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Reversing the byline hierarchy: The effect of equalizing bias on the accreditation of primary, secondary and senior authors

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ABSTRACT

Equalizing bias (EqB) is a systematic inaccuracy which arises when authorship credit is divided equally among coauthors who have not contributed equally. As the number of coauthors increases, the diminishing amount of credit allocated to each additional coauthor is increasingly composed of equalizing bias such that when the total number of coauthors exceeds 12, the credit score of most coauthors is composed mostly of EqB. In general, EqB reverses the byline hierarchy and skews bibliometric assessments by underestimating the contribution of primary authors, i.e. those adversely affected by negative EqB, and overestimating the contribution of secondary authors, those benefitting from positive EqB. The positive and negative effects of EqB are balanced and sum to zero, but are not symmetrical. The lack of symmetry exacerbates the relative effects of EqB, and explains why primary authors are increasingly outnumbered by secondary authors as the number of coauthors increases. Specifically, for a paper with 50 coauthors, the benefit of positive EqB goes to 39 secondary authors while the burden of negative EqB befalls 11 primary authors. Relative to harmonic estimates of their actual contribution, the EqB of the 50 coauthors ranged from <−90% to >350%. Senior authorship, when it occurs, is conventionally indicated by a corresponding last author and recognized as being on a par with a first author. If senior authorship is not recognized, then the credit lost by an unrecognized senior author is distributed among the other coauthors as part of their EqB. The powerful distortional effect of EqB is compounded in bibliometric indices and performance rankings derived from biased equal credit. Equalizing bias must therefore be corrected at the source by ensuring accurate accreditation of all coauthors prior to the calculation of aggregate publication metrics.

1. Introduction

Coauthors of a scientific paper customarily arrange the byline in hierarchical order to indicate the relative importance of each author's contribution (Lake, 2010; Maciejovsky, Budescu, & Ariely, 2009; Riesenberg & Lundberg, 1990; Vinkler, 2000; Waltman, 2012; Wren et al., 2007). Nevertheless, the standard bibliometric praxis is to ignore the byline hierarchy and instead allocate equal credit to all coauthors irrespective of their actual contribution; either by allocating one full credit to each coauthor, or by dividing one credit equally among all coauthors (e.g. Pendlebury, 2007). Either way, the ensuing information deficit introduces equalizing bias (EqB) which distorts authorship accreditation by underestimating the contribution of primary authors and overestimating the contribution of secondary authors (Hagen, 2008).

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The magnitude of such EqB distortion is potentially large. EqB accounted for 57% of the total variation in an analysis of empirical coauthor credit attribution (Hagen, 2013), confounded the ranking of *h*-index scores (Hagen, 2008), and was detrimental to accuracy when ranking the publication output of individual researchers (Hagen, 2014).

Here, I quantify the effect of EqB by subtracting harmonic estimates of actual coauthor credit from fractional credit scores. First, I show how fractional counting generates a reverse byline hierarchy of misallocated authorship credit, where the total amount of negative EqB affecting the primary authors is balanced by the total amount of positive EqB benefitting the secondary authors. I also delineate the transition from secondary to primary author status, and show how the ratio of secondary authors per primary author increases as the number of coauthors increases. Furthermore, I use relative EqB scores to show that each coauthor's fractional credit score becomes increasingly biased as the number of coauthors increases. Finally, I juxtapose authorship credit scores and EqB scores for papers with and without a senior author, and summarize the quantitative consequences for alternative bibliometric interpretations of senior authorship.

2. Material and methods

2.1. Authorship credit

Authorship credit was calculated according to a harmonic formula (Hagen, 2008), originally proposed more than 30 years ago by Hodge and Greenberg (1981). The harmonic formula (1) captures the basic structure of the byline hierarchy (Fig. 1A), and provides accuracy and parsimony by adhering to three simple ethical criteria for the equitable distribution of authorship credit (Hagen, 2010):

1. one publication credit is shared among all coauthors,
2. the first author gets the most credit, and in general the *i*th author receives more credit than the $(i+1)$th author, and
3. the greater the number of authors, the less credit per author.

The harmonic formula provides excellent fit when validated against empirical data (Hagen, 2010), whereas more complex models (Liu & Fang, 2012a, 2012b; Trueba & Guerrero, 2004) sacrifice simplicity without improving on the explanatory power of the harmonic formula (Hagen, 2013). In contrast, other simple allocation schemes, i.e. arithmetic, geometric and equal (fractional) counting, do not meet all of the aforementioned criteria and do not fit the data as well (Hagen, 2010).

Harmonic credit for the *i*th author of a publication with *N* coauthors is calculated as follows:

$$i\text{th author credit} = \frac{1/i}{1+(1/2)+\cdots+(1/N)} \tag{1}$$

2.2. Senior author credit

I assumed that the contribution of a senior author was equivalent to the contribution of the first author (cf. Buehring, Buehring, & Gerard, 2007; Mattsson, Sundberg, & Laget, 2011), and modified the harmonic credit scores accordingly to produce final harmonic estimates of actual coauthor contribution (cf. Hagen, 2008, Fig. 5 therein). In such cases, the first and the senior author share the credit for the 1st and 2nd position, and this reduces the credit of intermediate coauthors by one position as follows (cf. Hagen, 2008, Fig. 5 therein):

$$1\text{st and senior }(N\text{th})\text{ author credit} = \frac{1+(1/2)}{2(1+(1/2)+\cdots+(1/N))} \tag{2}$$

$$\text{Intermediate }(i=2,\ldots,N-1)\text{ author credit} = \frac{1/(i+1)}{1+(1/2)+\cdots+(1/N)} \tag{3}$$

2.3. Equalizing bias

Equalizing bias (EqB) was calculated as the difference between fractional credit and harmonic credit, as follows:

$$i\text{th author EqB} = \frac{1}{N} - \frac{1/i}{1+(1/2)+\cdots+(1/N)} \tag{4}$$

Relative EqB was calculated by expressing the EqB score as a percentage of the harmonic credit score.

$$\text{Relative EqB} = 100\,\frac{\text{EqB}}{\text{harmonic credit}} \tag{5}$$

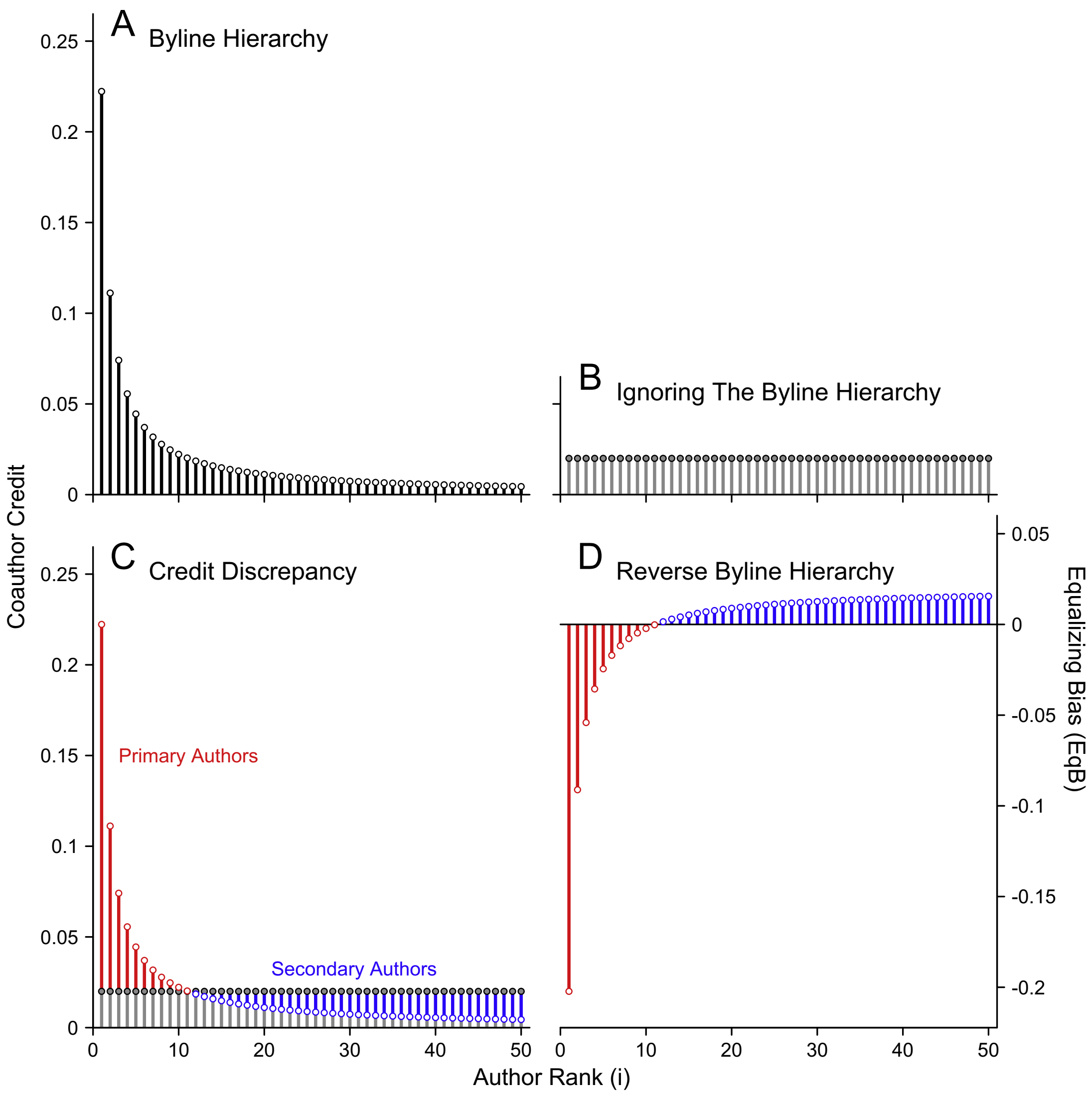

Fig. 1. Reversing the byline hierarchy. (A) Byline hierarchy of harmonic authorship credit. (B) Ignoring the byline hierarchy by dividing credit equally among all coauthors irrespective of their actual contribution. (C) Credit discrepancy between harmonic and biased equal credit illustrates the divide between primary authors whose contribution is underestimated by the amounts indicated in red, and secondary authors whose contribution is overestimated by the amounts indicated in blue. (D) Reverse byline hierarchy of equalizing bias (EqB), measures the amount of credit misallocated by dividing credit equally among coauthors who have not contributed equally. Primary authors are penalized by negative EqB (red), and secondary authors are favoured by positive EqB (blue). $N = 50$ coauthors.

3. Results

3.1. Reversing the byline hierarchy without a senior author

In Fig. 1A, the harmonic formula provides a parsimonious estimate of coauthor credit for a scientific paper with a hierarchical byline and no indication of equal contribution or senior authorship (cf. Hagen, 2013). Ignoring the byline hierarchy by dividing authorship credit equally among coauthors who have not contributed equally (Fig. 1B), underestimates the contribution of primary authors and overestimates the contribution of secondary authors (Fig. 1C).

The discrepancy between misallocated equal credit and harmonic estimates of actual credit generates a reverse byline hierarchy of equalizing bias (EqB), where the greatest penalty of negative EqB is levied on the first author, who has made the most important authorship contribution, and the greatest benefit of positive EqB is granted to last author who, in the absence of senior authorship, presumably has made the least important contribution (Fig. 1D).

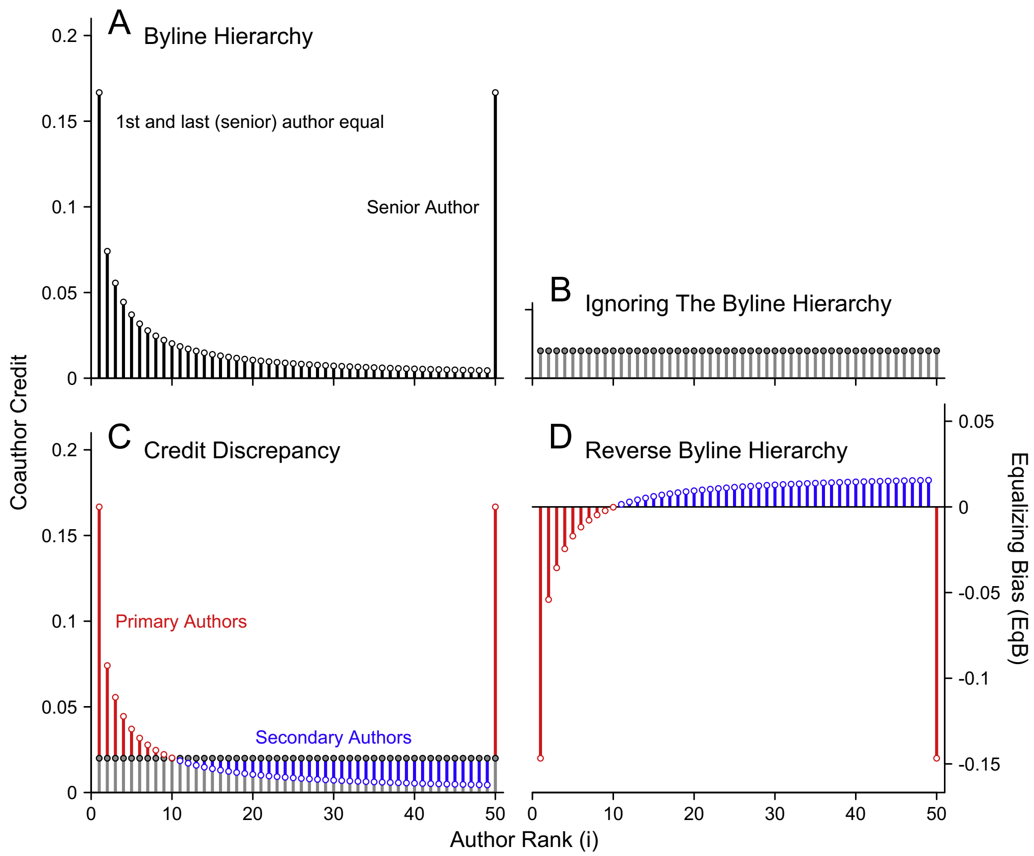

Fig. 2. Reversing byline hierarchy with a senior author. (A) Byline hierarchy of harmonic authorship credit with a senior last author whose contribution is equal to that of the 1st author. (B) Ignoring the byline hierarchy by dividing credit equally among all coauthors irrespective of their actual contribution. (C) Credit discrepancy between harmonic and biased equal credit illustrates the divide between primary authors), including the senior author, whose contribution is underestimated by the amounts indicated in red, secondary authors whose contribution is overestimated by the amounts indicated in blue. (D) Reverse byline hierarchy of equalizing bias (EqB), measures the distortional effect of dividing credit equally among coauthors who have not contributed equally. Primary authors (red), including the senior author, are penalized by negative EqB, and secondary authors are favoured by positive EqB (blue). $N = 50$ coauthors.

3.2. Reversing the byline hierarchy with a senior author

In Fig. 2A the harmonic formula provides a parsimonious estimate of coauthor credit for a scientific paper with a hierarchical byline and a senior last author (cf. Hagen, 2008, Fig. 5 therein). In terms of coauthor credit, senior authorship is functionally equivalent to shared 1st authorship, i.e. the credit for both the senior and the 1st author is equal to one half of the sum of the harmonic credit for the 1st and the 2nd coauthor positions (Fig. 2A).

Note that the presence of a senior author, who nominally occupies the position of last author, shifts the harmonic credit score of intermediate authors by 1 byline step such that the 2nd to the $(N-1)$th authors receive the same credit as the 3rd to the Nth authors of a paper without a senior author (Fig. 2A and C). Similarly, the EqB score of intermediate authors is also shifted by one byline step (Fig. 2D).

3.3. Relative EqB

Expressing EqB on a relative scale as a percentage of each coauthor's harmonic credit score reveals that the proportion of bias increases linearly as the contribution size decreases (Fig. 3A). Thus, dividing credit equally among $N = 50$ coauthors who have not contributed equally introduces inaccuracies ranging from a loss of −91% for the 1st author to a gain of >350% for the last (least) contributor. Furthermore, the fractional credit scores of 33 of the 50 coauthors are dominated by EqB, i.e. 5 primary authors are afflicted by losses greater than −50%, and 28 secondary authors gain more than 100%, relative to harmonic estimates of their actual contribution (points inside the golden areas in Fig. 3).

In the presence of a senior last (50th) author whose contribution is equivalent to the 1st author's contribution, both lose 88% of the credit corresponding to their actual contribution. Furthermore, the presence of a senior last author shifts the relative EqB scores of intermediate coauthors by 1 byline step as noted in the preceding section (Section 3.2, Fig. 3B).

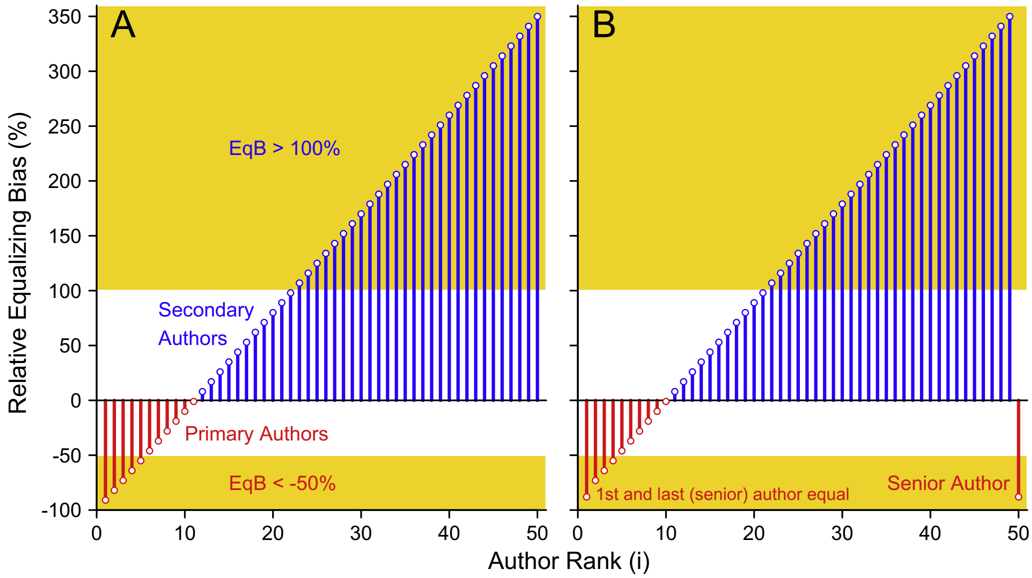

Fig. 3. Reverse byline hierarchy of relative EqB obtained by expressing EqB as a percentage of each coauthor's harmonic authorship credit score. (A) Without a senior author. (B) With a senior last author. $n_p = 11$ primary authors (red), and $n_s = 39$ secondary authors (blue). $N = 50$ coauthors. The golden areas indicate credit scores dominated by EqB.

3.4. The transition from secondary to primary authorship

For a paper with only 2 coauthors the amount of negative EqB for the primary author is balanced by the amount of positive EqB for the secondary author, and the ratio of secondary to primary authors is 1 (Fig. 4A). However, as the number of coauthors increases, the ratio of secondary authors per primary author follows a jagged pattern of increase where each drop marks a transition from secondary to primary authorship. Note that there is a trend for each successive transition to be separated by an increasing number of secondary authors (Fig. 4B). For papers with 3 or 4 coauthors the first author is the only primary author, i.e. the only coauthor affected by negative EqB. But the 2nd author also becomes a primary author at $N = 5$ coauthors, the 3rd author becomes a primary author at $N = 9$, *et cetera* until the 10th author becomes a primary author at $N = 44$, and the 11th author becomes a primary author at $N = 50$, at which point the ratio of secondary authors per primary author has risen to ≈3.5 (Fig. 4A).

Note also that although primary authors are increasingly outnumbered by secondary authors as the number of coauthors increases, the total amount of negative EqB befalling the primary authors is always balanced by the total amount of positive EqB benefitting the secondary authors. Accordingly, in the next section the resultant patterns of loss and gain are portrayed as a balance of asymmetrically partitioned negative and positive EqB.

3.5. Partitioning EqB

The first author of a paper with a hierarchical byline does not benefit from biased equal credit, and is always carrying the largest burden of negative EqB (Fig. 5A and B). For subsequent coauthors the initial advantage of positive EqB gradually diminishes as N increases, and eventually becomes a penalty when the EqB score drops below zero (Fig. 5A and B). This transition from positive to negative EqB signifies the change from secondary to primary authorship (see Section 3.4, Fig. 4A).

For primary authors the absolute amount of negative EqB reaches a maximum at a rank-specific inflection point (Fig. 5B). The first author reaches the inflection point as the number of coauthors increases beyond 8, the second author when the number of coauthors increases beyond 35, and for successive author ranks the inflection points are located outside the figure.

For papers without a senior author, the last (Nth) author always receives the greatest benefit of positive EqB (Fig. 5A and B). However, each subsequent co-author starts off as a secondary author with the peak benefit of positive EqB, and as the number of coauthors increases from N to $N + 1$, each successive last author receives less EqB than the previous last author, although this amount is still greatest among the $N + 1$ coauthors (Fig. 5A and B). In general, for a given number of coauthors the ith author has a lower EqB than the $(i + 1)$th author, while the EqB for the ith author of a paper with $N + 1$ coauthors is smaller than the EqB for the ith author of a paper with N coauthors. The combined effect of these changes is for the absolute range of EqB to contract as the number of coauthors increases beyond $N = 3$ (Fig. 5B).

For papers where the last author is a senior author the basic pattern is modified as the senior author, by equality with the first author, is also always a primary author when $N > 2$ (Fig. 5C and D). Note again that the presence of a senior author shifts the rank of the remaining authors by one byline position such that the 2nd author is shifted to the equivalent of 3rd

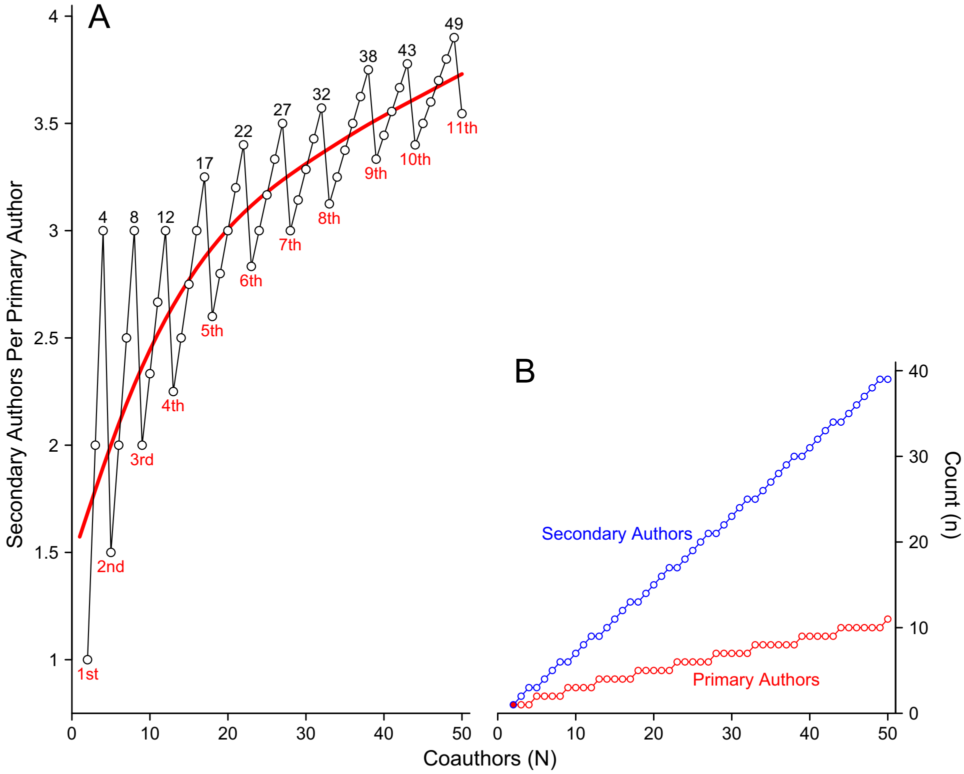

Fig. 4. Outnumbering primary authors. (A) The number of secondary authors per primary author zigzags upwards as the number of coauthors increases. Each peak indicates the threshold number of coauthors beyond which another transition to primary authorship occurs. The rank of successive primary authors is indicated underneath in red ordinal numbers. The smoothed trendline (red) indicates the jagged curve's general pattern of increase. (B) The number of secondary authors (blue) increases at a faster pace than the number of primary authors (red) as the number of coauthors increases, such that at $N = 50$ coauthors there are $n_p = 11$ primary authors and $n_s = 39$ secondary authors.

position *et cetera*, and the $(N-1)$th position is shifted to the equivalent of the Nth position of a paper without a senior author (Figs. 2 and 5C, D).

3.6. EqB dominance

The relative effect of EqB is exacerbated when authorship credit is shared equally among an increasing number of unequal contributors (Fig. 6A and B). Note that the effect of relative EqB is also exacerbated by lack of symmetry. The range expands in both negative and positive directions as the first author's loss increases and the diminishing amount of biased equal credit allocated to each additional coauthor is increasingly composed of EqB. At the negative end of the relative EqB-scale the first author's loss is asymptotically approaching −100% as N increases (Fig. 6B). But at the positive end of the scale, the relative EqB score of each successive last author increases without bound as N increases (Fig. 6A and B).

The number of credit scores dominated by EqB increases from 1 at $N = 4$ to 33 at $N = 50$ (points inside the golden areas in Fig. 6), i.e. from 25% of the credit scores at $N = 4$ to 66% of the credit scores at $N = 50$. Crucially, most credit scores are composed mostly of EqB for $N > 12$ (points to the right of the dotted line in Fig. 6B and D), either because more than −50% of the credit is lost to negative EqB or because the gain of positive EQB is greater than 100%.

For papers with a senior last author the basic pattern is modified (Fig. 6C and D), as described above (Section 3.5).

4. Discussion

When credit is divided equally among coauthors who have not contributed equally, the relationship between credit and contribution deteriorates as the number of coauthors increases, and the confounding influence of equalizing bias (EqB) rapidly intensifies to a level where it dominates the credit of most coauthors, i.e. to a level where more than half of the credit of more than half of the coauthors is either composed of positive EqB or lost to negative EqB. This massive shift of credit from primary to secondary authors is universally unaccounted for in evaluative bibliometrics relying on biased equal credit. Any ranking of biased equal credit scores is therefore likely to be misleading, as exemplified by the dramatic distortional effect of EqB the h-index (Hagen, 2008, Fig. 4 therein), and on rankings of publication output (Hagen, 2014, Figs. 2 and 3 therein).

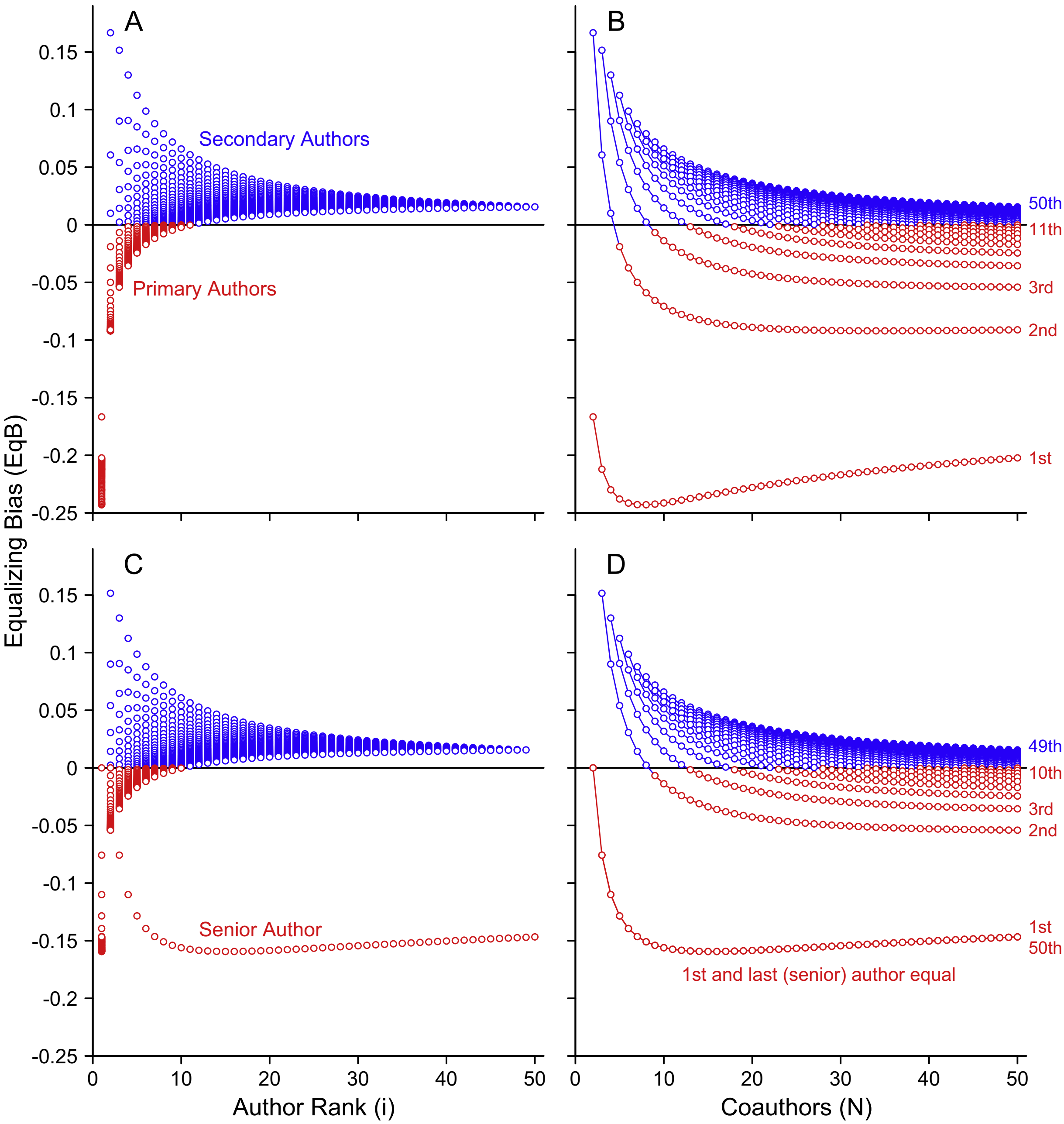

Fig. 5. Effect of EqB on primary, secondary and senior authors for papers with $N \leq 50$ coauthors. (A) Rank-related EqB scores for primary authors and secondary authors of papers without a senior author. (B) EqB scores and the transition from secondary to primary author status as a function of N. The first author never benefits from positive EqB, and is always a primary author. Subsequent authors benefit initially, but eventually become primary authors as the number of coauthors increases. (C, D) The presence of a senior (last) author whose contribution is equal to that of the first author shifts the EqB scores of intermediate authors ($N = 2, \ldots, N-1$) by one rank step, to the equivalent of authors ($N = 3, \ldots, N$) of a paper without a senior author. Horizontal line at zero indicates the transition from secondary (positive EqB, blue) to primary (negative EqB, red) authorship.

In general, EqB reverses the byline hierarchy and skews bibliometric assessments by overestimating the contribution of secondary authors and underestimating the contribution of primary authors. But the positive and negative effects of EqB, although balanced, are not symmetrical. Lack of symmetry exacerbates the relative effects of EqB, and explains why primary authors are increasingly outnumbered by secondary authors as the number of coauthors increases.

On an individual level EqB provides incentive for diluted effort by rewarding minimal contribution and penalizing above average contribution, thus contravening attempts to motivate and identify outstanding publication performance. Both extremes of individual contribution are exemplified by the last author position. At one extreme is a slight or non-existent

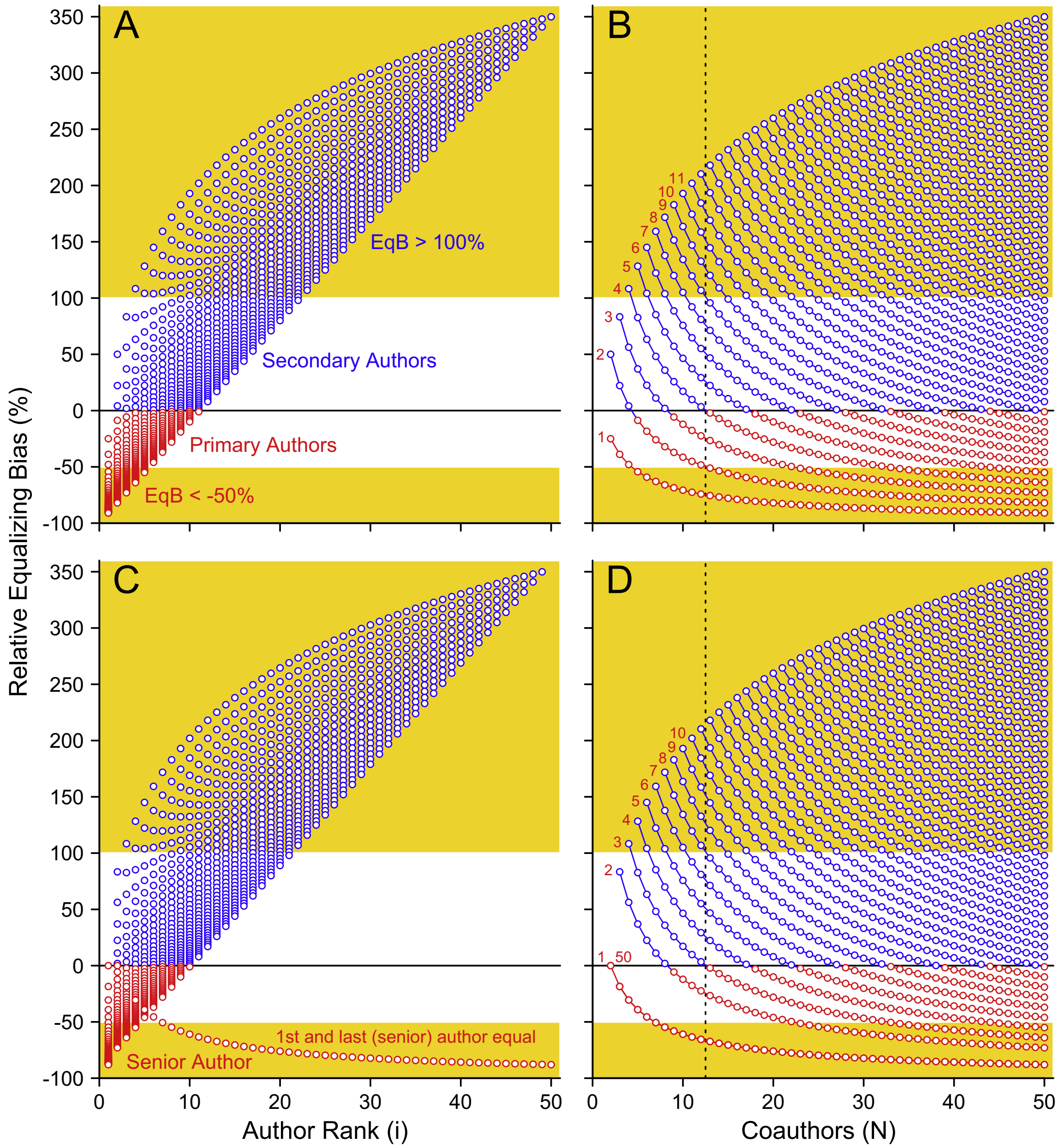

Fig. 6. Effect of relative EqB on primary, secondary and senior authors for papers with $N \leq 50$ coauthors. (A) Rank-related pattern of relative EqB scores for primary authors and secondary authors of papers without a senior author. (B) Relative EqB scores for individual authors scores and the transition from secondary to primary author status as a function of N. Red numerals indicate authors with primary status at $N = 50$ coauthors for papers with no senior author. (C, D) The presence of a senior (last) author whose contribution is equal to that of the first author shifts the EqB scores of intermediate authors ($N = 2, \ldots, N-1$) by one rank step, to the equivalent of authors ($N = 3, \ldots, N$) of a paper without a senior author. Horizontal line at zero indicates the transition between secondary (positive EqB, blue) and primary (negative EqB, red) authorship. The golden areas indicate credit scores dominated by EqB. Points to the right of the dotted vertical line represent papers where most credit scores are dominated by EqB.

contribution referred to as "honorary" or "gift" authorship (e.g. Greenland & Fontanarosa, 2012; Hodge & Greenberg, 1981), where any credit reward consists almost entirely of bias. At the other extreme is a *bona fide* senior author whose contribution is considered on a par with the first author's contribution, i.e. as equivalent to shared first authorship (Buehring et al., 2007; Hagen, 2008; Wren et al., 2007; Zuckerman, 1968), and should be accredited as such (Fig. 7A). But senior authorship cannot be properly accredited in the absence of evidence, and may therefore go undetected and be erroneously accredited as the smallest contribution in the byline hierarchy unless it is explicitly indicated (Fig. 7B). In a broader perspective, the question of how senior authorship should be properly identified and accredited is also part of a larger debate about the criteria for academic authorship that has spurred editorial demands for explicit author contribution statements to safeguard against unwarranted byline inclusion (Anonymous, 2009; Greenland & Fontanarosa, 2012; Rennie, Yank, & Emanuel, 1997).

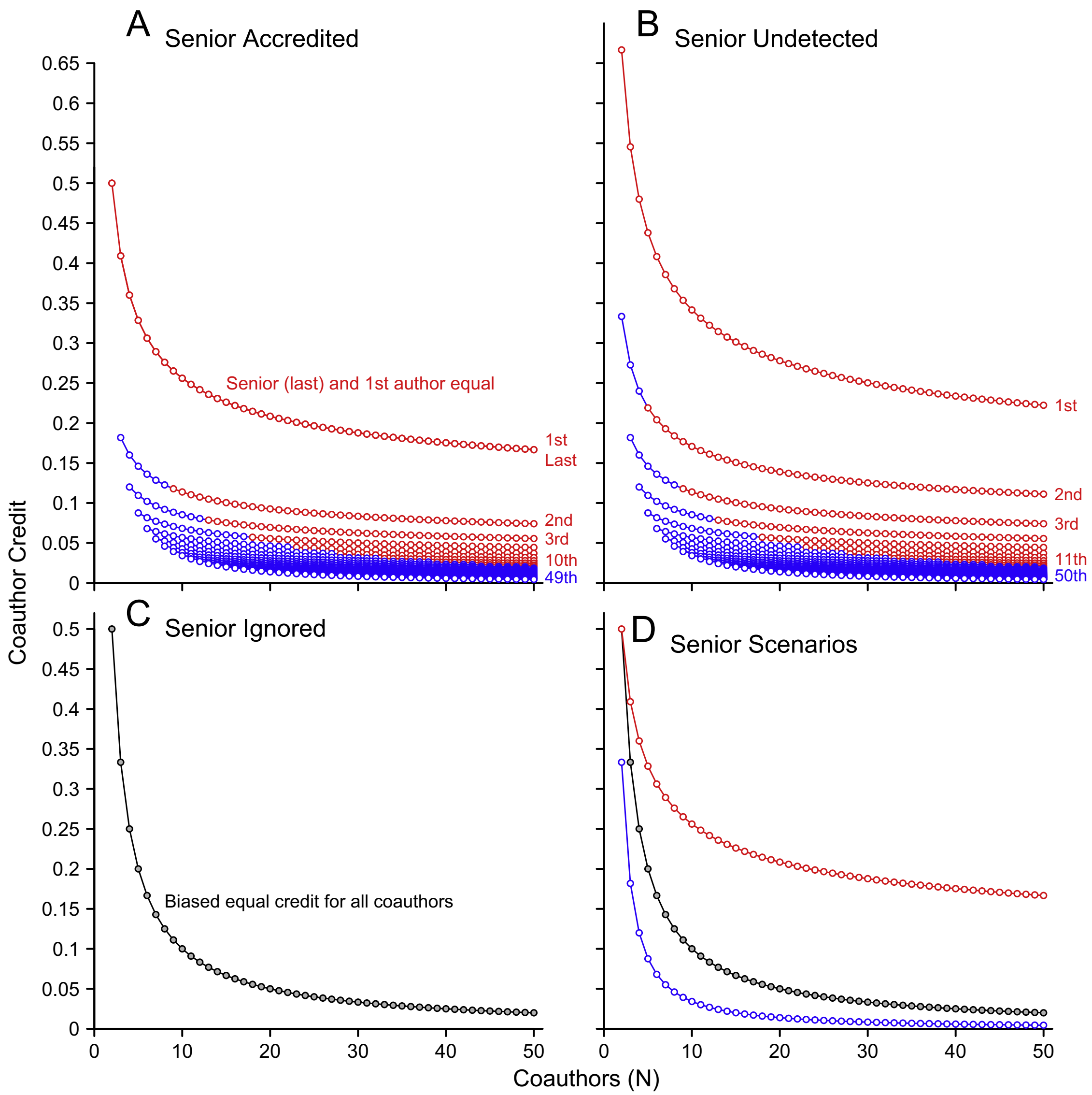

Fig. 7. Three scenarios for senior authorship credit. (A) Senior authorship correctly indicated, recognized, and accredited as equal to first author credit. (B) Senior authorship undetected in the absence of explicit indication. (C) Senior authorship ignored by issuing equal fractions of credit to all coauthors irrespective of their actual contribution. This is the default action of the currently prevailing bibliometric praxis. (D) Juxtaposing the three scenarios for senior authorship credit. A: Senior authorship undetected and erroneously classified as last authorship (blue curve). B: Senior authorship ignored as all coauthors receive biased equal credit (black curve). C: Senior authorship fully acknowledged and credited on a par with first authorship (red curve). Curves plotted for papers with $N \leq 50$ coauthors.

However, at present the default bibliometric action is to ignore all differential coauthor contributions, including senior authorship (Fig. 7C), which implies that the above average portion of the senior's credit is lost to negative EqB (Fig. 7D).

In closing it is important to note that the powerful distortional effect of EqB is inevitably compounded in bibliometric indices and performance rankings derived from biased equal credit (Hagen, 2014). Equalizing bias must therefore be corrected at the source by ensuring accurate accreditation of all coauthors prior to the calculation of individual publication scores or aggregate publication metrics (Hagen, 2008, 2013). Nonetheless, the use of biased equal credit has reached paradigmatic proportions, and is a virtually unquestioned integral ingredient of modern metrics-based research evaluation (e.g. Larsen, 2008; National Science Board, 2014; Pendlebury, 2007).

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References

Anonymous. (2009). Authorship policies. *Nature*, *458*(7242), 1078.

Buehring, G. C., Buehring, J. E., & Gerard, P. D. (2007). Lost in citation: Vanishing visibility of senior authors. *Scientometrics*, *72*(3), 459–468.

Greenland, P., & Fontanarosa, P. B. (2012). Ending honorary authorship. *Science*, *337*(6098), 1019.

Hagen, N. T. (2008). Harmonic allocation of authorship credit: Source-level correction of bibliometric bias assures accurate publication and citation analysis. *PLoS ONE*, *3*(12), e4021:4021-4027.

Hagen, N. T. (2010). Harmonic publication and citation counting: Sharing authorship credit equitably – not equally, geometrically or arithmetically. *Scientometrics*, *84*(3), 785–793.

Hagen, N. T. (2013). Harmonic coauthor credit: A parsimonious quantification of the byline hierarchy. *Journal of Informetrics*, *7*(4), 784–791.

Hagen, N. T. (2014). Counting and comparing publication output with and without equalizing and inflationary bias. *Journal of Informetrics*, *8*(2), 310–317.

Hodge, S. E., & Greenberg, D. A. (1981). Publication credit. *Science*, *213*(4511), 950.

Lake, D. A. (2010). Who's on first? Listing authors by relative contribution trumps the alphabet. *PS: Political Science & Politics*, *43*(1), 43–47.

Larsen, P. O. (2008). The state of the art in publication counting. *Scientometrics*, *77*(2), 235–251.

Liu, X. Z., & Fang, H. (2012a). Fairly sharing the credit of multi-authored papers and its application in the modification of *h*-index and *g*-index. *Scientometrics*, *91*(1), 37–49.

Liu, X. Z., & Fang, H. (2012b). Modifying *h*-index by allocating credit of multi-authored papers whose author names rank based on contribution. *Journal of Informetrics*, *6*(4), 557–565.

Maciejovsky, B., Budescu, D. V., & Ariely, D. (2009). The researcher as a consumer of scientific publications: How do name-ordering conventions affect inferences about contribution credits? *Marketing Science*, *28*(3), 589–598.

Mattsson, P., Sundberg, C. J., & Laget, P. (2011). Is correspondence reflected in the author position? A bibliometric study of the relation between corresponding author and byline position. *Scientometrics*, *87*, 99–105.

National Science Board. (2014). . *Science and engineering indicators 2014* (Vol. NSB 14-01) Arlington VA: National Science Foundation, US.

Pendlebury, D. A. (2007). *Using bibliometrics in evaluating research*. Thomson Scientific, White paper.

Rennie, D., Yank, V., & Emanuel, L. (1997). When authorship fails. A proposal to make contributors accountable. *Journal of the American Medical Association*, *278*(7), 579–585.

Riesenberg, D., & Lundberg, G. D. (1990). The order of authorship: Who's on first. *Journal of the American Medical Association*, *264*(14), 1857.

Trueba, F. J., & Guerrero, H. (2004). A robust formula to credit authors for their publications. *Scientometrics*, *60*(2), 181–204.

Vinkler, P. (2000). Evaluation of the publication activity of research teams by means of scientometric indicators. *Current Science*, *79*(5), 602–612.

Waltman, L. (2012). An empirical analysis of the use of alphabetical authorship in scientific publishing. *Journal of Informetrics*, *6*(4), 700–711.

Wren, J. D., Kozak, K. Z., Johnson, K. R., Deakyne, S. J., Schilling, L. M., & Dellavalle, R. P. (2007). The write position – A survey of perceived contributions to papers based on byline position and number of authors. *EMBO Reports*, *8*(11), 988–991.

Zuckerman, H. A. (1968). Patterns of name ordering among authors of scientific papers: A study of social symbolism and its ambiguity. *American Journal of Sociology*, *74*(3), 276–291.