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What's the Point of Authors?

Contributors: Line Edslev Andersen; Rosemary Bailey; Udit Bhatia; Joanna Burch-Brown Liam Kofi Bright; Jim Brooke; Peter Cameron; Catrin Campbell-Moore; Joe Cornelli; Stephen Crowley; Haixin Dang, Rachel Fraser; Isobel Falconer; Adam Ferner; Monica Gamez; Mikkel Gerken; Joshua Habgood-Coote; Katherine Hawley; Matthias Heyman; Klemens Kappel; Ethan Landes; Hélène Landemore, Benedikt Loewe; Ursula Martin; Dan Lunt, Chris Meyns; Louise Millard; Dann Mitchell; Samir Okasha; Andrew Peet; Richard Pettigrew; Jeroen de Ridder; Robert Ross; Pierre Saint-Germier; Anya Skatova; Mona Simion; Fenner Tanswell; Daniel Whiting; Alan Wilson; K. Brad Wray; Dilara Yeşilova.

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Spokesperson: Joshua Habgood-Coote

Writer: Joshua Habgood-Coote

Guarantor: Joshua Habgood-Coote

Abstract

Who should be the author(s) of an academic paper? This question is becoming increasingly pressing, due to the increasing prevalence and scale of scientific collaboration, and the corresponding diversity of authorship practices in different disciplines and subdisciplines. This paper addresses the conceptual issues underlying authorship, with an eye to ameliorating authorship practices. The first part of the paper distinguishes five roles played by authorship attributions: allocating credit, constructing a speaker, enabling credibility judgements, supporting accountability, and creating an intellectual marketplace. The second part of the paper argues that distinguishing these functions helps us see that at least some of the confusions around authorship are due to tensions between these functions. The final part of the paper suggests a way to resolve these conceptual confusions, which we will call the CSWG proposal. This proposal suggests replacing authorship with a bundle of roles tailored to the functions of authorship—contributor, spokesperson, writer, and guarantor—which can be distributed in a number of different ways.

1. Introduction

Who should be the author(s) of an academic paper? This problem is pressing: both the prevalence of co-authorship and the number of co-authors listed on each paper are dramatically increasing.[1] In May 2015 a paper giving an improved measurement of the mass of the Higgs Boson by CERN was published by *Physical Review Letters* (Aad *et al*. [2015]). This paper listed 5,154 authors, a significant number of whom were deceased at the time of publication. This list was derived from the members of the ATLAS and CMS projects, many of whom did not contribute to the research or writing, or even read the paper. There is also an increasing diversity in authorship practices: some disciplines list authors alphabetically [Waltman unpublished] or randomly [Ray ® Robson 2018], others by amount of contribution, others by seniority, while others give special significance to certain positions (typically first, second, and last positions). Some disciplines (especially in the humanities) list only the person who has done most work as an author, others list everyone in the organisation, lab, or project meetings irrespective of whether they have done any work on the paper, and others list the collaboration

[1] (Cronin [2001], Wuchty *et al*. [2007], West *et al*. [2013], Sonnenwald [2007], Sooryamoorthy [2009], Morrison *et al*. [2003], Larivière et al. [2006], Mallapaty [2018], Ioannidis *et al*. [2018]).

as a collective author.[2] In many disciplines (especially in interdisciplinary collaborations) it will be unclear or indeterminate what the norms for ascribing authorship are.

Researchers have identified a number of problems caused by the combination of scale of collaborations and diversity of authorship practice: i) confusion around disciplinary norms (Street *et al*. [2010], Mitcheson [2011], Macfarlane [2017]); ii) deliberate flouting of disciplinary norms (in a 2005 survey of NIH grant-holders 10% of respondents admitted assigning authorship inappropriately (Martinson *et al*. [2005], see also Pignatelli *et al*. [2005], Rohwer et al. [2017])), iii) the emergence of *ghost* authors (writers who are not listed as authors, often to hide commercial interests) who haunt as much as a fifth of papers in medical journals (Wislar *et al*. [2011] see also Flanagin *et al*. [1998], Mowatt *et al*. [2002]); iv) a lack of consensus about how to resolve disagreements (Macfarlane [2017]); v) disagreements about authorship (Mitcheson *et al*. [2011]); and vi) problems in reading a byline (Shaw [2016]). Given these problems, it is no surprise that authors often make subversive and unruly authorship attributions (Penders and Shaw [2020]).

This profusion of approaches to authorship partly stems from its complex history. One part of the genealogy of authorship traces back to legal battles around intellectual property in seventeenth and eighteenth Century England (Foucault [1980], Chartier [2003], Johns [2003]). These legal arguments led to a Lockean conception of authorship, whereby a researcher acquired rights to a piece of writing by mixing her labour with publicly available ideas (Chartier [2003], pp. 17-20, Johns [2003], pp. 82-4). Another thread traces back to the Spanish Inquisition, which required books to be published with their authors' names in order to facilitate the censorship of heretics (Foucault [1980], Chartier [2003], p. 21). Many of the features we associate with authorship—originality, peer review, the fragmentation of research into paper-sized pieces—were negotiated through the development of the contemporary scientific journal (Baldwin [2015], Csiszar [2018]).

What is to be done? Some suggest we ought to admit a category of collective author (Wray [2006], [2007], [2018], de Ridder [2014]) or even abandon the notion of authorship for certain kinds of collaborative work (Kukla 2012, Huebner *et al*. [2018]). Others suggest revising our concept of authorship (Rennie *et al*. [1997]), either by regimenting it, (ICJME [2018]), by supplementing it with more fine-grained roles (Mozilla [2018], CRediT [2018]), or by supporting it with contribution statements to papers (theBMJ [2018]) (we return to these proposals in section 4).

This paper focuses on conceptual issues surrounding authorship. Section 2 distinguishes several functions associated with the assignment of authorship.[3] These functions give us a job description against which we can assess authorship practices. Section 3 argues that the functions of authorship are in tension, meaning that no single status can address all of these

[2] See [The Combahee River Collective 1997], [Polymath 2012, 2014], [ATLAS Collaboration 2012], [International Human Genome Sequencing Consortium 2001]. On collective authorship in high-energy physics, see (Knorr Cetina [1999], pp. 166-70, Galison [2003]).
[3] For overviews, see (Rennie and Flanigan [1994], Cronin [2001], Marušić *et al*. [2011]).

functions. Section 4 suggests that we respond to this situation by doing away with the status of author, replacing it with a number of different roles—Contributor, Writer, Spokesperson, and Guarantor—which split up the distinct roles hitherto associated with authorship. I call this the CWSG proposal.

A couple of clarificatory points:

We will be concerned with authorship for non-fiction papers published by academic journals, setting to one side authorship for fiction and artworks (Bacharach and Tollefsen [2010]), the responsibilities associated with pre-prints, and publication outside of academic journals. Many of our examples come from natural, medical, and cognitive sciences, but we are also concerned with authorship in the social sciences and humanities. We will also leave to one side the complex relation between authorship and copyright (Biagioli [2003], Fyfe *et al*. [2018]), and the hermeneutic functions of authorship in allowing the interpretation of texts (Barthes [1967]).

Ordinary language switches between two ways of thinking about authorship. Sometimes authorship is treated as if it were determined by who contributed to the research, and other times it is treated as a social fact bestowed by the act of being listed on the byline (Huebner *et al*. [2018], p.103).[4] Consider two ways in which a researcher might articulate their indignance at being left off of the byline of a paper she has contributed to:

1. I'm an author of that paper! (contribution view).
2. I should be an author of that paper! (social fact view).

Our interest is in the normative question of who should be designated author of a given paper, so we will assume the *social fact* view of authorship.[5]

This paper lies within the scope of its own proposal, as the first page attests. Although the intellectual credit for this paper is distributed amongst a large group, one person has written it. The first-person pronoun throughout refers to the writer, who expresses their own beliefs, and takes all relevant intellectual responsibilities (to be discussed below).

2 The Functions of Authorship

We will focus on five functions played by authorship attributions:

1. Allocating intellectual credit;
2. Constructing a speaker;

[4] On the social fact view, listing someone as an author is something like an Austinian performative: it doesn't describe someone as an author, it makes them an author (Austin [1962]).
[5] This choice has some costs, meaning that 'ghost authors' are not authors (Rennie and Flanagin [1994], Flagagin *et al*. [1998], Mowatt *et al*. [2002], Moffatt and Elliott [2007], Wislar *et al*. [2011], Moffatt [2013]).

3. Enabling credibility judgements;
4. Supporting accountability;
5. Creating an intellectual market.

The evidence for these functions comes from a wide range of sources. In what follows, I will appeal to explicit authorship guidelines, the sociology of science, proposals to revise authorship, the history of authorship practices, epistemology, and economics. All of these functions are reflected in actual authorship practices—which is not to say that they reliably deliver these goods—but in some cases it will be easier to introduce the functions by appeal to normative considerations.[6]

2.1 Credit

We think that something has gone wrong when someone gets left off of a byline, or gets lower billing than they ought to. Think of Rosalind Franklin's work on the double helix structure of DNA (which lead to the famous 'discovery' paper authored by Crick and Watson), or Jocelyn Bell Burnell's work on pulsars (which lead to a paper on which she was second author).[7] In these cases, we might think that the byline goes wrong because it communicates something false about who contributed what to the paper.

We can capture this idea by connecting authorship with intellectual credit as follows:

Credit: Assigning someone the status of author on a paper is a way to attribute to them either full or partial intellectual credit for the intellectual achievement(s) of that paper.

The idea is that assigning authorship constitutes recognition of intellectual achievement. This way of thinking about credit is closely connected to the way epistemologists think about knowledge as an intellectual achievement (Greco [2010], Sosa [2007]): just as an individual is creditworthy when they have brought about some valuable end by exercising their practical skills, so too a researcher is creditworthy when they have made an intellectually valuable contribution by exercising of their intellectual capacities.

It is important to bear in mind the differences between i) intellectual credit, ii) praise and blame for intellectual performance, and iii) social recognition for achievement. We can think of credit attribution as analogous to a gold star awarded in recognition of athletic achievement. In the right social context, the awarding of the star itself constitutes a kind of recognition of

[6] These functions can be seen as disambiguating the notion of responsibility as it applies to authorship (Shoemaker [2011], Dang [unpublished]). The credit function concerns the claims made in a paper being attributable to the authors, the speaker function concerns the authors being answerable for the claims made, and the accountability function concerns the authors being accountable for the claims made.

[7] Neither case is a simple exclusion. Franklin co-authored a paper reporting her results in the same issue of *Nature* as Crick and Watson (Franklin and Gosling [1953]), and Bell Burnell has stated that her second author position was consistent with norms of authorship in astrophysics (Bell Burnell [1977]).

achievement, independent of praise or social recognition. In this section, our focus is on the recognition of achievement, but we will return to praise and blame (2.4) and to social recognition (2.5) below.

According to the credit function, a byline should list the people whose efforts contributed to the intellectual achievement of the paper. This idea raises a number of difficult issues.

One issue is how to think about what achievement an academic paper makes. It is tempting to say that the intellectually creditworthy achievement is the headline claim. This would make authorship too capacious. Science is a cumulative endeavour, and researchers who have done the work that a paper builds on deserve some credit, but they should not be included as authors. We might think that this kind of intellectual dependence deserves citation, but not inclusion as author.[8] I suggest that the achievement of a paper is the way it extends or systematises social knowledge, meaning that the authors are those who are creditworthy for the extension, leaving citation to pick up the work of acknowledging dependence on previous work.

A second issue concerns fairness in the allocation of credit. According to the credit function when people are left off the byline, they fail to receive recognition for their creditworthy achievements. Authorial exclusions often track peoples' social identities, suggesting connections with epistemic injustice, epistemic oppression, and epistemic appropriation (Fricker [2007], Dotson [2014], Davies [2018]).[9] Exclusion from the byline will track social identities which are negatively associated with academia or particular fields, including being female (especially in stem fields), being a person of colour, being non-European, and being a member of an indigenous culture.[10] Academic identities also create exclusions: junior researchers often don't get credit, and technicians, editors, and reviewers are denied authorial credit.[11]

Besides wholesale exclusion, there are various ways the contributions of researchers can be under-appreciated. Researchers might be assigned a position on the byline which does not adequately recognize the degree of their contribution. Women are less likely than men to hold the prestigious last and first author positions in many fields (West *et al*. [2013], Larivière *et al*. [2013]), and there is a long history of failure to recognize women's' contributions to science (the so-called *Matilda effect*, see Rossiter [1993]).[12] The significance of contributions can also be misconstrued by readers, especially when unclear authorship guidelines create leave space

[8] For a discussion of the epistemic functions of citation in acknowledging credit and constructing an intellectual conversation, see (Ahmed [2013], [2017], pp. 15-7, 148-58)
[9] On epistemic injustice in citation, see (McCusker [2019]), and for a general discussion of epistemic injustice in science, see (Grasswick [2017]).
[10] On authorship and indigenous knowledge, see (Jaszi and Woodmansee [2003]).
[11] Interestingly, in Germany in the eighteenth century writers, paper makers, typesetters, printers, proof readers, publishers and book binders were all listed, and seen as equally creditworthy. (Jackson [2003], p/ 122).
[12] See also (O'Connor and Rubin [2018], Bruner, and O'Connor [2018]) for a model that explains how unequal bargaining practices in negotiating author positions between majority and minority groups might develop without any explicit prejudice.

for stereotypes to do interpretative work. If it is unclear what ordering practice has been used to construct a byline, readers may read their assumptions into their assignment of credit, reading a last author with a non-English surname as least creditworthy, rather than as lab leader. The Matthew effect (Merton [1957], [1968], Zuckerman [1977], Strevens [2003])—whereby more senior or credible researchers are perceived as more creditworthy—can be compounded by social identity.[13] When some authors are the target of a social stereotype which systematically downgrades their credibility, the Matthew effect means that their perceived credit may also be downgraded.[14]

A third issue is whether authorship is a recognition of specifically intellectual credit. Historically, authorial practices have often focused on intellectual labour, leading to 'invisible technicians' who are left out of the history of science. This phenomenon is particularly striking in Robert Boyle's laboratory (Shapin [1989], [1995] Chapter 8): Boyle took sole authorship of all papers, despite his 'laborants' carrying out almost all of the administrative and experimental work. Associating authorship solely with intellectual labour is both unjust and difficult to justify. A practice of attributing credit solely focus on the kind of labour will have unjust consequences, including very small intellectual contributions while excluding very large practical contributions. The distinction between intellectual and practical labour is itself on shaky ground. One important upshot of the literature on knowledge-how is that all human activities involve a mixture of theoretical and practical knowledge (Snowdon [2004], Wiggins [2012]), and academic research is no exception. Many attempts to draw distinctions between 'intellectual' and 'practical' endeavours are driven by ideological commitments (Stanley [2012], [2015], Kremer [2016]). These considerations suggest that both practical and intellectual labour ought to be creditworthy in the way that matters for authorship.[15]

A final issue concerns multiple authorship. We might think that designating a people as co-authors recognises a team which is collectively creditworthy.[16] Understanding who is responsible in a team achievement is a complex question (van de Poel *et al*. [2015]). This issue is often fudged by saying that all co-authors must make significant contributions. This opens up the possibility of abuse. The context-sensitivity of 'significance' allow senior authors to raise the bar to exclude their colleagues' work whilst making their contributions to planning and conception particularly salient.[17] It is not obvious that small contributions are not creditworthy: if a piece of research involves thirty researchers who make small contributions, and one researcher who makes a large contribution, only including the 'significant' contribution would misrepresent the research.[18] If all authors make small contributions to a paper, requiring significant contributions would lead to an orphan paper that could not have any authors

[13] For empirical evidence about a generalisation of the Matthew effect, see (Cole [1970]).
[14] For a related discussion about exclusion in publication, see (Tanswell *et al*. [2018]).
[15] It is not obvious that credit should be only assigned to human researchers. (Savage-Rumbaugh *et al*. 2010) interviews several bonobos, who are listed as authors.
[16] On collective achievement in testimony, see (Green [2012], [2014a], [2014b]).
[17] On abuses of context, see (Grindrod [forthcoming], Ichikawa [2020]).
[18] The 1014-author (Leung *et al*. [2015]) takes this idea to heart, including hundreds of undergraduate students as authors.

(Moffatt [2013]).

I suggest that the credit function should be understood in an inclusionary way, meaning that anyone who has contributed any amount of practical or intellectual labour is creditworthy, and thus a candidate for being included as an author.

2.2 Building a responsible speaker

Besides distributing credit, authorship also functions to distribute intellectual responsibilities (Rennie and Flanigan [1994]), (Rennie *et al*. [1997]), (Biagioli [2003]). In order to understand the nature and source of these responsibilities, I suggest that we draw an analogy between publishing a paper in an academic journal and asserting a claim in a conversation. In this section, we focus on the way this analogy helps us to understand speaker-side responsibilities, and in the next two sections we will turn to credibility and accountability.

Making an assertion in a conversation involves putting forward some claim as true. When I say 'last summer was the hottest ever' I put the claim forward as true, and invite others to believe it. This speech act comes along with a bundle of responsibilities:

i. Sincerity norm: the requirement that the claim expresses the speaker's belief, and is not intended to mislead her audience.
ii. Consistency and coherence norm: the requirements that the speaker not assert a claim and its negation, and that the total of her claims in a conversation are coherent.
iii. Defend or retract norm: the requirement to either defend a claim as a conversation unfolds, or to retract it.
iv. The Knowledge norm: the requirement that the speaker only asserts propositions she knows to be true.

Although these norms are not universally accepted, for the purposes of this paper I will take them for granted.[19]

Our analogy presents publication as a kind of institutionally authorised assertion. When a paper involving multiple researchers is published in an academic journal, they perform a special act: with the authorisation of the journal they collectively assert all the claims made in the paper. We might think that one of the functions of the byline is to construct a collective agent which can meet these norms. This suggests the following function:

Speaker: a function of assigning a set of people as the authors of a paper is to create an

[19] There is a debate about whether the condition required for epistemic appropriateness is knowledge, rather than truth, justification, belief, or something else. I think that the case for the knowledge norm (see, Weiner [2017]) for scientific assertion is as good as anywhere. See (Gerken [2015]) for a defence of a justification norm in science (de Ridder 2014) for a defence of an understanding norm, and, (Fleisher [2018], [forthcoming]) for limited criticism of the knowledge norm, and (Dang and Bright [2021]) for criticism of belief, justification, and knowledge norms in science.

epistemically responsible speaker.

This function is simple in the single author case, since they will take on all responsibilities. In the collective case there are a number of ways in which epistemic responsibilities can be divided up. To see how these options work, focus on the knowledge norm.

The knowledge norm requires that a speaker backs up their assertions with knowledge (Williamson [2001]). Applied to individual assertion, this gives the following norm:

KNA: A speaker S must: assert that p, only if S knows that p.

This rule doesn't require the speaker to assert everything they know, it requires that when they assert, those assertions express knowledge. If they assert something false, or for which they do not have justification, they have done something epistemically wrong. This failure might be excusable, or justifiable on other grounds, but there remains something wrong with it. KNA applies to asserted content: a hedged claim like 'probably p' requires knowing that it is probable that p.

In a case where a group asserts a bunch of connected claims {p1, p2, … pn}, there are several ways KNA might be distributed:

All: A group G must: assert that {p1, p2, … pn}, only if every member of G knows all of {p1, p2, … pn}.

Distributed: A group G must: assert that {p1, p2, … pn}, only if each of the propositions in {p1, p2, … pn} are known by at least one member of G.

One: A group G must: assert that {p1, p2, … pn}, only if one member S1 knows all of {p1, p2, … pn}

Collective: A group G must: assert that p, only if G collectively knows that {p1, p2, … pn}[20]

Different distributions of responsibility may be appropriate for different research cultures.[21] Highly collaborative research involving a small number of researchers might generate the expectation that all researchers to know all claims (All). With research involving a greater division of labour, we may allow that different researchers know the claims relating to different parts of the paper (Distributed), or expect one researcher to have an overview of the research

[20] These options could also be implemented by considering different understandings of group knowledge. See (Bird [2010], [2014]), (Lackey [2014]), (Habgood-Coote [2019]).

[21] Another possibility is that different norms relate to different kinds of collective assertion (Lackey [2018]). When a spokesperson asserts on behalf a group, we might get KNA-ONE (with the spokesperson being the appointed member), when the group engages in co-ordinated assertion, we get KNA-DISTRIBUTED, and when the group makes an assertion by means of all members making an assertion (think of the way that a collective assertion at a protest is constituted by many individual assertions with the same content) we might get KNA-ALL.

(One). As the size and complexity of research increases, we may instead expect the group to collectively know the claims in the paper (Collective) (Hardwig [1985], Galison [2003], pp. 349-51, Huebner *et al*. [2018]). Other speaker-related norms can be distributed in similar ways:

	Sincerity	***Consistency and Coherence***	***Defend or Retract***	***The Knowledge Norm***
All	All agents must believe all claims	All agents take responsibility for the coherence of the whole	All agents must defend/ decide whether to retract	All agents must know all claims
Distributed	All agents must believe their allocated claims	All agents take responsibility for the coherence of their allocated parts	All agents take responsibility for defending their allocated parts	All agents must know their allocated claims
One	One agent must believe all claims	One agent takes responsibility for the coherence of the whole	One agent must defend/ decide whether to retract	One agent must know all claims
Collective	The collective must believe all claims	The collective takes responsibility for the coherence of the whole	The collective must defend/ decide whether to retract	The collective must know all claims

Table 1: Different ways to distribute speaker responsibilities in co-authorship.

These norms help us to think about a swathe of authorial practices.

The sincerity norm helps us to think about what goes wrong in fraud. In fraud, a researcher will have made various claims which they do not believe, and the discovery of a fraud often attracts a moralised reaction. This kind of response is much like the response to the discovery of a lie, suggesting that lies and fraud both involve flouting the sincerity norm.[22]

[22] The lie need not be the headline claim: a researcher might create fraudulent data to support a true claim in the hope that others will replicate it (Hardwig [1991], p. 703). This is the pattern we find in the Schön case (Reich [2009]).

This sincerity norm also helps explains the connections between publication and belief. In some cases, bylines are constructed to indicate the strength of belief behind a claim. Consider the seventy-two authors of (Benjamin *et al*. [2018]), which proposes to change the default p-value threshold for statistical significance from 0.05 to 0.005. In other cases authors seem to be governed by a collective interpretation of the sincerity norm. Some groups of co-authors seem to constitute a plural subject brought together by joint commitments (Gilbert [1987], [1989], [2004]) meaning that views expressed are those of the collective (Wray [2006], [2007], [2018]). In other cases authorship is only loosely connected to belief. Many of the authors of a CERN paper will not have read the paper, so cannot reasonably be taken to believe the headline claim, and there is an ongoing debate about whether publishing in philosophy requires belief (Plakias [2019], Fleisher [2020]).

The consistency and coherence norm helps us to think about the norms of collective writing. Why can't a team of researchers simply split up the paper into sections, and write those sections separately, in accordance with their own beliefs? Part of the answer is that authors are under an obligation to ensure that the papers they publish are consistent, and put forward a coherent point of view (Wray [2014], pp. 127-8 [2018], pp. 120-1, Bright *et al*. [2018], pp. 240-1). When researchers get into a disagreement about a question relevant to their paper, they cannot simply report disagreement. They can either take up no position, try to reach a consensus position via debate, or reach compromise. Who takes responsibility for dealing with these situations will typically depend on the writing process: if the group is writing together, then they must collectively hash out a position, but if one researcher is writing on behalf of the group, then they need to resolve these.

The defend or retract norm helps to understand the responsibilities of authors to defend their positions, and the importance of retracting papers. All authors will be under pressure to defend claims made in her papers in conversations, and there may be norms to publish collective responses to critical papers. Academic retraction is a complicated topic in its own right, but it does play a similar role to retraction in conversation. As with response papers, the expectation seems to be that all authors sign off on retraction notices, maintaining the integrity of the collective author.[23]

2.3 Credibility judgements

So far we have been focusing on the analogy between assertion and publication from the speaker's side. Let's now consider the reader's perspective. Although the peer review system provides some default reason to take published papers seriously,[24] there remains an important

[23] Here we are setting editorial retractions to one side (Wray [2018], p. 122). In a survey of retractions from *Science,* Wray and Andersen discovered that the majority of retractions (both in cases of mistake and fraud) are signed by the all authors, suggesting that authors continue to function as collectives (Wray and Andersen [2018], [2019], [unpublished]).

[24] How much trust we should place in peer review is a complex question, which will vary depending on journal practices, and norms of peer review in different subdisciplines. See (Heesen and Bright [forthcoming]) for a critique of peer review.

role for trust in the epistemology of scientific papers.[25] Although the role of credibility judgements is particularly important for lay readers of scientific papers (Anderson [2011]), researchers must take some parts of a paper on trust (such as data collection), and trust claims outside of their expertise.

Our central tool for managing epistemic trust is credibility judgements. When someone asserts a claim, we may consider whether they are being sincere, their competence in the relevant domain, and whether their sincerity is based in their competence. Credibility judgments also help us in making judgements about what to read, allowing us to select papers most likely to be true (or at least interesting).

This suggests the following function:

> Credibility: the function of assigning a set of people as the authors of the paper is to enable readers to make judgements about how credible the results of the paper are.

In the single author case this function is rather simple, but there are various different ways to assign credibility to a collective author:

> Lead: give the paper a credibility rating identical to that of the lead author;
>
> Average: give the paper a credibility rating corresponding to an average of the credibility of all authors;
>
> Highest: give the paper a credibility rating corresponding to the author with the highest credibility;
>
> Lowest: give the paper a credibility rating corresponding to the author with the lowest credibility.

There will also be more complex procedures that pay attention to group-level phenomena, such as the reliability of the aggregation procedure used to reach a collective position (List [2005], Bright *et al*. [2018]).

We might also appeal to other factors to assign credibility:

> Journal: give the paper a credibility rating corresponding to the reputation of the journal;
>
> Lab: give the paper a credibility rating corresponding to the reputation of the lab that

[25] (Hardwig [1985], [1991]), (Adler [1994]), (Fricker [2002]), (Wilholt [2009]), (Wagenknecht [2014]).

produced it.[26]

Various other phenomena may play a role in determining the credibility-rating for a paper, including pre-registration of results, the presence of open science badges, the quality of peer review in the field, and what country the authors are working in.

2.4 Accountability

Associating authors with papers doesn't just allow us to judge credibility; it also allows us to improve the quality of work. Having authors associated with a paper gives us a target for what we might think of as the epistemic reactive attitudes (Tollefsen [2017]), which encompass everything from the award of scholarly prizes to chiding a colleague for a shoddy work. Having a stable practice of praising and blaming gives all researchers social reasons to produce better work (Reynolds [2002], [2008], [2017], Bruner [2013]). If these community-level policing mechanisms are well-implemented, they may allow a default of trust in all work.

This suggests the following function:

Accountability: the function of assigning a set of people as the authors of a paper is to create a target for praise if the paper is epistemically good, and censure if the paper is epistemically bad.

As with the norms discussed in 2.2., there are various different ways to implement accountability:

All: hold every author accountable for every claim made in the paper;

One: hold one author accountable for every claim made in the paper;

Distributed: hold each author accountable for the claims they were responsible for;

Collective: hold the authors collectively responsible.

These practices incentivise different patterns of epistemic conduct, and have different costs and benefits. Holding all authors responsible incentivises all authors to double check the whole paper, which will push up the quality of published papers, at the cost of epistemic labour. This is the practice prescribed by the ICJME guidelines (ICJME [2018]). The labour involved in ACC-ONE and ACC-DISTRIBUTED is somewhat lower, but they also incentivise less thorough checking. A practice of collective or institutional accountability can motivate institutions to create internal processes, such as internal peer review and quality control (see

[26] One might also wonder whether we can replace trust in individual researchers with trust in the collective processes of science (Kukla [2012]). On the importance of trust in individuals in science, see (Hardwig [1991], p. 704-9), (Frost-Arnold [2014]), (Wagenknecht [2014]).

Galison [2003], pp. 336-40).

2.5 The scientific marketplace

Although there are centrally planned elements of the scientific community (including government funding, and commercial research), for the most part researchers are free to self-direct. Without explicit direction, we might think that science requires an incentive system to ensure that researchers produce socially useful knowledge in an efficient manner. It is plausible that market-style mechanisms will deliver this by incentivising individuals to work hard (Zollman [2018]), and leading to an efficient division of labour across projects (Kitcher [1990], Strevens [2001]). By itself, inquiry is poorly suited to market mechanisms, since it requires the investment of private goods (time, leisure, money) to produce a public good (knowledge). A set of scientists motivated only by truth would be subject to the public goods problem, leading to each individual defecting from the optimal distribution of labour (Dasgupta and David [1993], Stephan [1996], Zollman [2018]).

To address this problem, we need to introduce a private good into the system. We could just pay researchers money when they make discoveries,[27] but it would be cheaper (as well as according better with researchers' self-conception) to create a parallel economy of social credit. When a researcher publishes a paper, they get allocated social recognition based on having a publication. This recognition can then be used to leverage other private goods, including employment, promotion, patents, and academic prizes.[28]

This suggests the following function for authorship attributions:

> Market: a function of assigning a set of people as the authors of a paper is to create a system of private goods which are apt for market mechanisms.

This function draws our attention to the way social credit can create an incentive structure for academic research, but it does not by itself say anything about how this social credit is awarded. This is a big question. If joint-authored publications receive less social prestige than single-authored publications, researchers will be motivated to work alone. We ought also to worry about researchers manipulating the system (Kwok [2005], McElreath [2016], Heesen [2018]), and that different disciplines distribute credit in different ways, creating a set of overlapping marketplaces (Lee [2020]).

[27] Universities in China pay from $30,000 to $165,000 for publication in Web of Science indexed journals (Quan *et al*. [2017]), and an informal study by retraction watch found financial rewards in universities in Gulf states, South Africa, East Asia, Australia, and in the UK and US (Abritis *et al*. [2017]).

[28] This function opens up an interesting perspective on joining a laboratory that includes all members as authors. Alongside the productivity benefits, we might think of this kind of scheme as risk-pooling device in which one puts one's labour into a common pool, and receives a share of the benefits.

3.Who Should be an Author?

Our discussion has distinguished a family of functions for authorship practices: the credit function, the speaker function, the credibility function, the accountability function, and the market function. The ideal would be to find a practice of ascribing authorship which could simultaneously play all of these roles. In this section, I argue that this aspiration cannot be fulfilled. The different functions answer a number of questions in incompatible ways:

1. Should researchers be authors on papers whose results they don't believe?
2. Can the author list of a paper be manipulated to boost its credibility?
3. Should invisible technicians and ghost authors be included as authors?
4. Can we assign authors for massively collaborative work?

3.1 Credit and belief

Consider the following situation: a large group of researchers has put a considerable amount of work into an experiment, producing a large data-set which has potential to be used for many different purposes (think of a longitudinal population study, or experimental work in high-energy physics). One member of the team draws on this work to support a controversial claim, which many others believe to be false. Who should be listed as an author on the paper detailing these controversial results?

According to the credit function, authorship should respond to the labour which went into the production of the paper, and all researchers who have put in intellectual or practical work should be listed as authors. The disbelieving authors might be disgruntled by this proposal, being unwilling to stake their reputations on this controversial claim. The disbelieving researchers might leverage the speaker function (focusing on the sincerity norm applied as ALL) or the credibility function to argue they should not be authors. In this situation, considerations of credit makes one prediction about who ought to be an author, and the speaker and credibility functions make an opposing prediction.

3.2 Manipulating credibility

Consider the following dilemma, identified by a Nobel prize winner interviewed by Harriet Zuckerman:

> You have a student; should you put your name on that paper or not? You've contributed to it, but is it better that you shouldn't or should? There are two sides to it. If you don't [and here comes the decisive point on visibility], if you don't , there's the possibility that the paper may go quite unrecognised. Nobody reads it. If you do, it might be recognised, but then the student doesn't get enough credit. (Zukerman [1977], quoted in Merton [1968], p. 5)

Here we find a tension between the desire to ensure that all contributors get adequate credit, and the desire that the paper be widely read and taken seriously. From the perspective of the credibility function, including the senior scientist is a good idea, since it will boost the credibility of the paper, allowing it to reach more people. But from the perspective of CREDIT, things are difficult: the inclusion of a senior researcher might lead to her student getting insufficient credit.

Credibility can motivate both inclusion and exclusion. In inclusion cases, highly-regarded researchers are parachuted in at the last moment on a paper that they have done no work on to boost its credibility. From the perspective of the credibility function, this is a potentially helpful practice that ensures that good work gets read. However, from the perspective of the credit function, this bloating of the byline improperly represents the creditworthy work. [29] In exclusion cases, the byline of a paper is pared down to ensure that only credible researchers are left. This practice will be prevalent—and perhaps understandable—in conditions of widespread testimonial injustice (Fricker [2007]). We might think that the authorship practices of Robert Boyle and his contemporaries were in part a response to the culture of gentlemanly trustworthiness in early modern England. This culture associated trustworthiness with masculinised perceptual competence, Christian virtues, the disinterested attitude which presupposed financial independence, and a position in an aristocratic honour culture which assigned significant social costs to mendacity (Shapin [1995], p. 75-86). This epistemic culture made credibility in scientific matters the sole preserve of upper-class men, meaning that for experimental research to function in the seventeenth century credibility economy, Boyle had to transform the labour of paid laborants into the 'testimony of a free and independent gentleman' (Shapin [1995], p. 383). This practice of exclusion might be perfectly respectable from the perspective of credibility, but the credit function reminds us that it unfairly excludes creditworthy parties. In these cases, the credit and credibility functions pull in different directions.

3.3 Invisible technicians

A related tension between the credit and speaker functions shows up in cases where lots of people have contributed significant practical labour into a project which they do not fully understand. Consider Gaspard de Prony's mathematical tables project, which employed political refugees and unemployed hairdressers as human computers to prepare tables of trigonometric and logarithmic functions (Grattan-Guiness [1990], Daston [1994], Grier [2005],

[29] (Strevens [2006]) suggests a potential resolution to the credibility-boosting case. We might think that putting one's credibility behind a paper is itself a creditworthy move, meaning that the senior scientist who is included at the last moment is in fact creditworthy. If we buy this idea, we might think that credibility-boosting inclusion might be justifiable by the credit function. This idea doesn't fully resolve the puzzle, because it fails to address credibility-motivated exclusion. Not being credible does not decrease one's creditworthiness.

pp. 34-8).[30] The workers carried out calculations by means of repeated operations of addition and subtraction, which Prony claimed was the extent of their mathematical knowledge. These human computers are plausibly due credit for the tables produced, but Huebner, Kukla, and Winsberg (HKW) claim that *only* Prony—perhaps together with the mathematicians who assisted him in setting the calculations—can claim authorship:

> [Only Prony and the Mathematicians] could vouch for the results of this massive collaboration; they were the ones who were epistemically accountable for producing accurate tables, defending them if challenged, and revising them if necessary. [. . .] In effect, the text was still single-authored [. . .] because one person retained centralised control over the research process, including its methodological standards and implementation. While many people participated in the production of knowledge, only one person has the status of the author of the document communicating that knowledge. (Huebner *et al*. [2018], pp. 98-9).

Here HKW deploy several of the speaker norms, including the sincerity norm, the defend or retract norm, and the knowledge norm. They point out that because of the unequal nature of the collaboration, belief in the reliability of results, discursive responsibilities, and knowledge are all centralised, meaning that only Prony can fulfil the responsibilities associated with these norms. Whereas the credit function offers an inclusive and meritocratic picture of authorship for work that involves a division of labour, the speaker function offers an elite picture, associating authorship with epistemic responsibilities which may only be fulfillable by the managers of a project.

3.4 Radically collaborative research

The final dilemma concerns cases of radically collaborative research , which HKW argue involve a wholesale breakdown of authorship (Kukla [2012], Winsberg *et al*. [2014], Huebner *et al*. [2018], Winsberg [2018], Chapter 13). Radically collaborative research involves a high degree of specialisation and division of labour, a large number of collaborators working in different institutions around the world, and no centralised perspective that can synthesise the work of all of the researchers. HKW's examples are multi-site biomedical trials, high-energy physics, and atmospheric climate modelling. HKW argue that these cases pose a fundamental challenge to our conception of authorship, because the lack of a centralised perspective means that there is no individual who can take responsibility for this work. On their view, no individual or group can claim authorship for this kind of research.

I think that HKW are half right. By the lights of the speaker and accountability functions no-one should be an author of papers produced by radically collaborative research. It will be impossible to find anyone to fulfil the knowledge-norm, who might ensure consistency, who might defend the research, and who might be accountable. However, according to the credit

[30] Although these computers were mathematically illiterate, many people employed as human computers others were sophisticated researchers in their own right. For discussion of the computers at the Harvard College Observatory, see (Grier [2005] Chapters 4 and 5, Sobel [2017]).

function, authorship is straightforward: everyone who contributed to the project should be listed. This suggests that the speaker and accountability functions are also in tension with the credit function.

4. The Death of the Academic Author

The four tensions detailed in the previous section demonstrate that the different functions of authorship make different predictions about who should be an author, meaning that no rule for assigning authors to papers will be able to meet all of the functions of authorship. There are several ways we might try to move forward:

1. Pick a set of coherent functions and design a practice for ascribing authorship that matches up with those functions;
2. Accept the inconsistency, but allow researchers to continue to pick and choose which functions they want authorship to play;
3. Try to design a new practice which preserves all of the functions of authorship whilst addressing their inconsistency.[31]

The goal of the rest of the paper is to develop a version of the third strategy. I take it that all of the functions of authorship are important, making the first strategy unappealing. And the profusion of meanings for authorship allowed by the second strategy would do nothing to address the lack of clarity around authorship.[32] At present, authorship is both confusing and inconsistent, and it would be good to address both problems by crafting an authorial practice which is clear and responsive to the different functions of authorship.[33]

I suggest that we employ a divide and rule strategy that does away with the status of authorship, replacing it with several different statuses tailor-made for the different functions of authorship.[34] Rennie, Yank, and Emmanuel make a similar proposal, suggesting that we replace authors with contributors (someone who has done relevant work), and guarantors (someone who takes responsibility for the integrity of the whole) (Rennie *et al*. [1997], pp. 582-3).[35] I want to take things further, replacing authorship with four roles. Let's call this revisionary proposal the CWSG proposal:

The CWSG proposal:

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[31] We might also explore proposals for anonymous (Hanel [unpublished]), or pseudonymous (Minerva [2014a], [2014b]) authorship practices, though these are motivated on rather different grounds.
[32] (Biagioli [2003]), (Rennie *et al*. [1997]).
[33] This is why I don't think it would be sufficient to resolve the conflicts from section 3 by simply distinguishing two roles: contributor and writer-spokesperson-guarantor. By articulating more fine-grained roles, we can be responsive to authors who are writers but not guarantors, and so on.
[34] For an analogous response to the incoherence of truth, see (Scharp [2013]).
[35] This radical promise has been dulled in implementation (see Rennie *et al*. [1997], p. 583). Biomedicial journals have kept the byline for authors (regulated by the ICJME guidelines), and included contribution statements and a guarantor at the end of the paper (see BMJ [2018]).

> Papers should no longer be associated with authors, instead they should be associated with four roles:
>
> Contributor: someone who has contributed labour to the project, making them either fully or partially creditworthy for the achievement associated with the project.
>
> Writer: someone who contributes to the writing of the project
>
> Spokesperson: someone who takes responsibility for co-ordinating responses to criticisms of the paper, and retraction decisions.
>
> Guarantor**:** someone who gives their word that all the claims made in the paper are true.

The credit function concerns the role played by authorship in the recognition of creditworthy work, and will be associated with the contributor role. This role is backward-looking: we can determine who should be a contributor by considering who put their labour in to the collective intellectual achievement of the paper. This role bundles together the byline and the acknowledgements of a paper, giving a full picture of the people who contributed to the paper. It should be unusual to see just one person listed as a contributor. It might be helpful to distinguish the credit associated with research from the credit for writing and guaranteeing. This allows us to more easily represent cases in which someone has come in after the research has been done to act as writer or guarantor.

The speaker function concerns the epistemic norms associated with publication: sincerity, consistency and coherence, the knowledge norm, and the defend or retract norm. Unlike the credit function, this is forward-looking. I propose that we split these norms in two. Sincerity, consistency and the knowledge norm are associated with the writing process: the researcher(s) who have taken a lead on pulling together individual contributions to yield a coherent whole are best placed to fulfil these norms. The defend or retract norm concerns the life of the paper post-publication, and is associated with long term responsibilities. I propose that we associate the role of writer with the norms of sincerity, consistency and coherence, and the knowledge-norm, and the role of spokesperson with the defend or retract norm. These roles need not be played by the same people.

The credibility function concerns whose credibility is associated with a paper. Here the proposal gets a little more complex. Following Rennie, Yank, and Emmanuel, I propose a guarantor role: someone who guarantees the integrity of the whole piece of work. We can think of a guarantor functioning a little like book endorsements. The guarantor's credibility allow us to use a single agent's credibility for a paper, but we might want to allow for more complex credibility assignments that also look to the credibility of the contributors concerning their portions of the research. Perhaps the default should be that the primary credibility for entirety

of the paper is given by the guarantor's credibility, but the secondary credibility for the parts of the paper is given by the credibility of contributors.

The accountability function concerns the targeting of reactive attitudes to motivate epistemically high-quality research. We have seen that there are a number of ways to hold researchers responsible. I propose a similar division of labour to that we saw with the credibility function. The guarantors of the paper should be held accountable for the entirety of the paper (one),[36] and the contributors should also be held accountable for their own contributions (distributed). If one contributor has done poor work or lied, both they and the Guarantor(s) are to be held accountable for the failing. This gives us a similar distinction between the primary accountability of guarantors and the secondary accountability of contributors (Rennie *et al*. [1997], pp. 582-3).

The last function is the most complex. Recall that the market function was a response to the need for private goods associated with research. What the CWSG proposal gives us is a family of statuses which are each apt to be treated as private goods. All we need to get the benefit of market mechanisms is a status associated with social recognition, meaning that associating social credit with the Contributor role is enough to get market mechanisms up and going. However, we might want to explore more complex systems that assigns differential recognition to the different roles. For example, we might motivate careful checking by associating the guarantor role with lots of social credit.

	Credit	***Accountability***	***Credibility***	***Speaker norms***	***Market***
Contributor	Primary	Secondary	Secondary		Primary
Writer	Secondary			Sincerity; Consistency and Coherence; Knowledge.	Secondary
Spokesperson	Secondary			Defend or Retract	Secondary
Guarantor		Primary	Primary		Secondary

Table 2: Functions of authorship, and their relation to the roles of the CWSG proposal.

Having distinguished these roles, we can resolve the puzzles from section 3.

[36] This is a demanding role, and in radically collaborative research it may be difficult or impossible to meet its demands (Winsberg *et al*. [2014], Huebner *et al*. [2018]), leaving some papers without a guarantor.

The first issue is how to deal with researchers who have put creditworthy labour into a project whose results they do not believe. Such individuals can be listed as contributors to the paper, but left off of the lists of writers and guarantors, to represent the fact that they do not want to be bound by the sincerity norm, or put their credibility behind the result.

The second issue concerned credibility manipulation. Credibility-motivated inclusion and exclusion can be easily represented in this framework, without confusing credibility and credit.[37] If researchers wanted to parachute in a senior researcher, they can list them as a guarantor for the paper without including them as contributor. And if researchers wanted to downplay the credibility of some researchers, they could be contributors but not guarantors (giving their credibility a secondary role).

The third issue concerned how to represent the work of researchers who have contributed significant labour to a project, without being in a position to fulfil the norms associated with SPEAKER. This is simple: these researchers should only be listed as contributors.

The final issue concerned radically collaborative work, in which no individual can claim to know the results of research. The list of contributors for such research is unproblematic: we can list everyone who was involved in the research. The problem is that no-one seems in a good position to be listed as writer or guarantor. Here we have three options: the writer and guarantor slots could be left empty, the researchers could be compelled to do more work until some of them can play these roles, or these roles could be played by collective entities.[38]

A virtue of the proposal is that it makes the epistemically central features of publication extremely salient, lending itself to an open-ended pluralism that can represent diverse research cultures. This point is easiest to see by running through some examples of how this proposal can be applied to the research cultures of different disciplines:

> Humanities: we can represent the fact that one individual has done most of the work of reading and constructing an argument by listing them as sole writer, spokesperson, and guarantor, whilst recognising others' contributions—which would normally be listed as acknowledgements—by including them as contributors. This is the model used by this paper.
>
> Laboratory science: we can include everyone who has put labour into the project as contributors, while the researchers who have done the work of pulling the paper together

[37] We might be skeptical about credibility-boosting exclusion, but we might think that there is something valuable about a credible researcher putting their reputation behind a paper to give it more credibility (Strevens [2006]).

[38] All roles might be played by groups: massively collaborative work might have collective contributors, crowd-written papers might have a collective writer (Tomlinson *et al*. [2012]), and papers produced established labs might have a collective spokesperson, and hold the lab collectively accountable.

can be listed as a writer, and the laboratory head can be listed as a guarantor for the whole project.

High-energy physics: we can represent the membership list approach to authorship by including everyone who has contributed to the collaboration as an author. In addition, we would want to have information about who did the work of writing, who will act as spokesperson, and who should be held accountable.[39] In this case, it may be that we want to hold the collaboration collectively accountable to ensure that it has good institutional practices.

Crowdsourced/co-produced research: we can recognise the labour of a large group of people by including them as contributors, without assigning the epistemic responsibilities associated with writer, spokesperson, and guarantor, which will presumably be associated with the researchers who designed and implemented the project.

The CSWG proposal doesn't give a recipe for determining who should play what role for a given paper; it provides a set of tools for research groups to write their own recipes in a way that is perspicuous and reflects their distinctive epistemic cultures.

It is worth highlighting the differences between the CWSG proposal, the ICJME guidelines, and the CRediT system. The ICJME guidelines present four individually necessary and jointly sufficient conditions for authorship:

1. Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work;
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 in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

The idea is that we can extend the properties associated with single authorship to all co-authors of a collaboratively produced work, making collective authorship into a distributive property (Moffatt [2013], Wray [2018]). In our terminology, the properties associated with authorship are 1) 'substantial' creditworthy contribution, 2) input into the writing process, 3) being subject to the sincerity norm, and 4) being held individually accountable for the whole of the work. While the CWSG proposal would allow for an assignment of roles that approximated this arrangement—where all contributors are also writers, and guarantors—it is much more flexible. We might worry that the ICJME proposal forces a particular model of collaboration on researchers, whereas the CWSG proposal can accommodate diverse research cultures. If a

[39] High-energy physics has flexible practices for speaking for a collaboration, and the same research may be presented by many different researchers, depending on their need for 'exposure' (Knorr Cetina [1999], pp. 168-9).

group have researchers have produced a paper through a division of labour across these different conditions, according to the ICJME guidelines no-one should be listed as an author of the paper (Moffatt 2013).

Another salient point of difference is the requirement for 'significant' contributions. We don't have a good account of what significance is, and I suspect that it is often used as a get-out to get the desired people onto the byline (a similar get-out is to treat these conditions as individually sufficient for authorship). The CWSG proposal is compatible with various different accounts of the Contributor role, and leaves open the question of how best to represent credit-worthy work in an inclusive way.

The CRediT proposal proposes to distinguish the different authors of a paper by slotting them into a 'controlled vocabulary' of roles. These roles distinguish different kinds of contribution, and are designed to reduce conflicts about byline position, while displaying important information about research process.[40] A first problem is that this proposal doesn't have anything to say about the responsibilities associated with authorship, focusing exclusively on CREDIT (making it a version of strategy 1 above). This means that the proposal does nothing to address the problem cases from section 3. A second problem is that following the CRediT guidelines requires a lot of work to keep track of who did what in research. In large-scale collaborations it may be simply impractical to gather this information (CERN doesn't even gather information about who worked on particular paper). The CWSG proposal allows us to vary the amount of information about contributors depending on its value.

5. Conclusion

Discussions of authorship often note how confusing authorship practices are. In this paper I have made the case that authorship practices are not simply confusing: authorship itself is incoherent. If we want authorship to play all of the functions associated with it, then we will get inconsistent predictions about who to assign as an author. We can either do away with these functions, or do away with authorship. I have suggested that we take the second option, and have offered a revisionary proposal – the CWSG proposal – which replaces authorship with the roles of contributor, writer, spokesperson, and guarantor, dividing up these functions between the different roles.

It is important to own the limitations of this proposal. It is aimed at the conceptual problems with authorial practices, and it does not address its many practical problems, such as conflicts about authorial status, problematic incentive structures, and how to represent complex collaborative work. That said, the flexibility of the CWSG proposal offers tools to make progress on these questions. We should understand the CWSG proposal as a conceptual tool

[40] The full list is: conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, project administration, resources, software, supervision, validation, visualization, writing (original draft), and writing (editing and reviewing) (CRediT [2018]), (MozillaScience [2018]).

for dividing up the epistemic properties associated with authorship, and not as a recipe for determining who goes where on a byline.

What we should want is a non-exclusionary practice that is easy to use without disagreement, fairly allocates credit, properly distributes epistemic responsibilities, enables useful credibility judgements, facilitates practices of accountability, and creates a market that incentivises good research. The best—and perhaps only—way to design a practice that fulfils these desiderata is to have an open and interdisciplinary conversation between researchers from different disciplines. My hope is that this paper lays some of the groundwork for that conversation.

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