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Authorship Versus Contributorship in Scientific Articles: Considering COPE Principles and the CRediT Taxonomy

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Abstract

The allocation of authorship in scientific publications has long been a critical issue, as it directly affects the recognition and accountability of researchers. However, traditional models of authorship, guided by frameworks like the International Committee of Medical Journal Editors (ICMJE), are increasingly being challenged due to the growing complexity of collaborative and interdisciplinary research. Issues such as gift authorship, ghostwriting, and authorship inflation have exposed the limitations of the authorship model, leading to calls for more transparent and equitable systems.

In response, the contributorship model, exemplified by the CRediT (Contributor Roles Taxonomy) framework, offers an alternative approach that emphasizes the specific roles and responsibilities of contributors rather than assigning blanket authorship. The CRediT taxonomy defines fourteen distinct roles, from conceptualization to writing and data curation, allowing for more precise attribution of credit and accountability. This opinion paper compares the traditional authorship model with the contributorship approach, considering their ethical implications through the lens of the Committee on Publication Ethics (COPE) guidelines, which emphasize transparency and fairness in authorship practices.

Through a detailed analysis, the paper highlights the advantages of the contributorship model, such as enhanced transparency, reduced conflicts over authorship order, and a clearer distribution of responsibility. However, it also acknowledges the challenges of implementing contributorship, including potential fragmentation of credit and difficulty in applying the taxonomy consistently across diverse fields. Ultimately, the opinion paper argues that contributorship, particularly when aligned with COPE principles, offers a promising path forward for improving equity and accountability in scientific publishing, especially in large-scale collaborative projects.

Keywords

Authorship, Contributorship, CRediT Taxonomy, Scientific Integrity, Ethical Publishing, Credit Attribution

1. Introduction

The concept of authorship in scientific publishing has long been the primary method for recognizing contributions to research (Teixeira da Silva and Dobránszki, 2015). Authorship not only determines academic credit but also confers accountability for the content of the paper. However, with the increasing complexity of modern scientific research, which frequently involves large, interdisciplinary teams, traditional models of authorship are proving inadequate (Bennett and Gadlin, 2012; Lin, 2024). Issues such as authorship disputes, ghost authorship, and authorship inflation have exposed significant flaws in the system (Marušić et al., 2011).

In response to these challenges, new models have emerged that focus on contributorship, aiming to capture the specific roles and responsibilities of each collaborator. The **CRedit (Contributor Roles Taxonomy)** model, for example, categorizes contributions into distinct roles, ranging from conceptualization to formal analysis and writing (Allen et al., 2014). At the same time, ethical frameworks like the **Committee on Publication Ethics (COPE)** guidelines aim to standardize authorship practices and address ethical issues related to credit attribution (COPE, 2021).

This opinion paper explores the tension between traditional authorship models and the contributorship approach, considering their ethical implications and practical consequences. Through a comparison of these models in light of COPE principles and the CRedit taxonomy, the paper seeks to evaluate whether contributorship offers a more transparent, equitable, and functional system for scientific publishing.

2. Understanding Authorship in Scientific Publications

Authorship has traditionally been viewed as a key marker of academic achievement and credibility in scientific research (Newman and Jones, 2006). It is not just a means of acknowledging contribution but also a powerful tool in career advancement, determining the distribution of grants, tenure, and academic reputation (Smith and Williams-Jones, 2012). As such, it is heavily policed and often the source of contention within research teams (Tarkang et al., 2017; Fogarty, 2020).

According to the **International Committee of Medical Journal Editors (ICMJE)** guidelines, which are widely adopted across disciplines, an author must meet four specific criteria:

1. Substantial contributions to the conception or design of the work, or the acquisition, analysis, or interpretation of data.
2. Drafting the work or revising it critically for important intellectual content.
3. Final approval of the version to be published.
4. Agreement to be accountable for all aspects of the work, ensuring that any questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved (ICMJE, 2019).

While these guidelines aim to ensure that only those who make meaningful contributions are credited as authors, they do not always prevent unethical practices. For instance, **"gift**

authorship" occurs when individuals are named as authors despite contributing little or nothing to the research (Shamoo and Resnik, 2009). This is often done as a favor or to appease senior colleagues. In contrast, **"ghost authorship"** refers to cases where individuals who contributed significantly to the work, such as through data analysis or writing, are left out of the authorship list entirely (Teixera and Dobránszki, 2016). Both practices violate the principles of transparency and fairness that are central to scientific integrity and are considered questionable research practices. In fact, misattribution of authorship had already been flagged as a frequent problem (Smeeton, 2021).

Further complicating matters, authorship practices vary significantly across disciplines. In fields like **biomedicine**, large consortia and collaborative research teams are common, making the allocation of authorship more complex (Brunson et al., 2017; Fontanarosa et al., 2017). Even within a field, it has been recognized that there are mismatches between different perceptions of authorship between editors and authors (Bhopal et al., 1997; Pignatelli et al., 2005). Further, the need to list multiple authors may lead to **authorship inflation**, where individuals are included as authors despite only minor involvement, diluting the meaning of authorship (McNutt et al., 2018).

COPE has attempted to address these challenges by providing clear ethical guidelines on authorship. COPE emphasizes that authorship should be based on significant contributions and that the order of authorship should reflect the level of contribution (COPE, 2021). The organization also recommends that researchers discuss authorship criteria early in the research process to avoid disputes later on. Despite these efforts, the traditional model of authorship continues to face significant challenges, particularly in collaborative, multi-author research projects (Kovacs, 2017).

3. Contributorship as an Alternative Model

To address the limitations of the traditional authorship model, the concept of **contributorship** has emerged as a more detailed and transparent system for recognizing contributions to scientific research. Rather than focusing on the binary question of who qualifies as an author, the contributorship model asks what specific contributions each individual made to the project (McNutt et al., 2018; Holcombe, 2019a). This approach acknowledges that research is a collaborative process, involving a wide range of activity that may not always fit neatly into the conventional categories of authorship (Dance, 2012; Larivière et al., 2020).

The **CRedit (Contributor Roles Taxonomy)** was introduced as a structured way of identifying and acknowledging individual contributions. It defines fourteen **distinct roles** that contributors to a scientific project can play (Brand et al., 2015) :

1. **Conceptualization** – Ideas; formulation or evolution of overarching research goals and aims.
2. **Data curation** – Management activities to annotate (produce metadata), scrub data, and maintain research data for initial use and later reuse.

3. **Formal analysis** – Application of statistical, mathematical, computational, or other formal techniques to analyze or synthesize study data.
4. **Funding acquisition** – Acquisition of financial support for the project.
5. **Investigation** – Conducting the research and investigation process, including data collection and experimentation.
6. **Methodology** – Development or design of methodology; creation of models.
7. **Project administration** – Management and coordination responsibility for the research activity planning and execution.
8. **Resources** – Provision of study materials, reagents, materials, patients, laboratory samples, animals, instruments, computing resources, or other analysis tools.
9. **Software** – Programming, software development; designing computer programs; implementation of the computer code and supporting algorithms; testing of existing code components.
10. **Supervision** – Oversight and leadership responsibility for the research activity planning and execution, including mentorship external to the core team.
11. **Validation** – Verification, whether as a part of the activity or separately, of the overall replication/reproducibility of results/experiments and other research outputs.
12. **Visualization** – Preparation, creation, and/or presentation of the published work, specifically visualization/data presentation.
13. **Writing – original draft** – Preparation, creation, and/or presentation of the published work, specifically writing the initial draft (including substantive translation).
14. **Writing – review & editing** – Preparation, creation, and/or presentation of the published work by those from the original research group, specifically critical review, commentary, or revision (Allen et al., 2014).

This taxonomy allows for a much more precise allocation of credit, ensuring that every contributor is recognized for the specific role they played. By disaggregating contributions into distinct categories, the CRediT taxonomy promotes transparency, helping to resolve disputes and clarify the division of labor within research teams (Cooke et al., 2021; Hosseini et al., 2023).

A key advantage of the contributorship model is its potential to reduce conflicts over authorship order, which can be a source of significant tension in collaborative research (Clement, 2014). In traditional models, the **first and last author** positions are highly coveted, as they are often seen as markers of leadership and primary contribution. This can lead to competitive and sometimes unethical practices, such as senior researchers claiming authorship positions at the expense of junior colleagues (Wren et al., 2007; Tarkang et al., 2017). The contributorship model side-steps these issues by focusing on roles rather than rank, offering a more equitable system for credit allocation (Nosek et al., 2014).

4. Comparison Between Authorship and Contributorship

The primary distinction between **authorship** and **contributorship** lies in how credit, responsibility, and accountability are distributed within a scientific work. Traditional authorship models typically follow established conventions, such as the **ICMJE guidelines**, where authorship implies that contributors meet specific criteria related to the conceptualization, drafting, and approval of the manuscript (ICMJE, 2019). In this model, all listed authors are assumed to have participated significantly in the research and are

collectively responsible for the entirety of the work. This broad, collective accountability has significant implications, particularly in cases where errors, misconduct, or disputes arise.

However, the conventional model of authorship is prone to several challenges, including:

- **Ambiguity in Responsibility:** When multiple authors are listed, it can be difficult to pinpoint who is accountable for specific elements of the research. This ambiguity becomes problematic in cases of scientific misconduct or retractions, where it may be unclear who should bear responsibility for particular aspects of the study (Rennie, et al., 1997). This is all the more problematic since recent data would seem to suggest that senior researchers would more often “get away” with academic misconduct than their younger associates (Wright et al., 2008) or in cases where senior researchers refuse to endorse responsibility for errors (Fanelli et al., 2015).
- **Authorship Order Disputes:** Authorship order, especially the coveted first and last positions, often leads to disputes within research teams. The first author is typically regarded as having made the most substantial contribution, while the last author is often seen as the senior researcher or project leader (Smith and Williams-Jones, 2012). This hierarchical ordering can result in conflicts, particularly when junior researchers feel their contributions have been underappreciated, or when senior researchers use their authority to claim positions of prominence.
- **Misuse of Authorship:** Practices such as **gift authorship**, where individuals are named as authors without having made a meaningful contribution, and **ghost authorship**, where significant contributors are omitted, undermine the integrity of the authorship system (Shamoo and Resnik, 2009; Wislar et al., 2011). These issues reflect a broader lack of transparency in how credit is allocated, often leading to unethical practices that distort the academic record.

In contrast, the **contributorship model** offers a more granular and transparent approach to credit allocation. Rather than presenting authorship as a collective title, contributorship focuses on delineating specific roles and contributions. The **CRedit (Contributor Roles Taxonomy)** formalizes this approach by categorizing contributions into fourteen **distinct roles**, such as data curation, formal analysis, funding acquisition, writing, and supervision (Allen et al., 2014). Each contributor is credited for their precise role in the research process, fostering transparency, accountability, and reducing disputes over authorship order.

Key advantages of the contributorship model include:

- **Transparency in Credit Allocation:** The CRedit taxonomy clearly specifies who contributed to each aspect of the research, allowing for a more accurate distribution of credit. For example, someone responsible solely for data collection or project administration can be recognized for those contributions, even if they did not play a role in drafting the manuscript. This transparency ensures that every contributor’s work is appropriately acknowledged (Brand et al., 2015).
- **Reduction in Disputes:** By decoupling the hierarchical implications of authorship order, contributorship reduces conflicts over first and last author positions. Instead, the focus shifts to the specific contributions made by each individual, promoting a more equitable system of recognition. Researchers no longer need to compete for symbolic positions, as their roles are explicitly stated (Clement, 2014).

- **Clearer Accountability:** Contributorship assigns responsibility more directly, making it easier to determine who is accountable for specific parts of the research. For instance, if an issue arises with the data analysis, the individual or team credited with that role under the CRediT taxonomy can be more easily identified (McNutt et al., 2018). This targeted accountability is crucial for maintaining the integrity of the scientific process and for addressing issues like data fabrication or errors.

That said, the contributorship model is not without its challenges. The disaggregation of roles can sometimes complicate the process of determining the overall "lead" of a project, particularly in interdisciplinary collaborations where roles overlap. Moreover, in traditional academic cultures, authorship remains the dominant currency for career advancement, tenure, and grant applications. As a result, transitioning fully to a contributorship model may require changes in how academic institutions evaluate contributions to research (Cooke et al., 2021).

While both models have their merits, the **contributorship model** is better suited for addressing the ethical and practical challenges posed by large, collaborative research projects. It emphasizes precision, fairness, and transparency, aligning more closely with modern research practices, where contributions are diverse and multifaceted. As academic publishing continues to evolve, the contributorship model represents a promising step toward ensuring that all contributors receive appropriate recognition for their work, while also enhancing accountability in the scientific process.

5. Ethical Implications of Authorship and Contributorship

The ethical landscape of authorship and contributorship in scientific publications is deeply influenced by issues of transparency, fairness, and accountability. Traditional authorship, guided by frameworks like the ICMJE, has been subject to significant ethical scrutiny, particularly due to its vulnerability to misuse through practices like **gift authorship**, **ghost authorship**, and **authorship inflation** (Pruschack and Hopp, 2022; McNutt et al., 2018). These practices not only distort the academic record but also erode trust in scientific publications. In cases of misconduct or errors in research, the traditional authorship model makes it difficult to identify who is responsible for specific aspects of the work, leading to what has been called a "diffusion of responsibility" (Rennie et al., 1997).

By contrast, the **contributorship model**, particularly when supported by frameworks like **CRediT**, offers a more transparent and ethically sound system for recognizing contributions. The CRediT taxonomy clarifies the roles and responsibilities of each contributor, making it easier to assign credit appropriately and to hold individuals accountable for their specific work (Allen et al., 2014). The ethical benefits of this model align well with the **Committee on Publication Ethics (COPE)** guidelines, which emphasize the need for transparency in the assignment of credit and responsibility in research (COPE, 2021). This is particularly important considering the current landscape of scientific error-checking and correction in academia. While still too rarely conducted, more and more studies are being investigated for questionable research practices (van Noorden, 2023). In those cases, more junior researchers seem to be more likely to take the blame/responsibility for questionable

research practices when compared to their more senior co-authors. Parallely, since retractions, even outside of misconduct, are still considered negative (Vuong, 2020), contributorship would help clearly highlight what has happened and avoid assigning blame to a whole team of co-authors.

From an ethical standpoint, the **contributorship model** also promotes a more inclusive approach to scientific publishing. In traditional models, the value of contributions like data curation, software development, or project administration is often underappreciated, as these roles do not always fit the narrow definition of authorship. By recognizing these contributions explicitly, the contributorship model ensures that all individuals who played a role in the research process receive proper recognition (Brand et al., 2015). This not only promotes fairness but also encourages collaboration by valuing the diverse skill sets that modern research increasingly requires while, at the same time, preventing the bias of the last author receiving credit for things that they have not done (Smith, 2014).

6. Challenges in Implementing Contributorship

While the contributorship model offers numerous advantages, it also faces several practical challenges in its implementation. One key issue is the potential fragmentation of credit. In large, interdisciplinary projects, assigning granular roles may lead to confusion about who deserves primary recognition, particularly when roles overlap or when contributors play multiple parts in the research process (Clement, 2014). For example, contributors may take on different roles at various stages of the project, making it difficult to quantify their overall contribution.

In **biomedicine**, large-scale clinical trials often involve numerous contributors, including statisticians, clinicians, data managers, and laboratory scientists, each playing a different role at various stages of the research. A study by Holcombe (2019b) found that in a multi-center clinical trial on cancer treatments, there were disputes about who should be considered the primary author, as contributors involved in patient recruitment felt that their role was undervalued compared to those involved in data analysis. This highlights how difficult it can be to balance recognition in complex, multi-phase biomedical research projects (Holcombe, 2019b).

Moreover, the contributorship model requires a cultural shift in academic publishing. Many researchers, particularly in traditional disciplines, may resist moving away from the well-established authorship hierarchy, where the first and last author positions hold significant weight (Holcombe, 2019b). Convincing researchers and institutions to adopt contributorship as a legitimate form of academic recognition may take time, particularly in fields where grant applications, tenure decisions, and other career milestones are heavily dependent on authorship metrics (Kiermer, 2023). Effectively moving away from using authorship position to evaluate CVs in those cases would, however, be feasible already today if one considers that many hiring and grant committees are already requesting applicants to detail their exact contribution to the shortlist of papers that they decide to

include. Adopting contributorship would make these additional explanations redundant and help applicants prepare their submission package.

In **earth sciences**, large-scale projects such as climate change modeling often involve interdisciplinary teams of atmospheric scientists, oceanographers, and data specialists, among others. These projects can span years and rely on multiple rounds of data collection, analysis, and interpretation. For example, a report by the Intergovernmental Panel on Climate Change (IPCC) noted that over 200 scientists contributed to one of its assessments, but determining the exact contribution of each individual was challenging due to the overlapping roles in data modeling and review (Palutikof et al., 2023). The existing contributorship frameworks did not fully accommodate the collaborative and iterative nature of these contributions, illustrating the challenges of implementing the model in fields with such diverse roles.

Another challenge lies in the inconsistent application of contributorship across disciplines. While the CRediT taxonomy has been widely adopted in certain fields, particularly in biomedical research, other fields have been slower to embrace it (Hosseini et al., 2023). The taxonomy may also be difficult to apply uniformly across different types of research projects. For example, theoretical work or humanities research may not fit neatly into the fourteen categories defined by CRediT, which are more suited to empirical, data-driven research (Brand et al., 2015). Other innovations in scientific methodology and reporting have, historically, also stemmed from empirical and data-driven research before being studied and adopted by other domains and other methodologies (e.g., preregistrations). In such cases, further refinement of the taxonomy may be necessary to ensure it can accommodate a broader range of scholarly work.

7. Future Directions and Recommendations

The growing adoption of the contributorship model, particularly through initiatives like the CRediT taxonomy, suggests that the future of scientific publishing will continue to evolve toward greater transparency and fairness in credit attribution. However, to ensure its widespread adoption and effectiveness, several key steps must be taken:

1. **Standardization of Practices:** Journals, institutions, and funding bodies should work together to standardize the use of contributorship models across disciplines. This may involve expanding the CRediT taxonomy to better accommodate a wider range of research fields, particularly in the **social sciences** and **humanities**.
2. **Training and Awareness:** Institutions should provide training to researchers, particularly early-career scientists, on how to use contributorship models and how to negotiate credit allocation fairly. Educating researchers about the ethical benefits of contributorship, as well as how it aligns with **COPE principles**, will be crucial in overcoming resistance to change (Shamoo and Resnik, 2009).
3. **Policy Reform:** Academic institutions and funding bodies should update their evaluation criteria to reflect the importance of contributorship. This may involve shifting away from traditional metrics like **h-index** or **impact factor**, which prioritize authorship positions, and moving toward more nuanced assessments of individual

contributions based on role descriptors like those in the CRediT taxonomy (Nosek et al., 2015).

4. **Encouraging Collaboration:** By recognizing the contributions of individuals in non-traditional roles, the contributorship model encourages more collaborative, interdisciplinary research. Funders and institutions should incentivize such collaborations by recognizing the value of diverse contributions to the research process (McNutt et al., 2018).

Ultimately, the contributorship model offers a more ethically sound and transparent approach to credit attribution in scientific publishing. However, for it to achieve its full potential, the academic community must embrace it as part of a broader shift toward more equitable and inclusive research practices (Kiermer, 2023).

8. Conclusion

The tension between authorship and contributorship in scientific articles reflects the evolving nature of scientific research. While the traditional model of authorship has served the academic community for centuries, it is increasingly being recognized as inadequate for modern, interdisciplinary, and collaborative research environments. Ethical issues such as ghost authorship, gift authorship, and authorship disputes have revealed significant flaws in the current system (Martinson et al., 2005; Teixeira da Silva and Dobránszki, 2016).

The **contributorship model**, as exemplified by the **CRediT taxonomy**, offers a more transparent, equitable, and accountable system for recognizing the diverse contributions that modern research requires. By disaggregating credit into specific roles, contributorship not only ensures that all contributors are properly acknowledged but also aligns with the ethical principles of **COPE**, which emphasize transparency and fairness (COPE, 2021).

However, the successful implementation of contributorship will require cultural and institutional changes in how academic credit is allocated. Standardizing the use of the contributorship model across disciplines, updating institutional policies, and educating researchers about the benefits of this system are crucial steps toward achieving a more inclusive and ethically sound framework for scientific publishing (Allen et al., 2014).

In conclusion, while the **authorship** model remains deeply embedded in academic culture, the **contributorship** model represents a promising path forward for addressing the ethical and practical challenges of modern scientific research. By embracing contributorship, the academic community can foster more equitable collaboration, promote transparency, and enhance accountability in scientific publishing, ultimately contributing to the integrity and reliability of the scientific record.

Authors' Contribution

Olivier Pourret: Conceptualization, Writing - Original Draft; Lonni Besançon: Writing - Review & Editing.

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