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Women in *Antiquity*: An Analysis of Gender and Publishing in a Global Archaeology Journal

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ABSTRACT

Studies of archaeology publishing demonstrate a persistent imbalance in the ratio of male and female authors. We present an analysis of the world archaeology journal *Antiquity* using submissions and editorial decisions data (2015–2020). We identify a recurrent ratio of one female for every two male authors across measures including all listed authors, solo and first-named authors, and team authorship. Disaggregating author gender by country and region of corresponding author, however, reveals substantial variation, opening a new avenue for understanding of global trends in archaeology publishing. We also assess peer review and editorial decision-making in relation to author gender, finding no evidence of bias and, using the 2020 data, we look for any potential gendered impact of Covid-19, finding solo female authors may have been more affected than those working in teams. We contextualize the results in relation to initiatives to diversify authorship, including capacity-building programs for early career researchers.

KEYWORDS

structural inequalities; world archaeology; publishing demographics; editorial decision-making; peer review; open access; Covid-19

Introduction

A wave of feminist critique, led in the 1980s by Joan Gero, Margaret Conkey, and others, exposed how contemporary gender assumptions pervade understandings of the past (e.g., Gero 1985, 1996; Gero and Conkey 1991). Subsequent decades of feminist-inspired research have ensured greater awareness and reflection on the gendered nature of archaeological interpretation. Nonetheless, biases persist, for example, in relation to normative assumptions about gender roles (e.g., Stratton 2016; Coltofean-Arizancu, Gaydarska, and Matić 2021) and about which aspects of the past receive greater attention (e.g., De Leiuen 2015; Dempsey 2019). One of several reasons for these continuing biases is the systemic underrepresentation of research by female archaeologists in peer-reviewed journals. The gendered dynamics of publishing within archaeology have long been recognized (e.g., Victor and Beaudry 1992), including both who and what is published (Tomášková 2011) and, in turn, who “controls the narrative” (Bardolph 2018). Characterized as a “female-rich” discipline (Tushingham, Fulkerson, and Hill 2017), archaeology, with near parity in numbers of male and female archaeologists in both the UK and US, is no exception. Multiple studies have documented the underrepresentation of female authors in archaeology publishing (e.g., Bardolph 2014; Bardolph and VanDerwarker 2016; Heath-Stout 2020a), a lack of gender parity in grant applications (Bardolph 2018; Goldstein et al. 2018), and the uneven gender distribution of senior academic positions (UK: Hamilton 2014; North America: Tushingham, Fulkerson, and Hill 2017; Overholtzer and Jalbert 2021).

In this article, we present a gender analysis of submissions to *Antiquity*, a leading world archaeology journal. Our access to the journal’s submissions system enables us to present data on author gender for submissions between 2015 and

2020 and to track these papers through peer-review and editorial decision-making. Inspired by the lead of other archaeology journals (e.g. Bjerck 2008; Kelly et al. 2019; Gamble 2020, 2021; Heath-Stout 2020b), we have collated and analyzed gender statistics to establish baseline figures for planning action and monitoring progress. In addition, the Covid-19 pandemic has demonstrated the wider value of compiling such statistics. Early in 2020, on social media, several editors anecdotally observed a decline in submissions from female scholars; our dataset offers the opportunity to assess whether the early stage of the pandemic affected submissions from female authors to *Antiquity*. This study complements existing analyses of archaeology publishing, which focus predominantly on North American titles, by presenting a dataset for a journal with a global remit, in terms both of geographical coverage and authorship; in particular, we explore international variation in author gender ratios. More generally, here we focus on *Antiquity* submissions and editorial decisions rather than on articles published in the journal; the latter have been partially addressed elsewhere in a recent survey-based analysis (Heath-Stout 2020a). Instead, we prioritize the insights deriving from our access to the *Antiquity* submissions data.

Antiquity in Context

First published in 1927, *Antiquity* is a peer-reviewed journal of world archaeology showcasing archaeological research on all periods and regions (www.antiquity.ac.uk). Producing approximately 2000 pages of content a year, *Antiquity* is one of the largest peer-reviewed archaeology journals; two recent studies of archaeology publishing consider *Antiquity* as one of the discipline’s most prestigious journals (Heath-Stout 2020a; Beck, Gjesfjeld, and Chrisomalis 2021). Consequently, *Antiquity* offers a substantial, well-established global

journal through which to consider the gendered nature of archaeology publishing. The journal is owned by a charitable organization, the *Antiquity* Trust, which is tasked with ensuring the publication of the journal and providing support for the promotion of a wider public understanding of archaeology. In 2019, the *Antiquity* Trust commissioned the editorial team to report on the gender distribution of authors to provide a baseline against which potential action could be planned and assessed. Below, we present the results of this analysis and introduce some of the work initiated to follow up on the findings.

To frame our submissions data, it is useful to establish the long-term trend in the gender balance of authors published in *Antiquity* and how this compares to journals of similar status and content. We therefore compare data on author gender for articles in four volumes published at 10 year intervals: 1990, 2000, 2010, and 2020.¹ These years were chosen as the last full year (1990) immediately prior to publication of Roberta Gilchrist's (1991) influential *Antiquity* article on gender in archaeology and the most recent year (2020) for which full data were available at the time of the original analysis; 2000 and 2010 provide evenly spaced intermediate data points. Figure 1 shows that in 1990, 24.1% of all listed authors and 23.2% of first-named authors were female. By 2020, 33.2% of all listed authors were female, and 38.8% of first-named authors were female. Between those years, in 2000, there was a marked increase in the proportion of female authors, both as first author and among all listed authors, before the figures fell back in 2010, to a level lower than in 1990 in the case of female first-named authors. Here, we take these four years as representative of general trends, noting that specific issues may affect the statistics for any individual volume (e.g., a special section on archaeology and education in the 2000 volume has a high number of female first authors). Across the 30 years from 1990 and 2020, the percentage of all listed female authors increased from just under one-quarter to one-third of authors; the percentage of female first-named authors increased at a faster rate from 23.2% to 38.8% (expressed as a female:male ratio, the measure we use in the following analysis, these changes represent

increases from 0.32 to 0.5 and 0.3 to 0.63, respectively). These statistics demonstrate an overall upward trend with some volatility, though the 2020 figures clearly remain some way from parity.

Other analyses of published author gender in archaeology journals provide context for these figures. D'Anna and colleagues (2021, table 3, fig. 3) analyzed a sample of European journals on Near Eastern archaeology (1980–2019), finding female authors comprised 34% of total contributors, with wide variation between titles and a trend increasing from approximately 30.4% female authors in the early 1980s to 39.9% by the late 2010s. Meanwhile, Heath-Stout (2020a, table 2) used an email survey of authors who published between 2007 and 2016 in 21 predominantly North America-based archaeology journals to identify 36% female authorship. Heath-Stout's analysis includes a sample of 380 *Antiquity* authors, finding 32% female, 67% male, and 1% other. Although both studies use different methods, census periods, and journals, we note some broad similarities in their results, including an approximate ratio of one female to every two male authors (Figure 2) and a consistent but modest increase in the proportion of female authors over time.

Methods and Materials

In 2015, *Antiquity* started using the ScholarOne manuscript submission system, which collects detailed records for the receipt and processing of papers. Our analysis, accordingly, starts in 2015 and runs through to 2020, the final full year for which data were available at the time of analysis. Using the method explained below, we have assembled data on the gender of all authors listed on research, debate, and method papers submitted (due to changes in the format and handling of *Antiquity* Project Gallery papers during this period, these short articles are excluded from the following analysis). In total, we present data on 4835 authors listed on 1431 submissions.

As with similar retrospective studies of author gender in archaeology journals, no self-reported gender information was available for the submitted papers. We have therefore

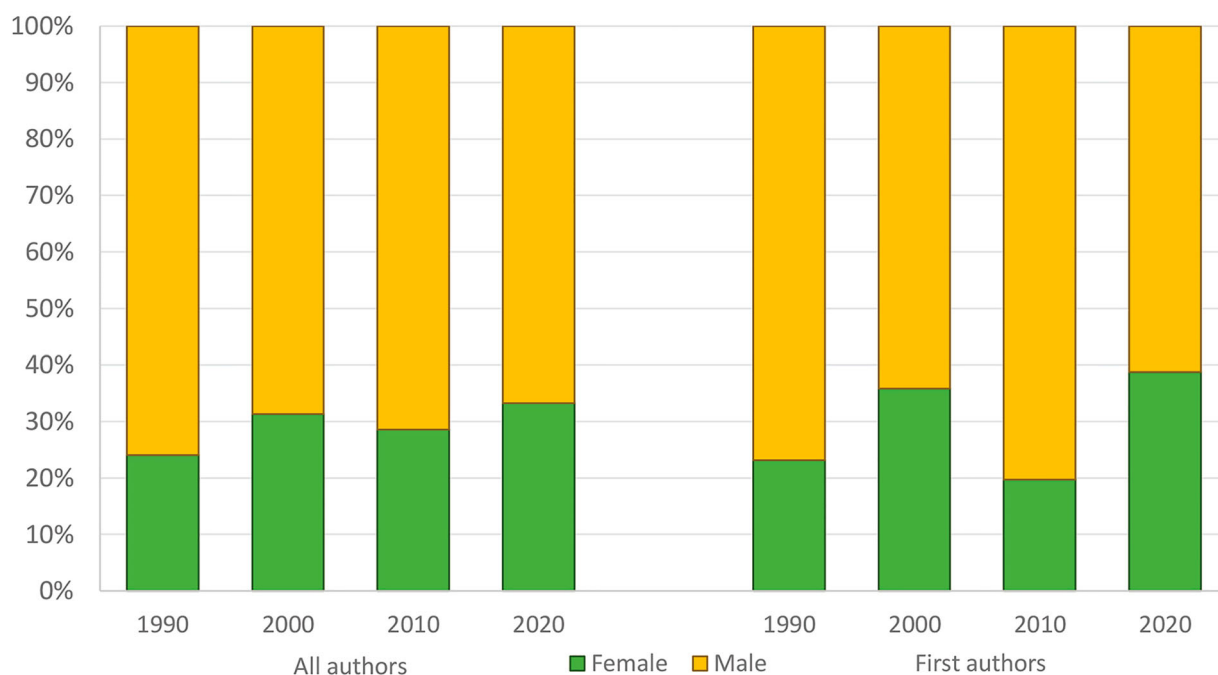


Figure 1. Gender of published *Antiquity* article authors from 1990, 2000, 2010 and 2020 (R. Witcher).

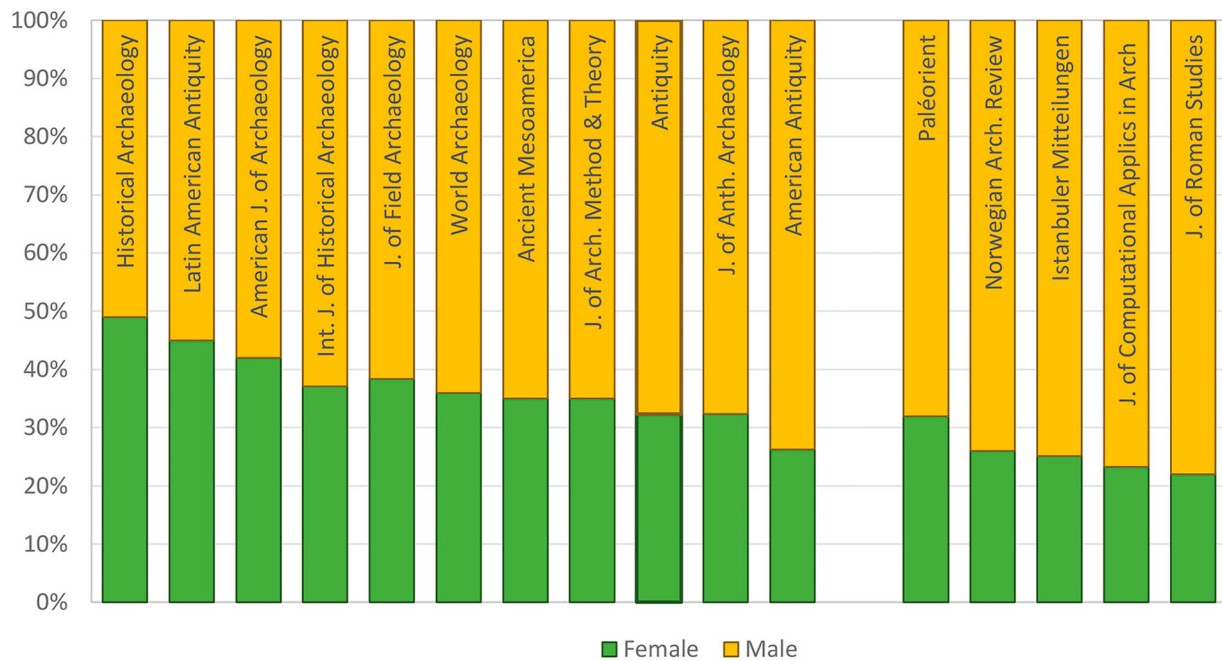


Figure 2. Gender of first-named authors for articles published in select archaeology journals, 2007–2016, based on survey responses reported in Heath-Stout 2020a (for journals with author responses totaling at least 4% of the overall dataset), plus data for *Norwegian Archaeology Review* (1968–2008; Bjerck 2008); *Journal of Roman Studies* (2005–2019; Kelly et al. 2019); *Istanbul Mitteilungen* (1980–2018) and *Paléorient* (1980–2019; D’Anna et al. 2021, table 4); and, *Journal of Computational Applications in Archaeology* (2019–2021; Johnson 2022) (R. Witcher).

identified and assigned author gender presentation by researching biographies and webpages (see Bardolph 2014; Tushingham, Fulkerson, and Hill 2017; Heath-Stout 2020b). Other studies using this method acknowledge the limitations of this approach, including the risks of misgendering authors and of missing non-binary individuals (e.g., Bardolph 2018, 165; Fulkerson and Tushingham 2019, 385; Heath-Stout 2020b, 136; Power 2020). Our research, for example, identified no non-binary individuals and no use of gender-neutral or gender-inclusive pronouns. In contrast, Heath-Stout’s (2020a, 4–5) recent survey-based method, covering some of the authors included here, found that 1% of *Antiquity* respondents identified as other than male or female.

Recent studies have emphasized the importance of attending to intersectional identities in the analysis of publishing trends, for example, gender and ethnicity (e.g., Kamash 2021). Here, establishing a first dataset, we focus specifically on author gender without consideration of cross-cutting identities, acknowledging that other studies have found significant patterns in this regard (e.g., Heath-Stout 2020a). Instead, we look to the comparatively broad range of countries from which *Antiquity* receives submissions to explore international variation in author gender. To date, most analyses of authorship in archaeology have focused on journals based in North America and/or focused on North American archaeology (e.g., Tushingham, Fulkerson, and Hill 2017; Heath-Stout 2020a; though see D’Anna et al. 2021 for a sample of European journals of Near Eastern archaeology). Data on *Antiquity* submissions therefore present the opportunity to explore if and how author gender ratios may vary by country or region. Globally, archaeologists work in diverse socio-economic circumstances and different cultural traditions, which not only shape general discrepancies in their ability to submit research to international journals but may also impact

differentially according to gender. To our knowledge, this issue has not previously been addressed through statistical analyses of archaeological publishing. Here, we focus on the institutional affiliation of the corresponding author. In doing so, we acknowledge that this may differ from an author’s nationality and, further, that there may be cross-cutting regional and gender considerations (e.g., international mobility may be higher between EU countries than between Asian countries and men may be more willing and able to relocate to another country for work than women). Furthermore, as we go on to discuss below, most *Antiquity* submissions have at least two authors, and team-authored papers may include contributors from several countries. For all these reasons, the institutional address of the corresponding author offers only an indirect proxy of a more complex reality; in the absence of data on author nationality, however, we use these data as an initial means of illuminating an important but understudied consideration in global archaeology publishing.

Team authorship is another issue that has received little attention in analyses and discussion of author gender. Archaeology is inherently collaborative, and journal articles frequently list multiple authors, often of mixed gender. Previous analyses of author gender have typically focused on the gender of the lead author (for exceptions, see Rautman 2012, table 1; D’Anna et al. 2021, fig. 4). There is, however, no standard definition of lead author or the differing roles of other listed authors. In this article, we consequently analyze the gender of authors in relation to three categories: all listed authors, first-named authors, and solo authors (in addition, as described above, we also consider the institutional addresses of corresponding authors, noting that the corresponding author is not always the same as the first-named author). These overlapping categories allow us to approach the question of gender parity from three perspectives and to identify similarities and differences in trends. For context,

we also present data for the number of authors listed on submitted papers.

Throughout, we present the data as female:male ratios. We calculate these ratios by dividing the number of female authors by the number of male authors for each of the three categories: all listed authors, first-named authors, and solo authors. A ratio of 1.0 indicates parity; less than one indicates more male authors than female and vice versa; we round all figures to two decimal places for reporting. The female:male ratio allows us to use control charts to identify any unusual variation over time (i.e., values outside upper or lower control limits defined by two standard deviations). It also allows us to account for inter-annual variation in the numbers of submissions and to assess whether editorial decisions are independent of author gender (i.e., that editorial decisions reflect the proportions of female- and male-authored papers submitted).

Several previous analyses of author gender in archaeology journals have compared their results to baseline populations such as the gender balance of society memberships (Bardolph 2018; Fulkerson and Tushingham 2019) and/or in comparison to participation in other scholarly activities such as conference presentations (Fulkerson and Tushingham 2019). Such studies have focused mainly on North America and demonstrated that, although the wider archaeological community comprises a broadly even female/male division, peer-reviewed journal authorship is skewed towards men. As *Antiquity* receives submissions from dozens of countries each year, ideally, we would compare authorship to baseline figures for the division of gender across the global archaeology community. These data do not currently exist. Instead, we can look to the results of several national and regional surveys that report on the gender of archaeologists, noting that the data collection methods are diverse, leading to potentially significant effects on comparability (e.g., self-reporting by individuals versus institutional returns and differences in the groups included or excluded, such as tenured staff versus honorary positions, which may be correlated with gender). We briefly compare our results to these figures for general context, noting the need for the collation of more consistent data with broader geographical coverage. A survey of professional archaeologists across 21 European countries (2012–2014) identified 50.7% as women and 49.3% as men, with notable variation across the continent, with the highest percentages of female archaeologists working in Greece (76.3%) and Italy (70.8%) and the lowest in Romania (35.8%) and Poland (38.5%) (Aitchison et al. 2014, 27, fig. 2).

In 2019/2020, the percentage of female archaeologists across the whole UK archaeology sector was 47%, matching the figure for women in the overall UK workforce (Aitchison, German, and Rocks-Macqueen 2021). Archaeologists based in UK universities form only a small percentage of the sector, with the majority employed as local authority archaeologists, as contractors, or in museums. Focusing specifically on universities, in 2020/2021, female academic archaeologists comprised 49% of the UK higher education sector.² Meanwhile, a survey of archaeologists in Australia (2004–2005) found 52% of respondents were female (Ulm, Nichols, and Dalley 2013, 4) and, in 2014, women formed 47% of members of the Society for American Archaeology (Bardolph 2018, 165–170).

Finally, we have recorded the editorial decisions made on each submission to assess any bias in editorial outcome in

relation to author gender. Each year, *Antiquity* receives many more submissions than can be published, and only a minority of the papers received are accepted for publication. All submissions are screened by the editorial team and any that are deemed out of scope or unsuitable (e.g., descriptive site reports) are desk rejected. The majority, however, are sent for consideration by two or more external peer reviewers. Informed by these reviewers' reports, papers receive one of three possible decisions: minor revisions, major revisions, or reject. No paper is accepted outright; submissions which go onto publication will receive at least two editorial decisions, typically minor revisions and, subsequently, accept; some may receive three or more decisions (e.g. major revisions, minor revisions, accept). Here, we focus on initial submissions and first editorial decisions, leaving aside decision-making on revised manuscripts. We note that nearly all papers that receive an initial decision of minor revisions go on to publication, as do the majority of those with major revisions.

Results

Team authorship

Just over two-thirds of submissions (68.19%) list two or more authors, with a mean of 3.37 authors per paper (Figure 3). Table 1 lists the most common combinations of author gender. Papers solo-authored by men and women are the two largest categories, constituting 21.13% and 10.56%, respectively, of the overall dataset. The third largest category, 9.17% of the total, is jointly authored papers with one female and one male author; papers authored by two men (8.27%) are four times more common than papers co-authored by two women. The next five most common categories, accounting for just under one-quarter of the total, all have more male than female authors.

A number of previous studies have excluded (mixed-gender) team-authored articles, as these complicate analysis of gender (e.g., Hutson 2002); others include team-authored papers, categorizing them according to the gender of the lead author only. Of the few datasets available, those presented by Rautman (2012, table 1) for submissions to *American Antiquity* (2009–2010) provide a point of comparison. Rautman recorded that 45% of papers were by solo male authors and 18% by solo female authors, a much higher combined percentage for solo-authored papers than the *Antiquity* figures presented here, although for both journals, solo male-authored papers are approximately twice as frequent as papers by solo female authors. Also similar is that papers co-authored by two men are more numerous than those co-authored by two women, although the discrepancy for the *American Antiquity* submissions is far more marked (14% versus 1%) than for *Antiquity* (8.27% versus 2.36%). The results presented here, and their similarities to Rautman's data, suggest the need for further analyses of the specific roles played by individuals of different genders within author teams.

Submissions: all authors, first-name authors, and solo authors

The submitted papers list 4835 authors in total. Some 35.02% of all authors are female, giving a female:male (F:M) ratio of

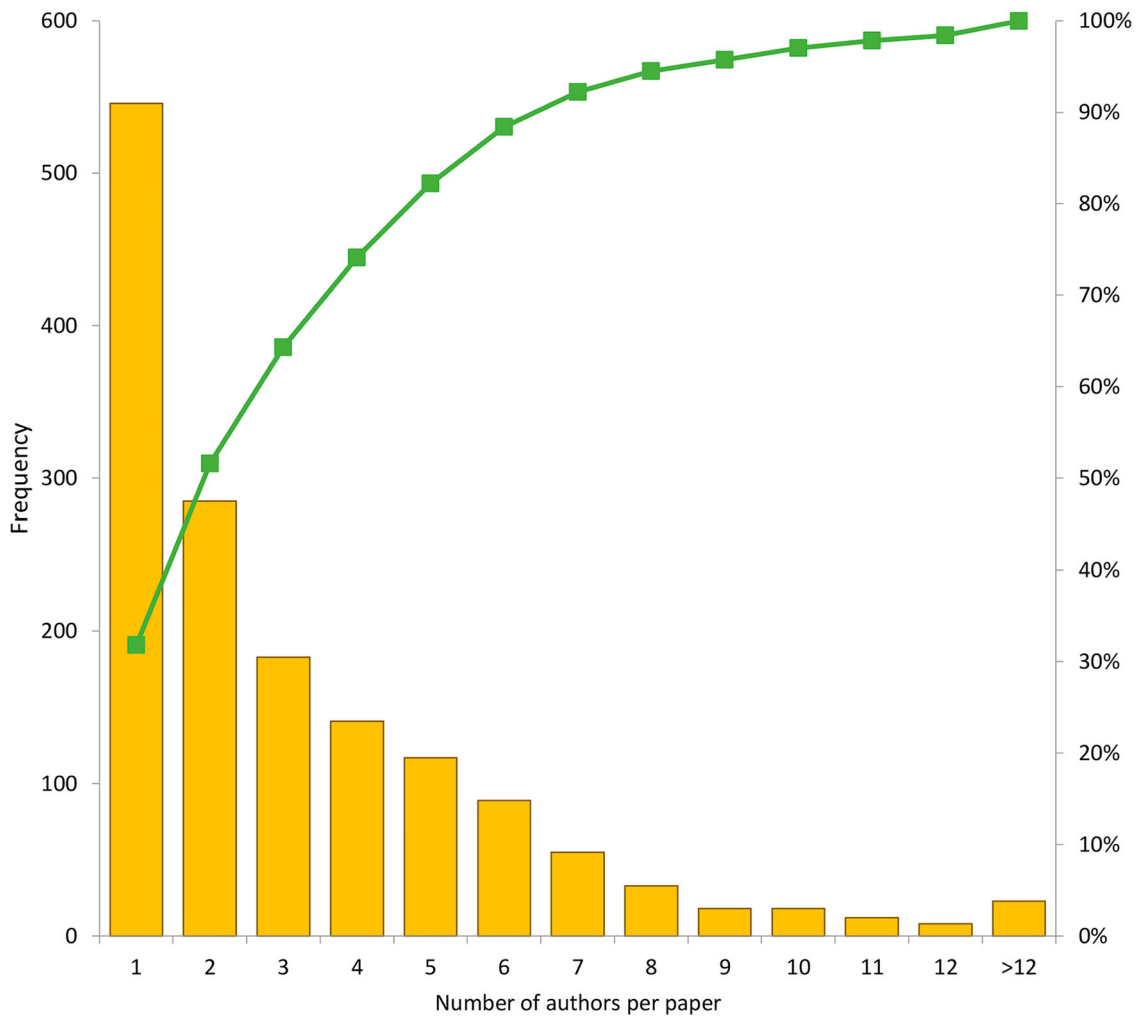


Figure 3. Numbers of authors listed on *Antiquity* submissions 2015–2020 ($n = 1431$) (R. Witcher).

0.54. Figure 4A shows the variation in the female:male ratio by year against this mean. As would be expected, there is some natural inter-annual variation, but all data points remain within two standard deviations, indicating that no year is notably different. During the 2015–2020 census period, our basic submission policies remained unchanged and, although we published a small number of special sections and attended conferences and workshops to encourage submissions, no activities were directed towards authors of a particular gender.

Table 1. Combinations of author gender on papers submitted, 2015–2020. All combinations comprising a minimum of 2% of the overall dataset (72 additional combinations account for the remaining 20.99% of submissions).

Number of authors		% of total submissions
Female	Male	
0	1	21.13%
1	0	10.56%
1	1	9.17%
0	2	8.27%
1	2	5.35%
1	3	3.89%
0	3	3.89%
2	3	2.85%
2	1	2.78%
2	2	2.50%
2	0	2.36%
1	4	2.08%
2	4	2.08%
0	4	2.08%

Next, we focus on the gender of the first-named author on 1431 manuscripts, plotting, as before, the female:male ratio by year (Figure 4B). As the dataset is smaller (i.e. numbers of manuscripts rather than authors), we would naturally expect more variation between years; the mean ratio, however, is almost identical at 0.55 to that for all authors (0.54), and all years are within two standard deviations (35.36% of first-named authors are women). Finally, we plot the female:male ratio of solo-authored papers (Figure 4C). As a still smaller subset of data ($n = 454$), we find a little more natural inter-annual variation and a slightly larger standard deviation. The mean female:male ratio is 0.5, the lowest of the three categories (33.04% of solo authors are women). All the data points, however, are well within two standard deviations, and the trend closely tracks that of female first-authored papers (see Figure 4B).

Across the three categories, the female:male ratios are broadly similar: 0.54 (all authors); 0.55 (first-named author); and 0.5 (solo-authored). This equates to slightly more than one female author to every two male authors. This result is broadly in line with the mean female:male ratio identified in Heath-Stout's (2020a) survey of (published) authors in 21 archaeology journals (see Figure 2). As noted above, however, it is likely that *Antiquity* has a more globally diverse authorship than many of the journals analyzed in that survey. In the next section, we therefore present gender ratios by the countries of the corresponding authors' institutional affiliations and then isolate subsets for comparison.



Figure 4. Female:male ratio of submitting authors, 2015–2020: A) all listed authors; B) first-named authors; and, C) solo authors, compared to mean, with upper and lower control limits (UCL and LCL, respectively) at 2 standard deviations (R. Witcher).

Finally, within the six year dataset, we also note a small number of authors submitting more than one paper. Of these, based on first-named authors, three times as many male authors submitted two or more papers than female authors, or a female:male ratio of 0.3. This ratio is much lower than that identified for all first-named authors above (0.55), indicating that (a small number of) male authors are much more likely than female authors to submit multiple papers.

Corresponding authors' country of affiliation

Based on the institutional addresses of the corresponding authors (who are not always the first-named author), between 2015 and 2020, *Antiquity* received submissions from 78 different countries. As most papers are team-authored (see Figure 3), the overall number of countries

represented by co-authors is still larger. Submission numbers from these countries are highly skewed, with 78.62% of papers coming from 14 of the 78 countries. Papers from each of these 14 countries represent a minimum of 1.5% of the overall dataset, providing a sufficiently large sample from each of them to establish robust female:male author ratios (Table 2; Figure 5). Submissions from authors based in the UK and US form the two largest groups within the dataset, comprising 34.96% of the total. The female:male ratios for these two countries are very similar, 0.62 and 0.60, respectively, and slightly above the mean for all countries (0.55). If submissions from the UK and USA are excluded, in order to assess whether their combined weight might have a particular influence on the overall figures, the female:male ratio falls only slightly from 0.55 to 0.52. Four of the top 14 countries have higher ratios than the UK and USA: Australia, France, Denmark, and Russia. The latter

Table 2. Gender of corresponding authors for 2015–2020 submissions for the top 14 countries by number of submissions, ordered from highest to lowest ratio.

Country	Female %	Male %	F:M ratio	% of total submissions
Russia	56.00%	44.00%	1.27	1.74%
Denmark	54.55%	45.45%	1.20	1.54%
France	47.17%	52.83%	0.89	3.70%
Australia	44.78%	55.22%	0.81	4.68%
Italy	43.18%	56.82%	0.76	3.07%
UK	38.38%	61.62%	0.62	19.82%
USA	37.33%	62.67%	0.60	15.14%
India	33.33%	66.67%	0.50	2.09%
China	30.59%	69.41%	0.44	5.93%
Germany	29.03%	70.97%	0.41	4.33%
Israel	27.03%	72.97%	0.37	2.58%
Spain	25.93%	74.07%	0.35	5.65%
Poland	24.44%	75.56%	0.32	3.14%
Canada	21.88%	78.13%	0.28	2.23%
Iran	14.63%	85.37%	0.15	2.86%

two countries have ratios above 1.0, indicating more submissions from female than male authors. The remaining eight countries have ratios lower than the mean, including Canada, China, Germany, and Iran (see Figure 5). Finally, drawing on the data from all 78 countries, the female:male ratio for countries in Africa is 0.24, Asia 0.36, Europe 0.60, and Central and South America 0.89.

Such geographical variation in the female:male ratios of first-named authors is unsurprising but has not previously been documented in the analysis of archaeology publishing. As no gender statistics for the global archaeology community are available, here we compare the female:male ratios for the top two countries for submissions, the UK and USA, to baseline data for those countries. In the UK, the ratio for the whole archaeology sector (2019/2020) is 0.89 and for archaeologists based in universities (2020/2021) is 0.96; this compares to a ratio of 0.62 for UK *Antiquity* submissions. In the US, membership of the Society for American Archaeology (2014) has a ratio of 0.89 compared to *Antiquity* submissions from the US with a ratio of 0.60. In both cases, submissions from female authors are notably lower than might be expected, given the wider archaeological demographics of these two countries. Comparison with the European national figures provided by Aitchison and colleagues (2014) reveals similar discrepancies; for Italy, for example, Aitchison and collaborators (2014) report an equivalent female:male ratio of 2.45 versus a ratio of 0.76 among *Antiquity* contributors.

Reviewers

Peer review plays a key role in assuring the rigor and quality of published research. All published *Antiquity* articles are assessed by at least two external specialist peer reviewers, whose reports and recommendations feed into editorial decision-making. We collected data on the gender of peer reviewers who commented on papers submitted between 2015 and 2020. Several invitations are usually needed to secure the required number of reviews, and it should be stressed that the figures presented here relate to those reviewers who accepted an invitation rather than those originally approached, and it is possible that women accept or decline invitations to review differently from men. Figure 6 shows the female:male ratio for reviewers by year against a mean of 0.48 (32.47% of reviewers are women), rising from 0.41 in 2015 to 0.55 in 2020. The latter figure brings the reviewers into line with the average female:male ratio for submitting authors (see Figure 4).

Editorial decisions

Informed by peer reviewers' reports and recommendations, authors receive one of three first editorial decisions: minor revisions, major revisions, or reject. Here, we group decisions as revisions (combining minor and major) versus rejections (either before or after external review) and plot the female:male author ratios by year, with 1.0 indicating that decisions are made in direct proportion to the gender distribution of submitted papers (i.e. that the decision is independent of author gender). For revisions, the mean ratio is 0.98, indicating that submissions by female and male first-named authors receive this outcome in almost direct proportion to those in which the papers are submitted. Figure 7A shows the editorial decisions for revisions by year, indicating minor inter-annual variation, with all data points well within two standard deviations. For rejected papers, the mean is 1.02, again demonstrating that decisions are made in almost identical proportion to the gender distribution of submitted papers. Figure 7B, similarly, shows minor inter-annual variation; logically, the trend for rejections is a mirror image of that for revisions.

Taking all editorial decisions together (both revisions and rejections), the six year means are very close to parity (1.0), and the figures for each year are well within two standard

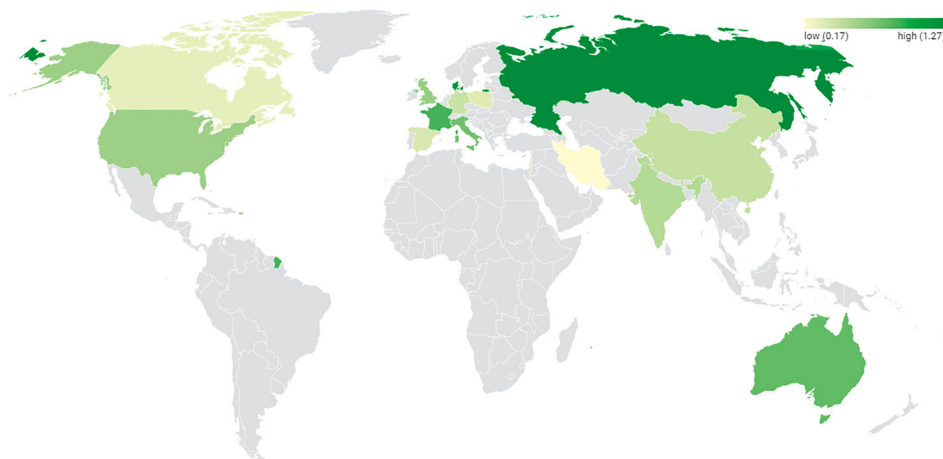


Figure 5. Map of female:male ratios of corresponding authors for 2015–2020 submissions for the top 14 countries by number of submissions (R. Witcher).

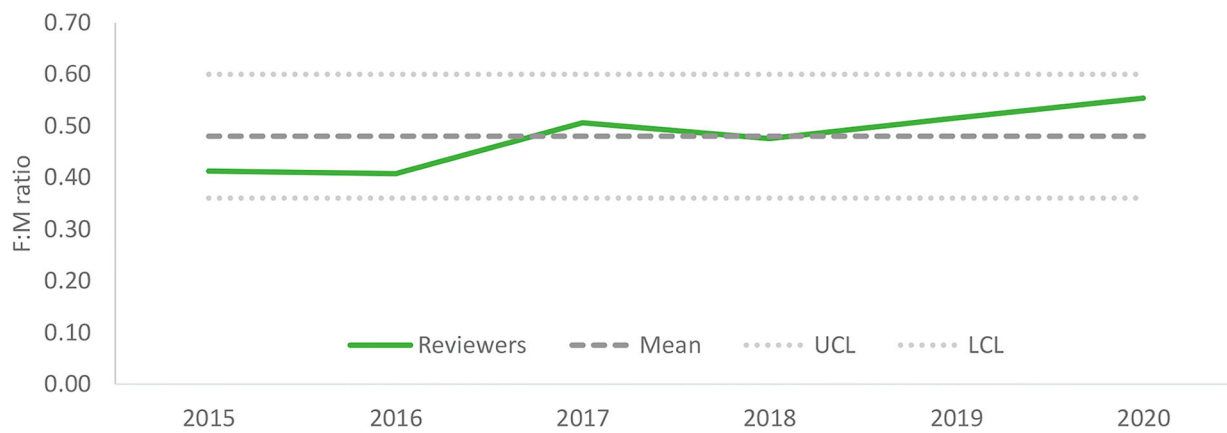


Figure 6. Female:male ratio of peer reviewers accepting invitation to review, 2015–2020, compared to mean, with upper and lower control limits (UCL and LCL, respectively) at 2 standard deviations (R. Witcher).

deviations, with the majority within one standard deviation. A chi-squared test of independence shows no relation between first-named author gender and first editorial decision (minor revisions, major revisions, or reject): χ^2 (2, $N = 1196$) = 1.75, $p = 0.417159$.

Covid-19

The final year of the six year census period, 2020, coincided with the start of the Covid-19 pandemic. As countries around the world imposed restrictions to contain the virus, research and scholarly publishing were affected, as were all other aspects of life. The impact on researchers of lockdowns and changes to working practices, such as online teaching, have been widely discussed (e.g., Smith 2020; Gewin 2021).

Particular attention has been given to whether societal responses to the pandemic have had a disproportionate effect on female researchers, for example, through a greater burden of caring and homeschooling responsibilities (Gewin 2020; Wittman, Haverfield, and Tannenbaum 2021). During the early months of the pandemic, some editors anecdotally reported on social media that submissions from female scholars noticeably declined in number. The current dataset allows us to explore this issue for the early part of the pandemic.

During 2020, general submissions behavior changed notably. Monthly submissions during the first four months of the year were broadly in line with same period for the previous five years. The numbers of papers received during May–August then rose above average, including a sharp spike in

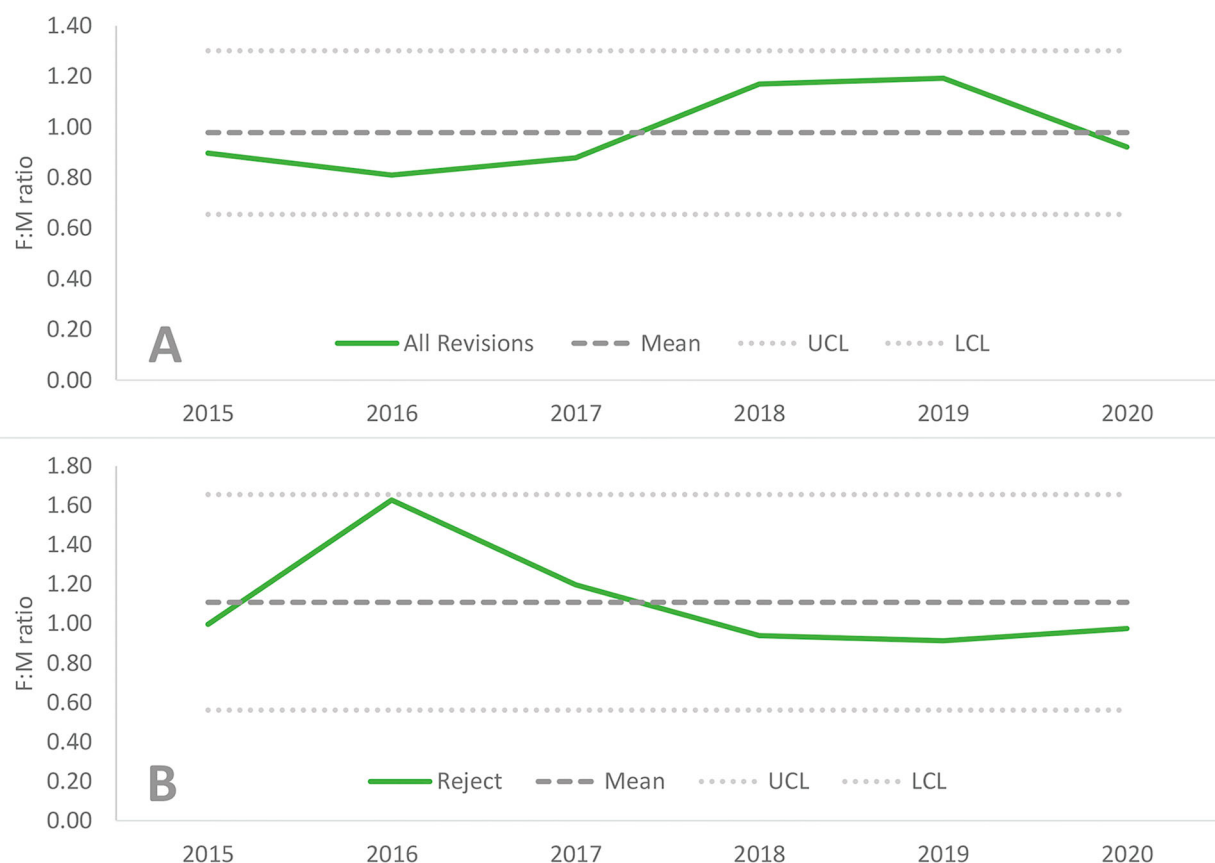


Figure 7. Editorial decisions on female and male first-authored papers expressed as a female:male ratio for A) minor and major revisions and B) reject before or after external review, compared to mean, with upper and lower control limits (UCL and LCL, respectively) at 2 standard deviations (R. Witcher).

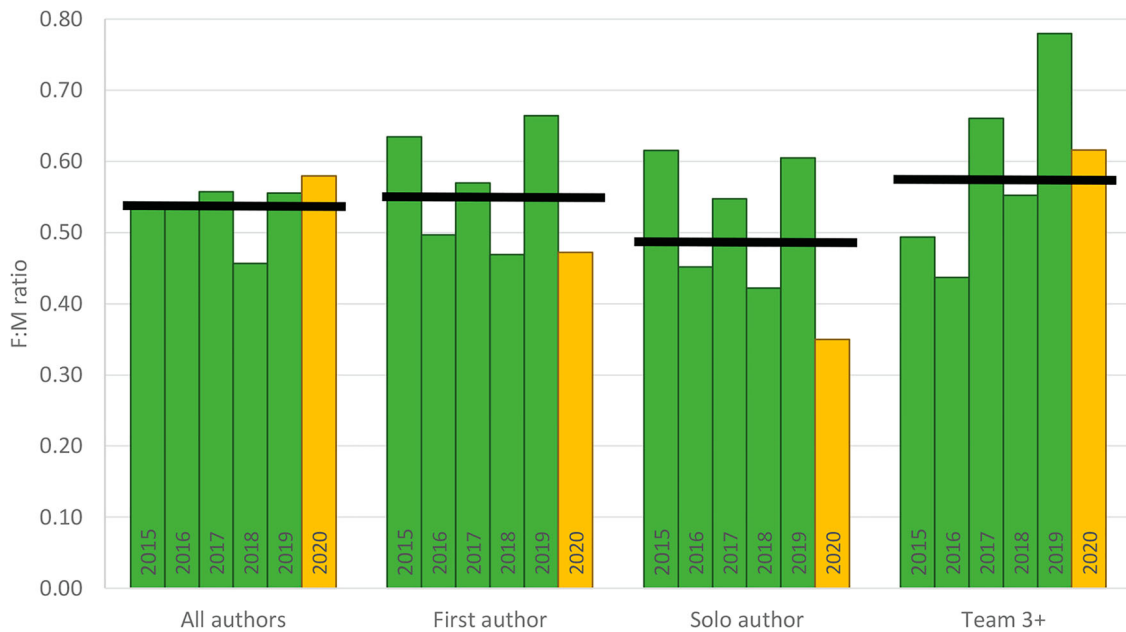


Figure 8. Comparison of female:male ratios for submissions between 2015 and 2020 by four categories of authorship. 2020, the first year of the pandemic, highlighted in yellow. Black bars indicate the six year mean female:male ratio for each category (R. Witcher).

submissions to almost double the average expected in August. This increase in submissions might be explained by authors pushing to complete and submit unfinished manuscripts in the face of significant uncertainty about future capacity for sustaining research activity. Alternatively, the cancellation of summer fieldwork may have freed up time to write up existing research. Following this period of above-average submissions, the numbers of papers received during the latter months of 2020 declined, remaining below the average of the previous five years. This reduction in submissions probably reflects the increased workload associated with the new academic year and/or the lack of field- and lab work undertaken earlier in the year.

Driven by the spike of submissions during the summer, there was a percentage increase of 13.31% in manuscripts received during 2020 compared with 2019. Reflecting this general increase, the absolute number of female authors listed on papers submitted in 2020 is the highest of the six year census period. The proportion of women listed as authors on submissions in 2020 expressed as the female: male ratio is also above the six year mean, 0.58 versus 0.54 (Figure 8). These increases, however, conceal divergent trends: submissions with women as first-named authors are below the six year mean (0.47 versus 0.55), as are papers solo-authored by women (0.37 versus 0.49). In contrast, the 2020 ratio of team-authored papers (3+ authors) with a female first-named author is above the six year mean (0.62 versus 0.57).

Superficially, the increases in both the absolute and relative numbers of submissions from female authors do not suggest a disproportionate Covid-19 impact on women researchers. Beneath these headline figures, however, the reduced proportions of submissions with women as first-named authors or as solo authors are notable. The ratios naturally vary for individual years, especially for solo-authored papers, as the absolute numbers are relatively small; it is accordingly difficult to assess statistical significance, particularly without a longer time series. We note, however, that whereas there was a 15.38% percentage

decrease in the number of female solo-authored papers in 2020 compared with 2019, there was a 39.53% percentage increase in the number of male solo-authored submissions. These divergent trends might speak to the disproportionate impact of the Covid-19 pandemic on solo female authors. Conversely, while the female:male ratio for female first-authored papers with three or more authors fell compared to 2019, unlike solo female authors, the ratio remains above the six-year mean. Again, it is difficult to assess statistical significance, but we hypothesize that women working as part of larger research groups may have been able to draw on wider networks of support to mitigate the impact of Covid-19 and to submit papers at a higher rate than, in particular, women working by themselves.

Discussion

In common with the results of other studies of author gender in peer-reviewed archaeology journals, the results reported here identify an imbalance in the proportions of papers authored by women and men. A recurrent statistic is a female:male ratio of approximately 0.5 (see Figures 4, 6). Further, we have identified this ratio in relation to both submitting authors and reviewers. As a journal of world archaeology with a global range of submitting authors, it is notable that the ratio 0.5 is broadly similar to that for North American journals (see Figure 2). Disaggregating this ratio to focus on submissions from specific countries reveals some notable variation (see Table 2) but attests to a broader international underrepresentation of female authors. Compared with baselines for the numbers of female and male archaeologists in the UK, USA, and Australia, which are reported as close to parity, a female:male ratio of submitting authors of 0.5 does not reflect wider disciplinary demographics. The collection of consistent baseline data for the global archaeological community, including Africa, Asia, and South America, would enable a better understanding of the degree to which female authors are underrepresented.

An important but under-discussed issue in the analysis of gender and publishing in archaeology concerns team authorship (for an analysis of science journals, see Broderick and Casadevall 2019). Just under two-thirds of all *Antiquity* submissions between 2015 and 2020 had two or more authors, and the majority of these papers were mixed gender, potentially complicating the notion of papers as either male- or female-authored. Solo-authored papers by female and male authors comprise the two most common categories, constituting 10.56% and 21.13%, respectively, of overall submissions. The discrepancy, however, is almost entirely removed if the absolute differences in the numbers of submissions by men and women are considered: female solo-authored papers constitute 30.03% of all female first-authored papers, and male solo-authored papers represent 32.86% of all male first-authored papers.

Similarly, papers with two or more male (only) authors represent 16.75% of overall submissions, whereas papers with two or more female (only) authors comprise just 3.41%. Accounting for fewer overall submissions from women, however, does not remove this discrepancy: male-only co-authored papers constitute 26.05% of all male first-authored papers, whereas female-only co-authored papers represent just 9.68% of female first-authored papers. In short, while men are no more likely than women to submit solo-authored papers, men are much more likely than women to co-author papers with other authors of the same gender (for a gender analysis of co-authorship in Near Eastern journals, see D'Anna et al. 2021, fig. 4).

Our results also demonstrate that, within the census period, male authors were disproportionately more likely than female authors to submit multiple papers. While caution is required, as the total number of authors submitting two or more papers is small compared to the overall dataset, this result could be interpreted in several ways. It is possible, for example, that male authors produce and submit papers at a faster rate than female authors (a phenomenon observed generally in scholarly publishing, see e.g., Morgan et al. 2021). Other explanations might include male authors focusing their research submissions on fewer, high-impact journals compared with female authors who might direct their papers to a wider range of outlets (for a more detailed analysis of this issue, see Beck, Gjesfjeld, and Chrisomalis 2021).

Disaggregating the average female:male author ratios by country demonstrates notable differences in submissions from different countries and regions. The female:male author ratio for submissions from African countries is particularly low, for example, perhaps reflecting wider intersectional cultural and societal barriers to participation (e.g. North, Hastie, and Hoyer 2020). Another consideration which might influence the variable rates at which women submit papers is variation in national traditions of organizing and funding research. Submissions from female authors based in Russia and Denmark, for example, include notably high numbers affiliated with museums and research institutes rather than with universities. It is possible that the institutional organization of archaeology in countries such as Denmark and Russia is more supportive of sectors where women are better represented. A related consideration might concern subject matter—there are established gender biases in archaeological specialisms, for example, female archaeologists are better represented in the areas of palaeopathology, textiles, archaeological chemistry, and ethics (e.g., Sinclair 2016, table 10;

Gamble 2020, table 2; 2021, table 1); it is possible that some of these areas may be correlated with other factors, such as working in museums or Cultural Resource Management (CRM). This variation in the female:male author ratio by region and country suggests the need for nuance both in terms of the interpretation of the overall figures for journal submissions and in relation to actions intended to address gender inequality.

While the underrepresentation of female authors was already apparent before undertaking our analyses, the underrepresentation of female reviewers was a more unexpected result. Peer review is handled through the ScholarOne submission system on a paper-by-paper basis, and, prior to the current analysis, there was no way to observe or intuit any discrepancy in the overall proportions of reviewers. The similarity between the female:male ratios of submitting authors and invited reviewers—both approximately 0.5—was also surprising. The question arises of whether this is a reflection of the wider gender balance of the global archaeology community (as noted above, we lack the baseline figures to assess this) or whether there might be other factors at play. For example, peer reviewers can be difficult to find, and authors who have previously submitted papers may be more “visible” when searching for specialists to comment on new papers. If submissions to a journal are skewed towards male authors, drawing on the author pool for peer reviewers might then lead to the recruitment of male reviewers in similar proportion to male authors (see below). As a first attempt to assess whether this unequal gender division might have any influence on reviewer recommendations, we collated data for reviewer decisions submitted in 2020. A chi-squared test of independence shows no significant relationship between reviewer gender and reviewers’ recommended first decisions (χ^2 [3, N = 386] = 2.53, $p = 0.469615$; reviewer gender has no effect on recommendations at 0.05 probability).

Similar to the results of a number of other journals’ analyses, our results demonstrate that editorial decisions closely reflect the proportions of submitted papers from female and male authors; in other words, the gender imbalance of published articles is a reflection of the higher numbers of submissions from male authors rather than editorial selection (e.g., Rautman 2012; Fulkerson and Tushingham 2019, 382; Heath-Stout 2020b). Growing attention is therefore focused on the question of why women submit fewer papers to peer-reviewed journals than men and what can be done to encourage more submissions. In this regard, Tushingham, Fulkerson, and Hill (2017) have identified a “peer review gap,” documenting better representation of female authors in non-peer-reviewed journals. In the USA, this has been partially explained through the concentration of female archaeologists in sectors such as CRM or museums, which do not incentivize publication in peer-reviewed journals (e.g., VanDerwarker et al. 2018). As a result, research by those employed in these sectors is directed towards regional, mostly non-peer reviewed, journals, edited volumes, and grey literature, where the representation of female authors is higher (Fulkerson and Tushingham 2019, fig. 5; also Bardolph 2018). A number of studies have gathered information on the types of authors’ affiliations (e.g., universities, local government, or CRM) in order to discern any intersection with author gender. With the exception of Russia and Denmark (above), we have not to date systematically collated

this information for *Antiquity* submissions, though we expect it would broadly reflect that of other comparator journals, with the majority of authors affiliated with universities; for example, 85% of *American Antiquity* submissions between 2007 and 2017 were from university-based academics (Bardolph 2018, 174). As this group of researchers constitutes only a small and unrepresentative sample of all archaeologists working in the US (Tushingham, Fulkerson, and Hill 2017) and in many other countries, this may help to explain some of the underrepresentation of female authors. We hope to collect data on affiliation in order to explore this issue in the future.

As a result of the identification of the “peer-review gap,” and how it contributes to the underrepresentation of female authors, suggestions have been put forward for ways to reduce the real or perceived additional time costs of submitting to peer-reviewed journals. These include mentoring and co-authorship (Bardolph 2018). Several studies have recommended, though not elaborated, on the importance of Open Access publishing in order to help address the lack of gender parity (e.g. Fulkerson and Tushingham 2019, 396; Beck, Gjesfeld, and Chrisomalis 2021). The Open Access agenda has advanced rapidly over the last decade, driven, for example, by the principles of Plan S (www.coalition-s.org). The removal of paywalls to allow free access for all readers (with an internet connection) is universally welcome. Many archaeology journals, including *Antiquity*, *American Antiquity*, and the *European Journal of Archaeology*, have signed up to the Plan S principles and are working towards full Open Access publication models. It is unclear, however, if and how Open Access in its own right might encourage more submissions from female authors. Indeed, there are concerns that shifting the costs of publication from readers to authors may erect new barriers to participation. The model of Author Processing Charges (APCs) has raised questions about the viability of publishing in the humanities and social sciences and about unaffordability for scholars based in the Global South (e.g., Kwon 2022). The current response of many publishers has been to strike deals with national university consortia to cover the costs of submissions by employees and to support free access for all. This model works well for authors based in an institution covered by a publishing deal, as well as for readers. But authors not covered by these deals face high APCs and, in the context of gender, we note that publishing deals are focused almost exclusively on universities. If, as some of the above studies argue, one way of addressing the underrepresentation of female authors in peer-reviewed journals is to encourage more submissions from sectors such as museums and CRM, the current Open Access funding model might actively erect a new barrier to participation. It would clearly be an unfortunate outcome if the removal of paywalls in order to broaden access to scholarly research was matched by the entrenchment, or even worsening, of the current imbalance of author gender. A variety of APC discounts and waivers have been established to address such issues; most, however, have focused on supporting scholars based in the Global South and have not considered the research coming from sectors such as museums and CRM or related issues such as gender representation.

The Covid-19 pandemic has been suggested to have disproportionately impacted on female scholars and their ability

to submit and publish papers at the same rate as male scholars. Our results cover only the first year of the pandemic, and the specific impact on female authors may be clouded by wider shifts in submissions behavior. Indeed, superficially, the increases in absolute and relative numbers of female authors submitting papers in 2020 does not appear to support the suggestion of a disproportionate impact on women. Disaggregating the data, however, reveals divergent trends that tentatively lend some support to the hypothesis that the effects of lockdowns and domestic responsibilities fell more heavily on female authors than male authors. In particular, our data show that while female solo-authors decreased by 15.38% compared with the previous year, there was a 39.53% increase in the number of male solo-authored submissions. As throughout, these results suggest the need for some nuance in the interpretation of general statistics and the formulation of strategies to encourage and support more submissions from women. Female archaeologists working as part of research teams, for example, may have stronger support networks than solo female authors. In turn, this might mean that women working on particular topics or specialisms typically undertaken by teams, such as archaeological science, might need different types of support compared to those working on areas without a tradition of collaborative work. The inclusion of the 2020 data in the planned research provided the unexpected opportunity to explore the potentially gendered impact of Covid-19; in due course, data for subsequent years will be collated and analyzed to check for any sustained effects.

Strategies

Our comparison of the proportions of female and male authors published in *Antiquity* between 1990 and 2020 (see Figure 1) reveals an improving but still marked underrepresentation of female authors. As widely discussed, such a situation may lead to particular voices dominating the narrative and the occlusion of other perspectives on the past (e.g., Dempsey 2019). Our awareness of this issue had already led to a number of changes in recent years; for example, since 2013, the editorial advisory board has been evenly split between female and male appointments and, recognizing the underrepresentation of female scholars invited to comment on debate pieces, a concerted effort since 2019 has allowed us to quickly reach parity in 2021 (Figure 9). It was as part of this growing awareness of the underrepresentation of female authors that the *Antiquity* Trust commissioned the work reported here. The resulting quantitative data establish baselines against which we can plan further action to address this issue and to measure progress. The latter will require ongoing data collection, and we hope to be able to implement changes to our online submissions system to allow authors to log this information themselves when they upload their manuscripts. These changes are already underway as part of wider industry proposals. In April 2022, the “Joint commitment for action on inclusion and diversity in publishing” initiative, comprising a group of 52 publishers led by the Royal Society of Chemistry (RSC), produced guidance on the collection of author data covering gender identity and ethnicity (though not, currently, nationality).³ We intend to implement these guidelines as soon as possible; the proprietors (Clarivate) of our submission system (ScholarOne) are currently exploring the

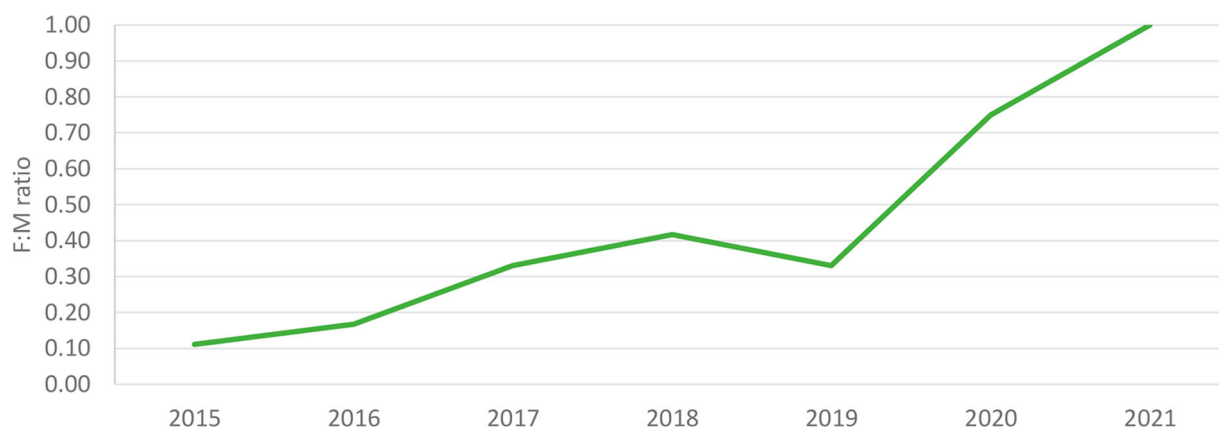


Figure 9. Female:male ratio of invited respondents to debate pieces, 2015–2021 (R. Witcher).

implementation of this framework, which will need to ensure that personal data are kept separately from individual submissions and accessible only in aggregate. In this way, we aim to improve the efficiency and accuracy of data collection, ensure compliance with data protection laws, and educate and reassure authors about the purpose for requesting this and other personal information.

Another change, implemented in January 2021, has been the decision to move from a single- to a double-blind review process. A number of studies have highlighted potential or actual gender bias in peer reviewing; Kaatz, Gutierrez, and Carnes (2014), for example, discuss different ways in which (unconscious) bias might shape reviewers' assessments. As part of the journal's commitment to equity—in relation to gender but also other considerations, such as career stage—we decided to align the peer review process with the most widely used model in the social sciences (for an overview of different peer review models, see Eve et al. 2021; Heath-Stout 2020b describes the transition to double-blind review for the *Journal of Field Archaeology*).

An initial assessment on the impact of this change during its first year of use indicates that the number of invitations issued to secure the required number of peer reviewers has increased. From 2015–2020, under the single-blind peer review system, the mean number of reviewers invited per paper was 3.4 (ranging from 3.4–3.7 across that period); in 2021, under double-blind peer review, the mean rose to 4.2. One full year of data is insufficient to establish a trend, but this figure is notably out of line with previous years, when the annual figure never rose above 3.7. One confounding factor is the pandemic, which has added to academic workloads, making it harder to find reviewers. If sustained, however, this higher mean might suggest that the knowledge of author identity factors into the decision to accept or decline an invitation. In relation specifically to gender, we suggest that the factors that influence the number of submissions from female authors are likely to also apply to women's ability to accept invitations to peer review. This raises a broader question of how to define an appropriate proportion of female reviewers: is a target of equal numbers of male and female reviewers suitable if there are already additional barriers to authorship for female scholars? In particular, if women undertake a larger proportion of citizen service roles, it may not be appropriate to expect this group to significantly increase its collective role in peer review. One approach might be to maintain a broad

correspondence between female:male ratios of submitting authors and reviewers, aiming to increase these in tandem.

Changes such as double-blind peer review and ensuring parity in invited debate responses serve to increase the visibility of female scholars in the pages of the journal and in the evaluation of the research published. They do not, however, directly increase the number of submissions. As Lynn Gamble (2020, 2021), the former editor of *American Antiquity*, has recently observed, despite good intentions, it is not easy for journals to quickly increase the number of submissions from female scholars. Given the broader structural issues within the discipline, and wider society, it is unsurprising that this is the case; it will take sustained collective effort to achieve gender parity across the wider publishing sector. Indeed, without growing capacity, the widely stated ambition of many journals to attract more submissions from female authors amounts to a zero-sum game—individual journals may improve the gender representation of their authors, but if this is achieved at the expense of other journals, this does not address the wider structural imbalance.

Antiquity's strategy has been to ensure that the journal is seen as open to submissions from all authors, and especially to early career researchers (ECRs), through proactive use of social media. Investment in a full-time Public Engagement and Press Administrator has allowed us to build a large online following where, among other objectives, we are able to promote the research of ECRs who have published in the journal and to encourage others to submit their own papers (Figure 10). Within this framework, the editorial team is involved in a number of mentoring initiatives. While these have not been directed specifically towards addressing the gender issue, focusing instead on ECRs and scholars from underrepresented regions of the world, gender has been a relevant concern in each case. Over the past five years, the Editor (Robert Witcher) and Associate Editor (Robin Skeates) have been two of the principal contributors, along with colleagues from Norway and Sweden, to the "How to write a successful article" workshops organized and funded by the Nordic Graduate School in Archaeology program (*Dialogues with the Past*). Across five cohorts, small groups of ECRs are led through an intensive mentoring program to develop draft articles for publication. Of the 50 ECRs selected for this scheme between 2017 and 2022, 32 (64%) are female. By ensuring that candidates at the doctoral stage are trained in key skills and given the confidence to submit papers through the demystification of the



Figure 10. Example of *Antiquity* social media promotion (A. Benton).

submissions and editorial decision-making processes, it is hoped that more female ECRs will not only establish a foot on the academic ladder but will also remain in the sector and move into more senior positions (on the “leaky pipeline,” see Fulkerson and Tushingham 2019, 384). Equally, however, for those who choose to work in museums or CRM, such training can also help take understanding of journal publishing into those sectors. A key part of the mentoring process is to help recast peer review as a fundamentally constructive process to be actively engaged with. Rather than a form of gatekeeping or a hurdle to be overcome, these workshops put an emphasis on the value of good peer review for helping authors to improve papers and, thereby, help to maximize their impact. Submitting to a peer-reviewed journal does involve a significant time burden, but this can be offset against the wider engagement and citation that the resulting articles can achieve. Hence, although the gender imbalance in authorship identified here, and by other journals, likely reflects wider societal issues beyond our immediate control, we see initiatives such as demystifying peer review, and the wider journal publishing process, as one essential element of enabling and attracting a more diverse range of authors.

Building in part on the *Dialogues with the Past* workshop format, in 2021, *Antiquity* launched the *Rewriting World Archaeology* program, a year-long initiative to mentor three groups of ECRs based in Africa, the Middle East, and South Asia. Working in collaboration with colleagues from Bangladesh, India, Lebanon, South Africa, and the UK, and with funding from the British Academy, the program has paired 25 ECRs with two mentors each, bringing in other specialists from around the world to help develop a range of skills including writing for international, peer-reviewed journals. Through a mix of workshops and individual mentoring sessions, participants have been supported in the preparation of manuscripts for submission to journals, in the process also building international peer networks. The process to select the ECRs was based on an open

competition, with attention given to ensuring a wide geographical range and an equitable gender balance.⁴ Individually, none of the initiatives outlined above will bring about parity in submissions in the short term. They are, however, concrete first steps towards encouraging and supporting a more diverse range of authors, including better representation of female authors, in the pages of *Antiquity*.

Conclusions

Building on recent research to document and explore the underrepresentation of female authors in a range of archaeology journals, mainly based in North America, here we have provided the first study to analyze the gender of authors submitting papers for publication in the world archaeology journal *Antiquity* between 2015 and 2020. Our results broadly reflect those of other studies, identifying a long-term increase in the representation of women, but with figures still remaining far from parity. A recurrent female:male ratio of approximately 0.5, or one female for every two male authors, identified for a number of other journals appears to hold for *Antiquity*, as well; disaggregating this average by country and region of submission, however, reveals notable variation and encourages further investigation of the intersection of gender with geography. Also similar to other studies of archaeology journals, we have not found any evidence for bias in editorial decision-making, though the data collection process has highlighted the need to consider a more equitable balance of female and male peer reviewers. Data from 2020 also provide some qualified support for the observation that the Covid-19 pandemic has had an impact on the ability of female scholars to maintain their research, affecting some groups of women more than others. The results of this data collection and analysis now provide baselines against which the journal can monitor the results of initiatives to ensure equity in the publishing process, including the publication of more articles authored by women. These initiatives include a shift to double-blind peer review, increasing the

proportion of female peer reviewers, and leading mentoring programs to demystify journal publishing and to develop the skills and confidence required to grow capacity.

In presenting the results of our analyses, we have sought to caution nuance in the interpretation of some of the high-level figures, here and elsewhere, for example by recognizing significant variation in the female:male ratios of authors from different countries, which suggests the need for further investigation of intersectional issues and for more baseline data on the global archaeology community. We have also argued for the need to look beyond competition between journals to improve their individual gender ratios and to focus on growing overall capacity. In this regard, some initiatives such as Open Access publishing may inadvertently risk entrenching or worsening gender representation by erecting new barriers to authors based in “female-rich” sectors such as museums and CRM. We hope that the results of this study will feed into the growing body of research on gender and journal publishing, as well as helping to reflect on and reshape *Antiquity* as the journal moves towards its centenary.

Endnotes

1. NB that articles published in 2020 were almost all submitted during 2019 and thus predate any potential Covid-19 effect.
2. <https://www.hesa.ac.uk/data-and-analysis/staff/areas>.
3. <https://www.rsc.org/new-perspectives/talent/diversity-data-collection-in-scholarly-publishing/>.
4. <https://www.durham.ac.uk/departments/academic/archaeology/research/archaeology-research-projects/rewriting-world-archaeology/>.

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