010).

References

Breda, T., Jouini, E., Napp, C., & Thebault, G. (2020). Gender stereotypes can explain the gender-equality paradox. *Proceedings of the National Academy of Sciences, USA*, *117*(49), 31063–31069. https://doi.org/10.1073/pnas.2008704117

Charles, M., & Bradley, K. (2002). Equal but separate? A cross-national study of sex segregation in higher education. *American Sociological Review*, *67*(4), 573–599.

Charles, M., & Bradley, K. (2009). Indulging our gendered selves? Sex segregation by field of study in 44 countries. *American Journal of Sociology*, *114*(4), 924–976. https://doi.org/10.1086/595942

Dorius, S. F., & Firebaugh, G. (2010). Trends in global gender inequality. *Social Forces*, *88*(5), 1941–1968. https://doi.org/10.1353/sof.2010.0040

Hebb, D. O. (1955). Arousal and the C.N.S. (conceptual nervous system). *Psychological Review*, *62*(4), 243–254.

Napp, C., & Breda, T. (2023). The gender-equality paradox in chess holds among young players: A commentary on the Vishkin (2022) study. *Psychological Science*, *34*, 1404–1410.

Schwartz, S. H., & Rubel-Lifschitz, T. (2009). Cross-national variation in the size of sex differences in values: Effects of gender equality. *Journal of Personality and Social Psychology*, *97*, 171–185.

Simonsohn, U. (2018). Two lines: A valid alternative to the invalid testing of U-shaped relationships with quadratic regressions. *Advances in Methods and Practices in Psychological Science*, *1*(4), 538–555. https://doi.org/10.1177/2515245918805755

Stafford, T. (2018). Female chess players outperform expectations when playing men. *Psychological Science*, *29*(3), 429–436. https://doi.org/10.1177/0956797617736887

United Nations Development Programme. (2020). *Human development report 2020: The next frontier: Human development and the Anthropocene*. Retrieved from http://hdr.undp.org/sites/files/hdr2020.pdf

Vishkin, A. (2022). Queen's gambit declined: The gender-equality paradox in chess participation across 160 countries. *Psychological Science*, *33*(2), 276–284.

Vishkin, A., Slepian, M. L., & Galinsky, A. D. (2022). The gender-equality paradox and optimal distinctiveness: More gender-equal societies have more gendered names. *Social Psychological and Personality Science*, *12*(2), 490–499.

World Economic Forum. (2019). *Global gender gap report 2020*. Retrieved from https://www3.weforum.org/docs/WEF_GGGR_2020.pdf