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Group authorship, an excellent opportunity laced with ethical, legal and technical challenges

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ABSTRACT

Group authorship (also known as corporate authorship, team authorship, consortium authorship) refers to attribution practices that use the name of a collective (be it team, group, project, corporation, or consortium) in the authorship byline. Data shows that group authorships are on the rise but thus far, in scholarly discussions about authorship, they have not gained much specific attention. Group authorship can minimize tensions within the group about authorship order and the criteria used for inclusion/exclusion of individual authors. However, current use of group authorships has drawbacks, such as ethical challenges associated with the attribution of credit and responsibilities, legal challenges regarding how copyrights are handled, and technical challenges related to the lack of persistent identifiers (PIDs), such as ORCID, for groups. We offer two recommendations: 1) Journals should develop and share context-specific and unambiguous guidelines for group authorship, for which they can use the four baseline requirements offered in this paper; 2) Using persistent identifiers for groups and consistent reporting of members' contributions should be facilitated through devising PIDs for groups and linking these to the ORCIDs of their individual contributors and the Digital Object Identifier (DOI) of the published item.

KEYWORDS

Authorship; group Processes; publishing; reward; ethics

Introduction

Authorship credit is the most common and important way of recognizing contributions in academic collaborations (Shamoo and Resnik 2022). Because

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of the symbolic value of authorship credit (as an indicator of authority and expertise) and its compound effect on funding acquisition, personnel evaluation, and most academic career achievements, it is one of the most coveted forms of recognition in academia (Biagioli and Galison 2003; Latour and Woolgar 1986). Besides its value as a form of capital that facilitates access to resources and career advancement, authorship is also tightly connected to responsibility and accountability in published research, as it is a means of tracing those involved in research if questions arise about the used methods or about the reliability of published research results (Cronin 2001; McNutt et al. 2018). Accordingly, due to its value as a commodity in academic contexts and its potential to indicate responsibilities, the distribution of authorship credit is often a contentious issue (Youtie and Bozeman 2014). There are numerous historical cases of authorship misattributions and related ethical challenges as well as a range of guidelines and best practices about ethical authorship and/or how to minimize tension in attributions (see COPE: Committee on Publication Ethics (2024) Embassy of Good Science (2024) or the Online Ethics Center (2024) for examples).

While the distribution of authorship credit among individual researchers has been widely discussed, group authorship has not been specifically explored in recent reviews of the literature on scholarly authorship (see e.g., Claxton 2005a, 2005b; Hosseini and Gordijn 2020; Marušić et al. 2011). Some technical issues related to indexing group authorships, such as linking the citations to articles with a group author, were explored and addressed in the early 2000's (Dickersin et al. 2002; Flanagin, Fontanarosa, and DeAngelis 2002) but since then, group authorships have not been debated thoroughly.

By “group authorship,” we mean contributions that are recognized with a group, team, consortium or other collective names. The phenomenon can occur in a range of contexts, from citizen science (Resnik, Elliott, and Miller 2015) to “multicenter study investigators, members of working groups, and official or self-appointed expert boards, panels, or committees, who wish to display a group name to indicate authorship” (Fontanarosa, Bauchner, and Flanagin 2017, 2434).

Bibliometric reports show that group authorship (also called corporate authorship, team authorship, and consortium authorship) has increased in recent decades. While between 2000–2004 only 29,588 articles listed in PubMed, about 1.04% of publications, noted a group author in their byline, between 2015–2019 this increased to 77,698 articles, about 1.35% of publications (US National Library of Medicine, 2023). Group authorship is not only common in scholarly manuscripts (Ridley 2019), but it also appears in other scholarly outputs, e.g., datasets (Dudek, Mongeon, and Bergmans, 2019) and software (Miller 2007). Group authorships can continue to rise for several reasons.

Besides the increasing significance of team science and large-scale research collaborations, the increasing use of group authorships can be due to their ability to improve the visibility of group activities. Furthermore, group authorships can help teams resolve or bypass difficult and contentious issues in assigning authorship credit. In urging journals, repositories, and funders to encourage and promote the recognition of group authorships (Elliott et al. 2017), researchers have argued that group authorship helps alleviate the challenges of defining authorship order and improves the findability of works conducted by a group (Meinert 2020).

Group authorship also allows recognizing individuals whose contribution is not the type that satisfies conventional authorship criteria, or not sufficient in amount but, as a group, the individuals' combined efforts meet authorship criteria. This may be an important function of group authorship in some fields, such as in clinical studies in which patient recruitment and community engagement experts are only involved in the initial stages of the project. In health and biomedical research, citizen scientists involved in N-of-1 or self-tracking data collection and data processing (Wiggins and Wilbanks 2019), and in ecology with citizen scientists, indigenous communities or even conventional scientists who merely collect a small subset of the data for a project (Fraisl et al. 2022). Indeed, the advent of smartphones and the Internet has made it possible to distribute data collection to larger and larger numbers of people, crucial for the far-flung and/or frequent monitoring required in fields like ecology (Ward-Fear et al. 2020).

Group authorship can also help diversify recognition of contributions in group efforts beyond individual authorship. Indeed, in theory, group authorship could be a useful form of attribution to support teams in recognizing a wider range of contributions, but as will be shown shortly, they also raise some fundamental ethical, legal and technical challenges.

There are also reasons to believe that group authorships might fall out of favor. Especially with the recent modifications in Clarivate's criteria for ranking highly-cited researchers – a metric utilized by the Academic Ranking of World Universities – a decline in this form of attribution could be a likely scenario. Since 2022, Clarivate has excluded papers with over 30 authors or those with group authorship from this calculation, stating, “Awarding credit to a single author among numerous listed on a paper is unreasonable. Hence, any highly cited paper with more than 30 authors or explicit group authorship was removed from our analysis” (Clarivate 2022). While using quantitative metrics for identifying the quality of research is problematic, given their use in the current scholarly incentive and evaluation systems, changes in how these metrics are generated impacts attributions.

In what follows, we use specific examples to discuss ambiguities of group authorship and the associated ethical, legal, and technical implications.

Ethical challenges

Some group authorships contribute to ambiguities regarding the attribution of credit and responsibilities, which can negatively affect career progression of researchers. For instance, let's consider a researcher who published dozens of important papers under a group name. If the paper does not mention their name and specific contributions, how can they provide a verifiable account of their previous contributions in their resume? These ambiguities can also negatively affect the integrity of publications since providing a clear description of who has done what in a research project, enables a fair attribution of credit and responsibilities (Shamoo and Resnik 2022). Furthermore, ambiguities regarding attributions not only distort the provenance of ideas, they also perpetuate unjust and toxic work environments that tolerate or condone misattributions of credit (Penders and Shaw 2020).

Without aiming to be exhaustive, we will explore two ambiguities associated with the use of group authorship:

- (1) **Who were the group members involved in the project?** When using group authorship, some papers do not clarify who the members of the group are.
- (2) **What did the group members do?** When using group authorship, the contributions of the individual members of the group are not always mentioned.

The second ambiguity also frequently occurs with a conventional list of individuals as authors, but contribution statements often provide at least some information about an individual's contributions. However, these solutions do not always fit group authorships, and may result in employing haphazard disclosure methods. An analysis of group authorships in the Cochrane Database of Systematic Reviews ($n = 41$) showed that 23 papers that had a group author in the byline, listed members in the "Acknowledgements" section, 10 listed members in the "Contributions of authors" section, one listed members in both "Acknowledgements" and "Contributions of authors," and one offered an external hyperlink to a list of group members but the link was inaccessible (Andersen et al. 2020, 200).

In cases in which both a group author and individual authors are present in the byline, the group may be listed because of having collectively contributed to one specific task (e.g., data collection or analysis). This may have required a team effort, with each of these contributors doing a different part

of that task, which cannot be accurately reflected with taxonomies designed to reflect individual contributions.

In addition to the above-mentioned ambiguities, the varying extents of contribution per group member and the duration of involvement can also be considered, though these are also common ambiguities in individual authorships.

In what follows, we describe three examples to illustrate how these ambiguities arise in published papers and to elucidate their ethical consequences.

- A) In 2020, Ruttu Phiri et al. (2020) reported a medical study with 9 individual authors and one group co-author – the “BILHIV study team.” While the BILHIV study team is listed as the last author, we could not find any listing of the team’s members (**ambiguity #1**). Team members are not listed in the acknowledgements section, nor are they identified at the webpage linked in the paper. Since it is possible for subsets of a large team to work on different projects, and team members can change over time, adding a team or group’s name to the byline without further specification of members who contributed to the paper raises questions about ethical attribution of credit and responsibilities. Regarding credit, providing a blank check for all members of the BILHIV study team to claim credit for the paper leads to credit inflation (Hosseini, Lewis, et al. 2022). Everyone who has been a member of the BILHIV group around the time when this paper was published could potentially claim involvement in this study, regardless of what they did (**ambiguity #2**). In relation to responsibilities, these ambiguities contribute to a diffusion of responsibilities and blur the demarcation between individual and group assumptions about responsibilities. Accordingly, in case of erroneous results or future discovery of fraud, investigations will have no access to a public record of involved members and may have to rely on claims made by the group members. This can be a much more contentious issue in discussions about sanctions and liabilities: which group member should suffer the consequences of an error or egregious violation of ethical norms?
- B) Eaton et al. (2018) listed the *Reproducibility Project: Cancer Biology* group in addition to three individual authors. Group members are listed in the “Group author details” section of the PDF and can be seen by clicking on the group name in the online version. The overall contribution of the team is also disclosed (“Analysis and interpretation of data, Drafting or revising the article”), but the specific contributions of individuals within the team are not (**ambiguity #2**). Similar to the previous example, this could result in unethical attributions of credit and responsibilities. Furthermore, as a result of using group authorship, conflicting interests seem to be obscured. Three of the team members

hold shares in one of the research partners (Science Exchange Inc.). This is a particularly thorny issue because from the perspective of industry partners, (individual) authorship implies *intellectual intervention* whereas contribution to *tasks* might help “avoid allegations of conflicts of interest” (Larivière, Pontille, and Sugimoto 2021, 124). Furthermore, in an apparent typo, in the list of group author members of this paper, the five members of the group are listed twice. We do not consider this to be a consequential mistake, and such a mistake could be made with non-group authors as well, but we suspect that it would have been caught if it happened in a non-group authors list.

- C) Unlike previous examples, the paper published by McIntosh et al. (2018) does not contain ambiguities about involved project members or their contributions. In this case, twenty-two individual authors and a group author, called the SIMPATHY consortium, are mentioned in the byline. In this case, we not only know who the members of the SIMPATHY consortium were, we also know their specific contributions, which are indicated using CRediT roles in the acknowledgements section, e.g., “Astrid Forsström, Uppsala University Hospital, Uppsala, Sweden (resources, supervision and writing—review & editing related to the Swedish Case Study).” However, because the contributions of the SIMPATHY consortium are mentioned in the acknowledgements section wherein the JATS-XML standardized metadata is not included, contributions cannot be indexed and tallied.

Addressing these types of ethical challenges will require extended community discussion, ideally leading to consensus, though perhaps only at a high level, with details that vary across communities. The Committee on Publication Ethics (COPE) is an appropriate body for these interdisciplinary discussions, while the situation within disciplines is less clear. In some cases, there is a possible convening group, such as the International Committee of Medical Journal Editors (ICMJE) in medicine, while in others, such as computer science, there are a variety of individual groups and organizations but no regular coordination, other than through the larger STM Association.

There may also be differences in policy across different types of works. It is perhaps for this reason that COPE does not define authorship requirements but merely recommends “including clear guidance/criteria for authorship in journal instructions” (COPE: Committee on Publication Ethics 2019b). While many journals that publish traditional scholarly results have demanding requirements on authorship (e.g., ICMJE’s four criteria¹), journals that publish outputs such as software may have much looser requirements, such as in the Journal of Open Source Software: “The authors themselves assume responsibility for deciding who should be credited with co-authorship, and co-authors must always agree to be listed. In addition, co-authors agree to be

accountable for all aspects of the work, and to notify JOSS if any retraction or correction of mistakes are needed after publication” (Journal of Open Source Software documentation 2024, para 11). Similarly, many journals are now requiring contribution statements using the CRediT taxonomy (NISO: National Information Standards Organization 2020), but as this was created by analyzing freeform statements in life science papers, it may not be as useful in disciplines where peer reviewed publications may not be the primary output (e.g., visual arts) or disciplines where other types of output, such as data, software, computational notebooks, might be more important than journal articles (Hosseini, Colomb, et al. 2022).

Legal challenges

Authorship is tightly linked with copyrights and intellectual property rights (Lissoni and Montobbio 2015; Lissoni, Montobbio, and Zirulia 2013; Shamoo and Resnik 2022). A legal question that can arise when using group authorship pertains to the relationship between contributors and the aforementioned rights: are members of a group authorship entitled to the rights of individual authors? Various guidelines about group authorship offer different recommendations regarding criteria for inclusion, responsibilities and disclosure, all of which can also have legal implications. For example, the ICMJE guidelines state that the members who can take credit and responsibility as *authors* should be identified, without stipulating that this must include *all* the group members:

Some large multi-author groups designate authorship by a group name, with or without the names of individuals. When submitting a manuscript authored by a group, the corresponding author should specify the group name if one exists, and clearly identify the group members who can take credit and responsibility for the work as authors. (ICMJE: International Committee of Medical Journal Editors 2024)

While this stipulation suggests that it is acceptable for a group to have both members who can take credit and responsibility for authorship, and, members who cannot; it remains ambiguous as to how this distinction should be made. Should the ICMJE’s four criteria for individual authors be used to identify those who can take credit and responsibility for the work, or should the corresponding author use other criteria? In contrast, the World Association of Medical Editors (WAME) only demands that one investigator takes responsibility for the work done by a group:

A “corporate” author (e.g., a “Group” name) representing all authors in a named study may be listed, as long as one investigator takes responsibility for the work as a whole. (WAME: The World Association of Medical Editors 2007)

Authorship guidelines offered by *Nature* journals do not have any specific suggestion regarding responsibilities but do indicate that one can be both an individual author and a member of a group author in the same paper:

A collective of authors can be listed as a consortium. If necessary, individual authors can be listed in both the main author list and as a member of a consortium. All authors within a consortium must be listed at the end of the paper. (Nature Portfolio Editorial policies 2024)

The authorship guidelines of Oxford University Press's *Toxicology Research* require that all members meet the ICMJE authorship criteria and offer a rather unusual suggestion for authorship order:

For large, multi-institutional project consortiums, we recommend the following. Using the Consortium Name as the author for the entire paper, which will appear as such in the indexing services. Then include in the article, a separate table that lists each institution with the researchers at that institution in the order preferred by that institution. The individuals in this list must all meet the ICMJE authorship guidelines. (Oxford Academic 2023)

These disparities could have legal ramifications for those involved depending on how copyrights are handled at a publisher level. Some academic publishers require authors to transfer the copyright of their work to the publisher. Others allow authors to keep the copyright but require them to license the publisher to publish the work. For instance, Elsevier requires authors to transfer their copyright upon manuscript acceptance. Springer provides Open Access options that allow authors to keep their copyrights, but they also request a copyright transfer for some of their publications. Public Library of Science (PLOS) and BioMed Central (BMC) operate on an Open Access model, and authors retain copyright for their work provided they grant the publisher a license to publish the article.

Under U.S. copyright laws, both routes require all *co-authors* (i.e., those who have met authorship criteria) to agree to the transfer or the licensing. The need for all authors to agree to copyright transfer or to grant an exclusive publishing license will be problematic when a group author is involved and not all members are listed. Some publishers ask all authors to fill out a form. One reason for this is that all authors maintain joint ownership of the copyright unless they all agree to transfer the copyright to the publisher. Agreement of all authors is also needed for a publisher to receive an exclusive license to publish the work, as is expected by most publishers for open access publishing. Nevertheless, in our experience, it is more common that the publisher asks only the submitting author to do this, asserting that all the coauthors have agreed to transfer (or own) copyrights. If someone were to contest whether the copyright was legally transferred (or an exclusive publishing license granted), the publisher may have no evidence that all

group members agreed to the transfer or license granting. The same applies in the case of open-access publication or an exclusive publishing license.

Ambiguities about copyrights could also add more complexity to discussions about responsibilities and accountabilities. As mentioned earlier, when investigating erroneous results or fraud, public records of involved members and their specific contributions may have a bearing on what/how sanctions are imposed. Beyond responsibilities and accountabilities, conflicts and tensions in group authorships are unique and cannot be adequately resolved by recourse to norms of individual authorship. An example of this discrepancy was highlighted in a case submitted to COPE. This case involved a department that publishes short reviews of existing articles, written by their researchers. These researchers are prohibited from reviewing articles that they have authored. Accordingly, the department rejected a review because the reviewer was a member of “study group X” listed as an author on “Name A” paper. The reviewer challenged the decision, claiming:

I am not an author on the “Name A” paper. The latter is a substudy, which uses the “study group X” database. While we entered some patients into the main trial, in no way do I fulfil authorship criteria given that I never even saw a draft of the paper nor knew it was being submitted. (COPE: Committee on Publication Ethics 2008, para. 3)

The department proceeded to publish the review, noting this as a “competing interest.” The COPE forum considered this case to be in a gray area and advised:

Even though the reviewer is not directly involved in the study, is he sufficiently removed? The case also highlights the fact that the definition of an author can be vague and different journals have different criteria. Some suggested that the journal should consider disqualifying a reviewer with any involvement in a study from publishing reviews concerning that study. This would give the reader more confidence in the system. All agreed that the best course of action is to have a policy on this issue for future such incidences. (COPE: Committee on Publication Ethics 2008, para. 3)

Although this case mostly discusses the peer-review process, it also illuminates authorship issues: a member of a group authorship openly disclosed not only their lack of contribution to the paper and confirmation of the draft, but also their unawareness of the submission in the first place. Again, depending on how copyrights are handled at a publisher level, solutions as well as legal ramifications for cases like this might differ. The point is that group authorships can lead to more cases of individuals not even knowing that a manuscript was submitted and not approving of its contents or willing to take any responsibility for it. Indeed, since group authorship often implies small individual contributions, it is challenging to expect every group member to take full responsibility for the whole manuscript. Nevertheless, the

expectations for individuals to be responsible for their own contributions, be aware of the manuscript submission, and confirm the drafted manuscript are well placed and self-evident.

Technical challenges

Since journals, repositories and other publication outlets have dissimilar infrastructure and sometimes offer no specific guidelines regarding how group authorships should be reported, it is unsurprising that group authorships are reported inconsistently (Andersen et al. 2020). As was mentioned in the section about ethical challenges, some groups list all their members in an Author Note section, Acknowledgments or elsewhere, but some do not. However, when publications avoid displaying the group members' names or list group members and their contributions only in the acknowledgments section or elsewhere, individual members of a group cannot be linked with the paper in scholarly databases such as Web of Science or PubMed because these systems are designed to recognize and tally authors' names and do not consider those who are acknowledged. As a result, when group authorships are used, scholarly indices only register the group name and not the team members' names even in cases when they are readily available in the manuscript.

Furthermore, while individual authors can use Persistent Identifiers (PIDs) such as ORCID to prevent name ambiguity and allow indexing services to unambiguously index and tally their records., groups have not been linked with PIDs. As a result, there is a greater chance for name ambiguity when using group authorships.

Recommendations

Develop and share context-specific and unambiguous guidelines for group authorship

Regardless of suggested solutions, adoption and consistency of practices across disciplines are a major challenge for the use of group authorships. Similar to the disciplinary differences in terms of contributions that grant individual authorship (Cronin 2005), the nature of group contributions varies by discipline. For example, a group of philosophers might brainstorm as a team and offer collective insights as part of a moral case deliberation session, and a group of chemists in a wet lab might work on compounds and generate a new formula as a team. While both groups have collaborated and worked toward a common goal, their deliverables are very different (e.g., in terms of whether/how/where it is published and its potential value as a commodity in academia or outside of it) and should be assessed in

a different light. Disciplinary differences aside, even for some research objects like open-source software that may be developed across disciplines, new versions are produced frequently, with some versions associated with new authors (making their first contribution to the most recent version), existing authors (those who contributed to previous and most recent versions) and previous authors (those who contributed only to earlier versions). As time passes and code changes, some former authors may no longer have any remaining code they have written in a software project. This could mean that they should no longer be listed as a contributor of future versions, but it also might not, as authorship does not need to be directly tied to writing code: many other types of contributions exist (e.g., designing, testing, debugging) that might not necessarily require writing code. Acknowledging legacy contributions is particularly complicated in coding. In scholarly writing, researchers do this by means of citing published works of previous authors to openly acknowledge them and pay their intellectual debt, but this is not an option when writing code.

Accordingly, offering one solution that captures all disciplinary and contextual variations and research objects would be extremely challenging, if not impossible. Even if problems such as a clear demarcation of disciplines are resolved and each discipline devises their own guidelines, challenges will arise in interdisciplinary projects. Furthermore, some disciplines will inevitably adopt different (or opposing) practices and so there will never be total consistency across disciplines. More importantly, as guidelines on individual authorship and contributions have shown us, *enforcing* guidelines is more complicated than their development (Hosseini et al. 2023). This is shown loud and clear in studies that have explored researchers' contributions to scientific publications (indicated via CRediT), demonstrating that the ICMJE guidelines are not always followed (Larivière, Pontille, and Sugimoto 2021).

On that basis, in accordance with the COPE minimum requirements for authorship (COPE: Committee on Publication Ethics 2019a), we encourage journals to define unambiguous guidelines and recommendations for group authorship. To minimize ethical and legal challenges of group authorship outlined in the previous sections, and to account for disciplinary differences, we recommend the following baseline requirements to be considered by all journals when compiling guidelines for group authorship:

- (1) All group members should make relevant contributions (be it administrative, creative, intellectual or technical) to the work, and should be responsible and accountable for their contributions;
- (2) All group members should be aware of the manuscript submission, and should confirm the final draft;
- (3) Both the group name and the contributing group members as well as their ORCIDs should be listed in the manuscript;

- (4) Group members' specific contributions should be specified in the acknowledgment section with as much details as required to ensure that specific questions about different tasks can be addressed.

Considering the lack of specific guidelines for group authorship in some journals, groups too are advised to develop their own authorship arrangements and workflow and openly communicate them. For example, this could include how and when they collect group members' agreement to the transfer of copyrights or the publishers' licensing agreement. There are currently many examples of this approach in individual authorship practices. For example, the International Nutrient Network (NutNet), consists of scientists based at more than 170 sites in six continents with more than 120 publications "documenting new insights into Earth's grassland diversity and ecological functioning" (Borer et al. 2023, 1433). On NutNet's website, a page titled "Authorship of NutNet Manuscripts" (see <https://nutnet.org/authorship>) explains the publication and authorship process, mandating researchers to accompany their papers with a supplemental table indicating one of the seven contributions that are specific to NutNet's context. Other examples include the Algonquian Language Digital Resources Credit System (Bliss et al. 2020) and Taxonomy for software contributions with a qualitative scale (Alliez et al. 2020).

Facilitating consistent and transparent reporting of group contributions

To address technical challenges mentioned in this article, we propose a two-stage solution to enable better integration of group contributions to the existing scholarly reward system and improve the consistency of reporting group authorships.

First, we propose the creation of PIDs for groups (similar to ORCID for individual authors) for reporting collective contributions. The use of group PIDs would prevent group name ambiguity by creating a link between the group and its outputs. This would also help discoverability by allowing major DOI registration agencies, such as Crossref or DataCite, to tally research outputs made by the same group. It is true that developing a new PID "requires a lot of effort, including careful thinking about uniqueness, persistence, descriptiveness, interoperability, and governance" (Katz 2017). We also understand that due to the movement of members across groups and/or institutions, devising PIDs for groups is much more complicated than for authors. That said, one can argue that in the same way that the scholarly community reached a consensus about and developed the Research Organization Registry (ROR), a global registry of PIDs for research

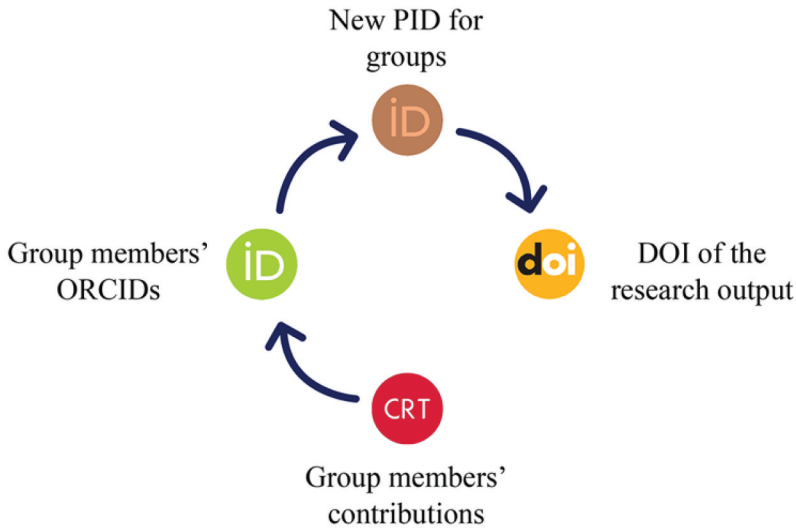


Figure 1. Upon devising a new PID for groups, each group member's ORCID (when possible, together with their contributions described with taxonomies like CRediT) can be linked to the digital object identifier (DOI) of the published work.

organizations (which are one variety of a group of researchers), groups also could and perhaps should be assigned PIDs.

Second, we recommend linking each group member's ORCID (when possible, together with their contributions described with taxonomies like CRediT) to the Digital Object Identifier (DOI) of the published work and the new PID for groups (Figure 1).

These linkages could help mitigate the ambiguity concerning which group members contributed to a particular output and what their contributions were. In contexts where existing role taxonomies adequately describe the roles involved in a project, PIDs for groups could be linked with role taxonomies such as CRediT (NISO: National Information Standards Organization 2020) and TaDiRAH (Borek et al. 2021) and communicate with the ORCID API to remove the mentioned ambiguities around what the whole group or specific members of a project did. Open-source applications such as Tenzing (<https://tenzing.club>) can be incorporated into these solutions to reduce the burden on authors (Holcombe et al. 2020). These linkages could be facilitated at two points of the publication process:

Integration by publishers

- During the submission process, publishers could ask the submitting contributor to include all group members' ORCIDs and their contributions, which could be included in the metadata publishers pass to the DOI registration agency. When registering content like journal articles with Crossref and DataCite, publishers can include the

individual ORCIDs of group members together with their contributions. The first step of this approach is adopted by the *Proceedings of the National Academy of Sciences (PNAS)* and seems to be rather straightforward. *PNAS* guidelines on group authorship notes “Individual members of the group are displayed within the Supporting Information of the published article and are included within the article metadata to ensure that the article is correctly indexed and linked to individual members in searches” (PNAS, 2023, para. 16). Adding individual contributions to this linkage could follow the same method.

Institutional repositories

- Institutions can facilitate this linking in their repositories by encouraging or mandating the use of ORCIDs and contributor taxonomies when faculty or researchers submit their works. When works with group authors are assigned DOIs (either by the institution or another entity), the repository system can associate the ORCIDs of group members together with their contributions with the assigned DOI.

Offering PIDs and linking the ORCIDs of group members together with their contributions to the published DOI could be conducive to ethical values such as transparency and accountability. Perhaps the `relationType` property for ORCIDs might be one way of associating group PIDs with the ORCIDs of the individual group members. Currently, however, Crossref and DataCite (major DOI registration agencies that have integrated ORCID into their systems) only include a group name under the authors list, as if it was another (individual) author without making the connection between the group and its members explicit. In cases where both individual and group authors are included in a byline, adding better structure to distinguish authors who are part of a group from authors who are not part of the group would need to be added by Crossref/DataCite to achieve a full solution.

Discussion

Group authorship challenges the traditional agent-centered view of authorship that puts one or some individuals at the center of research projects (Bennett et al. 2023; Clark and Khosrowi 2022). The agent-centered view may be ill-suited for recognizing contributions to collaborative science because authorship was initially not intended for this purpose. We inherited this concept from an era with a different scientific paradigm when all aspects of

a research project were conducted by one person or a few individuals. However, when dozens and sometimes thousands contribute to a project, and only a few actually write the manuscript and review it before publication, assigning individual authorship to acknowledge all contributors can be problematic. Specific challenges associated with acknowledging collective contributions have been explored in contexts such as high-energy physics (Birnholtz 2008), global biodiversity (Borer et al. 2023), creation of a language atlas (Bliss et al. 2020) and software development (Alliez et al. 2020). Indeed, the agent-centered view is especially contentious in contexts in which authorship is meant to recognize a collective. This includes indigenous contexts in which, collective production and expression of cultural knowledge benefits an entire community (Bliss et al. 2020; Marshall's et al. 2021).

Sed contra est ...

In this paper, we have explored group authorship and ways in which it can comply with, or would rather be at odds with, established frameworks concerning authorship. Group authorship can help to solve (or bypass) discussions and negotiations about (individual) authorship. Especially in international and interdisciplinary consortia, involving researchers from different disciplinary backgrounds based in different countries, where ideas and conventions about authorship attribution easily become contentious (Bird, Hosseini, and Plemmons 2023). Yet, we also highlighted serious challenges, such as a plurality of practices and conventions about group authorship. The ambiguities we highlighted showed that in practice, group authorships diverge from the established assumptions about authorship.

A hidden assumption may be at work in our arguments so far, namely that the individual author should unquestionably be the starting point, our default. It is precisely here, one could argue, that some interesting questions about our focus on individuality could be put forward. For instance, in medieval times when authors were active in the context of monasteries, workshops, and schools, anonymity, or even conscious misattribution was prevalent. Indeed, it could be argued that, historically speaking, scholarly authorship began as *group* authorship. The agent-centered concept of authorship is a recent invention, which according to the Oxford Dictionary was first mentioned in 1710, and since then has resulted in attribution of individual credit (Ede 1985). Citing Judson B. Allen (1971), Lisa Ede added:

When we are faced with medieval authors and readers alike, we are faced with a foreign nonempirical sensibility. We are confronted by authors who are for the most part content to repeat inherited materials, making their own primary contribution ... primarily in the area of decoration, and often content to remain anonymous: if they name themselves, it is only in the later Middle Ages that they are not primarily doing so in order to solicit prayer. (Ede 1985, 4)

Derek J. de Solla Price has highlighted another caveat regarding anonymity of scientific authors in the 1700s, namely that anonymous publication of articles in scientific journals was an attempt to deter bias (Price de 1986). Either way, in the current era of team science and consortia research, agent-centered concepts of authorship may increasingly be seen as superficial and nostalgic; a legacy from the era of hyper-individualism. Two arguments could be made in favor of this view. First, given the numerous technical functions served by authorship, such as indexing, information retrieval, performance assessment of researchers or mapping collaborative networks, attribution of credit and responsibilities could be seen as secondary to the primary (technical) functions of authorship in modern science. Second, in many established disciplines, used vocabularies, phrases, manuscript design and even the types of arguments at one's disposal are mostly predetermined and fit a certain mold. This stylistic anonymization profoundly affects concepts such as originality. One could argue that academics are constantly plagiarizing existing discourses because the words, the concepts, the arguments, the methods we use are (almost always) already there (Zwart 2017).² Research is replete with countless anonymous discourses, tools and methods of the past; such that we can only partially account for all of them by means of academic authorship, references and explicit acknowledgments. In other words, originality is rarely the default, it is a fiction or exceptional at best. We cannot "own" ideas, because they are (almost always) already there. We would not be able to think or write at all in the absence of a discourse already established, a stream of ideas and signifiers already thriving.

Group authorship makes sense when it comes to acknowledging that the work could not have been done without the group effort and that the overall result is more than the sum of specific contributions that can be attributed to individual group members. This may apply to generating new data but also to the synergy of group-wide deliberations about formulating relevant research questions or formulating hypotheses, addressing methodological issues, and interpreting and discussing the implications of new findings. If we approach group authorship along these lines, the claim could be made that, in many areas of scientific inquiry, group authorship comes much closer to how research actually works (indicating who did what in the collaborative research endeavor, not necessarily nor exclusively in the writing process) than individual authorship (where only a limited number of authors are afforded the recognition for the work that is actually done by teams). In many publications involving a group name in the byline, group authorship is actually combined with individual authorship, so that the group is listed together with individual authors who may have made a substantial contribution to the actual writing process. This may be a best practice which clarifies some of the ambiguities involved in group authorship while retaining the added value of acknowledging and rewarding the importance of teamwork in practice. One could argue, for instance, that a paper may count as a chapter in a thesis only

if the author is listed as one of the individual authors rather than as a group author. Although currently academia decisions about hiring, promotion and tenure are often made solely or primarily based on individual authorship, the argument could be made that participation in collaborative efforts (e.g., group authorship) should be weighed as well, given the importance of collaboration and teamwork in research, which is increasingly emphasized in reflections on acknowledging all talents and contributions in the academic rewards system.³

Future research

Conducting empirical research about group authorship is necessary and will enhance our understanding of this phenomenon. We see several opportunities and possible directions:

- By recruiting participants from publications that include both a group author and one/some individual author(s), future research could explore issues related to tasks conducted by group members versus individual authors; commonly used criteria/considerations to clarify whose contributions should be subsumed under a group name and who should be named as an individual author; decision-making dynamics; communication strategies regarding manuscript approval, copyrights, and reporting individual and group contributions.
- By exploring the views of researchers and administrators involved in assessment and evaluation, future research could shed light on the value and impact of group authorships in tenure and promotion, or in assessing dissertations in different research domains and countries.

Conclusion

This paper is intended to be a call for the cautious exploration of group authorship within the current agent-centered scientific paradigm to make this mode of recognition a viable alternative for researchers who wish to emphasize the collaborative nature of their work. Group authorship provides unique opportunities that would hardly emerge under the conventional agent-centered authorship model. In this paper, we have explored specific examples of group authorship attributions and discussed various ethical, legal, and technical challenges and nuances regarding its use. Some of these challenges also arise with individual authorship but are amplified with group authorship because of ambiguities related to group members and their exact contributions. While addressing all these challenges might be exceptionally difficult, there are possible solutions that

could improve group authorship attributions. We see opportunities in development and communication of context-specific and unambiguous guidelines for group authorships. We recommend the following four baseline requirements to be considered by all journals:

- (1) All group members should make relevant contributions (be it administrative, creative, intellectual or technical) to the work, and should be responsible and accountable for their contributions;
- (2) All group members should be aware of the manuscript submission, and should confirm the final draft;
- (3) Both the group name and the contributing group members as well as their ORCID IDs should be listed in the manuscript;
- (4) Group members' specific contributions should be specified in the acknowledgment section with as much details as required to ensure that specific questions about different tasks can be addressed.

We also offer technical suggestions, namely, to devise PIDs for groups to be linked with the group members' ORCID IDs and the DOI of the published item to minimize the likelihood of ambiguities about who was involved in the project and what they did.

Notes

1. The ICMJE recommends that authorship be based on the following 4 criteria: 1. Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; AND 2. Drafting the work or reviewing it critically for important intellectual content; AND 3. Final approval of the version to be published; AND 4. Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved (ICMJE: International Committee of Medical Journal Editors 2024).
2. Exceptions may include the use of syllogisms or scholars who offer scientific paradigm shifts that alter our understanding concepts and theories in a certain field.
3. For instance, Utrecht University's recognition and rewards vision and the recognition of collaborative contributions for promotion at Northwestern University Feinberg School of Medicine (Hosseini, Lewis, et al. 2022).

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