

Accountability in Research

Policies and Quality Assurance

ISSN: (Print) (Online) Journal homepage: <https://www.tandfonline.com/loi/gacr20>

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To cite this article: Bart Penders & David M. Shaw (2020) Civil disobedience in scientific authorship: Resistance and insubordination in science, *Accountability in Research*, 27:6, 347-371, DOI: [10.1080/08989621.2020.1756787](https://doi.org/10.1080/08989621.2020.1756787)

To link to this article: <https://doi.org/10.1080/08989621.2020.1756787>



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Published online: 14 May 2020.



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Civil disobedience in scientific authorship: Resistance and insubordination in science

Bart Penders ^a and David M. Shaw^{a,b}

^aDepartment of Health, Ethics & Society, Care and Public Health Research Institute (Caphri), Maastricht University, Maastricht, The Netherlands; ^bInstitute for Biomedical Ethics, University of Basel, Basel, Switzerland

ABSTRACT

The distribution of credit, resources and opportunities in science is heavily skewed due to unjust practices and incentives, hardwired into science's rules, guidelines and conventions. A form of resistance widely available is to break those rules. We review instances of rule-breaking in scientific authorship to allow for a redefinition of the concept of civil disobedience in the context of academic research, as well as the conditions on which the label applies. We show that, in contrast to whistleblowing or conscientious objection, civil disobedience targets science's injustice on a more systemic level. Its further development will ease critical evaluation of deviant actions as well as helping us evaluate deviance, defiance and discontent in science beyond issues of authorship. However, empirically, civil disobedience in science engenders uncertainties and disagreements on the local status of both act and label.

KEYWORDS

Civil disobedience; resistance; research integrity; research governance; authorship; protest

Introduction

Resources and power in contemporary science are distributed asymmetrically. The so-called Matthew Effect in science, a term first coined by Robert Merton, holds that it is easier to gather resources, credit and prestige if one already possesses more than a critical amount (Merton 1988). Merton drew the name from the Parable of the Talents, which reads “For to everyone who has will more be given, and he will have abundance; but from him who has not, even what he has will be taken away” (Matthew 25:29). If applied to science, it results in reward based not on quality, but on preexisting prestige, thus amounting discrimination against those who have not yet or may never pass the threshold. Distribution of resources and power and science can be unequal without necessarily being unjust, but the Matthew Effect, which effectively promotes reputation over content, can safely be argued to be

CONTACT Bart Penders  b.penders@maastrichtuniversity.nl

Due to a lack of coins to toss, authorship was assigned through two criteria. First, given equal seniority at the time of writing, Shaw was awarded senior authorship based on age alone. Second, authorship sequence was further legitimised by reversing authorship order from their last co-authored paper.

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both. Injustice in science is not solely the result of the Matthew Effect, yet it is evident between genders (Fox, Whittington, and Linkova 2017; Rossiter 1993), disciplines (Allison 1980), country of origin (May 1997; Salager-Meyer 2008), the ability to write in English (Flowerdew and Li 2009, Vasconcelos et al. 2008) and many more differences between people that do not necessarily influence their ability to do high-quality science. Those inequalities are systemic and can be attributed in part to the cultures of evaluation and reward that currently permeate the academic climate (Bornmann and Daniel 2008; Fochler and de Rijcke 2017; Hackett et al. 2017; Hammarfelt, de Rijcke, and Wouters 2017). The Matthew Effect has repeatedly been confirmed to shape resource allocation, for instance by awarding funding to researchers based upon their history of receiving funding (Bol, de Vaan, and van de Rijt 2018; Langfeldt et al. 2015). Working within the confines of the academic infrastructure that produces such inequalities, overcoming these inequalities and reversing the Matthew Effect is unlikely to come about by acting within the limits of this system.

Given that the organization of the governance of science, including reward and evaluation cultures, is beyond the direct sphere of influence of individual researchers, many feel powerless to combat the status quo. This powerlessness, as well as the all-encompassing feeling of unfairness, has contributed to the rise of mental health issues in science, especially among early career researchers (ECRs) (Levecque et al. 2017). In the life sciences, such pressure has caused ECRs to continuously consider their engagement in collaborative work (Müller 2012), exposing this tension to affect both the health of individuals as well as the epistemic impact of research work (Müller and de Rijcke 2017).

The translation of this particular type of organization and governance of research into practitioners cutting corners (Altman 1994) and the diminishing quality of research reported (Ioannidis 2005; Lehrer 2010) does not come as a surprise. In the context of concerns about Taylorism and neoliberalism pervading academic institutions, some have argued that the university is occupied and requires liberation (Halffman and Radder 2015). Academies that are supposedly meritocratic turn out to display bias, rentiership and even exploitation (Birch 2019; Kovacs 2017; Nielsen 2015). Researchers working under these conditions do not just all apathetically accept them. Rather, they resist through various strategies. Some turn their scholarly gaze upon the subject of evaluation cultures and mobilize their expertise to expose the performativity of organizational and entrepreneurial logic (Hicks et al. 2015). However, such a path is accessible only to a few. Some actively go on strike, a rare event among research professionals, although resurrected in 2017 through the Marches for Science (Penders 2017b; Brulle 2018). More accessible, yet not necessarily very common, is civil disobedience: the act (or activism) of purposefully and visibly breaking norms, rules or guidelines with

the political purpose of exposing these as unjust, wrong, or corrupted in themselves or in the context of their use.

We ask what role civil disobedience can play in the context of research organization and research evaluation and what it would look like. Here, we focus on civil disobedience in the context of authorship rules, in which authorship rules are intentionally broken in order to expose the structural inequalities they and other credit distribution structures represent. We do so for very pragmatic reasons: these are acts of potential civil disobedience that leave a trace in the literature, as authorship lists and contributor statements are part of the scientific record. Even within that record, however, some cases of civil disobedience may go unrecorded if authors are not fully transparent about their act, either immediately or with some delay. This will make quantification of civil disobedience difficult. The practice of civil disobedience in science is, however, far from limited to authorship practices.¹

This paper refines the notion of civil disobedience as a specific form of resistance to the managerial or neoliberal university (Ese 2019), to help establish a conceptual frame through which we can understand seemingly deviant behavior when it comes to scientific authorship. Here, apparent deviance, points to possibly legitimate rule-breaking and not regular authorship misconduct. First, we discuss the concept of civil disobedience and its merits for expressing discontent in science. Subsequently, we demonstrate that despite its rarity, historical and contemporary candidates exist in the literature, using three types of civil disobedience in authorship: the use of pseudonyms, the obvious guest author and authorship attribution/the kilo-author. Finally, to add precision to the moral and social status of civil disobedience, we compare it to two other acceptable modes of insubordination also practiced in science: whistleblowing and conscientious objection.

Civil disobedience in science

Henry David Thoreau describes how the victims of the American political organization in the 1840s did not have to be physically attacked in order to be subject to violence (Thoreau 2016). He listed explicitly the slave, the Mexican and the Indian, and argued that to submit or, even consent, to a state that sanctioned slavery, war or genocide, made regular citizens morally culpable. Thoreau argued: “Unjust laws exist: shall we be content to obey them, or shall we endeavor to amend them, and obey them until we have succeeded, or shall we transgress them at once?” to conclude that civil disobedience, insofar as it resists unjust or immoral laws, is a duty. The state of contemporary science is sadly, only slightly different. Nevertheless, exploitation of cheap (and sometimes free) labor under conditions of growing uncertainty are key characteristics that fuel continued inequalities in science (Fochler, Felt, and Müller 2016; Hangel and Schmidt-Pfister. 2017; Sigl 2016)

and given the effects they can have, referring to them as violence is not unheard of (Kovacs 2017).

Sociologist Schuyt argues that rather than being a duty, civil disobedience can be permissible, provided it lives up to a series of requirements. Schuyt draws from a typology of resistance compiled by Bell (1973) and argues that the requirements include that the act is borne out of moral conviction, is well-considered, other means to resist have been used before, the act is transparent and publically visible, a symbolic relationship exists between the transgression and the rule resisted, one accepts possible consequences or ramifications (such as punishment) and the act is without violence (Schuyt 2009; Bedau 2002).

Thoreau and Schuyt directed their analyses toward public administration. In a similar vein, though, science hosts rules, regulations and guidelines that have been labeled unjust: the inequalities listed above, and befitting the focus of this paper, credit distribution (Ben-David 1972; Lawrence 2002) and authorship attribution conventions, norms and guidelines (Shaw 2011, 2014). Wesley Shrum tops off the final chapter in a collection on the sociology and politics of scientific collaboration in the life sciences (Parker, Vermeulen, and Penders 2010) with the diagnosis that to many, despite reservations about sharing credit (Müller 2012), collaboration has become a coping mechanism to survive science's production pressure (Shrum 2010). In the life sciences, collaboration is often not a choice, but a decision forced onto researchers by among others, funders, institutes or scarcity (Penders, Vermeulen, and Parker 2015; Vermeulen, Parker, and Penders 2010).² These external pressures on collaboration often contradict internal needs to collaborate: the collection of a variety of expertises required to answer a research question or tackle a complex research problem. To resist external collaborative pressure, especially when it promotes collaboration where none or little is required, Shrum proposes the institution of 'collaborative networks':

"Groups of friends – I suggest ten but larger ones may even work better – could agree to join forces through the co-authorship practice of entering all names as authors on any paper submitted for publication by any member. Hence, if each of the collaboration produced two papers per year, all members of the network would have 100 papers in only five years, an absurd number [...]" (257-258).

While of course such a practice does not live up to the authorship rules as laid out below, Shrum argues: "by the best activist tradition, the practice of counting would be problematised and undermined" (258). To Shrum it is important that this type of activism changes neither the number of papers being written, nor the content of the research produced. It exposes a "simplistic evaluative mechanism" (258) and while it will unquestionably invoke a response, that response merely contributes to the total exposure. In order to follow this course of action, authors may have to untruthfully

complete authorship forms and accordingly subject themselves to risky research integrity probes or audits. As well as risking accusations of misconduct, one could question whether this type of act actually amounts to civil disobedience, as Shrum does not mandate transparency and openness about the act.

Shrum's proposal is a thought experiment. To our knowledge, neither he, nor the other participants in the sociology of scientific collaboration pursued this action further. This time, the thought experiment and its publication served as the activism in itself. But cross-citation and citation circles are not thought experiments. They are usually, however, less extreme and actively obscured, as a way to game the system rather than challenge it. Unlike Shrum, other researchers did not stick to thought experiments and actively pursued and perpetrated civil disobedience with respect to authorship norms. We have collected a series of candidates and offer them here. In our subsequent evaluation of these examples, we will separate reasonable civil disobedience from poor practice and in the process theorize on the status and role of civil disobedience in science. This list is not complete, and with the growing body of scientific publication, its incompleteness will grow. We target the moral and social status of civil obedience, rather than aiming to empirically document or quantify its existence.

Authorship rules and how (not) to break them

Before turning our gaze to how and why authors resist authorship guidelines, we first present a very concise overview of existing guidelines and practices. There are no all-encompassing authorship guidelines, but the criteria set forth by the Committee on Publication Ethics (COPE) and especially the International Committee of Medical Journal Editors (ICMJE) have grown to become the most dominant prescribing instruments in biomedical literature. The ICMJE authorship criteria dictate that authorship may only be awarded to an individual who has involved in all three of the following activities: “Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work”, “Drafting the work or revising it critically for important intellectual content”, “Final approval of the version to be published”, as well as agrees 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” (ICJME 2019). It is worth noting that any one of these criteria used to be sufficient for authorship, and the change to making all criteria mandatory has the effect of excluding many researchers who would previously have been authors – assuming, of course, that they actually observe these rules. The ICMJE adds to this, that all authors “should be able to identify which co-authors are responsible for specific other parts of the

work. In addition, authors should have confidence in the integrity of the contributions of their co-authors”. One can only be an author if all those requirements have been fulfilled and one should not be denied authorship if all requirements have been fulfilled.

Despite the fact that these criteria, especially at first glance, seem to make sense, they are not immune to critique. The requirement to approve the final version can be abused, for instance, by denying contributors that option or ability, or it can be voluntarily refrained from, to willfully forgo status as an author. Matheson (2011) has shown how this produces ghost authors on publications backed by the pharmaceutical industry, all while adhering to the letter of the ICMJE criteria. (ICMJE guidelines also state that the criteria should not be used “as a means to disqualify colleagues from authorship who otherwise meet authorship criteria by denying them the opportunity to meet criterion #s 2 or 3”, but a researcher willing to rob colleagues of authorship will presumably be happy to disregard this stipulation.) Shaw (2011) argued that the requirement to fulfil *all* criteria has the potential to create the paradoxical situation that science is performed but that none of the contributors qualify for authorship because of their distribution of labor. To publish the research without authors would make attribution of credit and responsibility impossible, but to publish it with authors would violate ICMJE criteria and would count as detrimental research practice (DRP) at best, and scientific misconduct at worst. While authorship criteria might generally be easy to meet, Shaw’s example highlights there are some cases where they could become problematic.

Matheson describes a scenario that is unlikely to be as hypothetical as it had to be presented. Nothing is being done wrong according to the letter of the ICMJE criteria, yet clearly the attribution of credit and responsibility as described does not represent actual labor distribution. In contrast, the scenario sketched by Shaw, as well as the aforementioned thought experiment by Shrum, displays weaknesses or mistakes in rules and conventions around authorship and evaluation. Their suggestions propose breaking the rules as a form of political resistance in the context of power distributions in scientific organizations. They propose or describe instances where breaking the rules exposes these weaknesses, makes them visible for all to see. Such rule-breaking is not a homogenous affair. Here, we offer three types of civil disobedience, breaking and thereby exposing different subsets of authorship attribution rules. These three do not comprise the full breadth of possible activism and serve as examples here. They are (1) the use of pseudonyms, and very much interlinked, (2) the obvious guest author and (3) the kilo-author and other authorship attributions.

The pseudonym

The reliable attribution of credit, intellectual ownership, and responsibility requires that authors can be identified and can be linked directly and reliably to the texts they produce. Authors change their name, which happens for various reasons but mostly as the result of marriage, or authors have difficult-to-distinguish or very common names, or one that can be spelled in various ways. Author ID systems have emerged to alleviate these difficulties (Haak et al. 2012), although the attribution of past publications continues to be difficult. Author IDs help identify authors who were inappropriately and accidentally misidentified or unable to be identified. A second group facing difficulty in the reliable attribution of credit, intellectual ownership, and responsibility are those authors who actively resist identification by publishing under a different name. Although a *nom-de-plume* or a pseudonym is acceptable in many parts of our culture, it represents a problem for the contemporary governance and evaluation of science.

Anonymity in science is rather common, but located mostly in the realm of peer review. Despite many actual and proposed changes in the process of peer review (McNutt et al. 1990; Smith 2006; Stahel and Moore 2014), the most common process still entails that editors at least are aware of the identity of a reviewer and thereby able to assess the worth of the evaluation they offer. Authors, on the receiving end, will have to trust the editor that a legitimate peer has been chosen. The situation of publishing under a pseudonym presents a much larger challenge, since (in most cases) the author cannot be reliably questioned about their work. Why did (and do) scientists publish under a pseudonym? Why forego the credit associated with publications? At least three answers exist: first, authors have been unable to publish under their own name since existing political structures did not allow them to do so, or did not allow their contributions to be assessed fairly. Second, authors attempted to use a fictitious identity to contribute to a different or radically new intellectual tradition without their contribution being dismissed because of preexisting evaluative contexts. Third, publishing under pseudonym can serve to protect oneself against the backlash or fallout of the scientific community (or a few powerful members).

Marie Sophie Germain (1776–1831) was an accomplished mathematician known for her work on Fermat's Last Theorem. She was forced to make her entry into the field under a pseudonym, Antoine-August Le Blanc, because she feared and expected gender-based ridicule. Germain is not the only woman who has had to use a pseudonym to hide her gender. Sophia Kovalevskaya published under the male version of her last name, Kovalevsky, throughout her career and the contributions of an unknown number of other women to science will have been obscured because they continue to remain hidden behind unknown pseudonyms. However, social

and political pressures continue to shape choices to publish under a pseudonym. A critical climate science paper, published by Volokin and ReLlez (2015), was retracted in the same year after the author names were revealed to be pseudonyms. Nikolov and Zeller, the actual authors of the paper (the pseudonyms are their names spelled backwards, almost) argued that through their pseudonyms, they wanted to exclude the bias inherent in the publication process since both authors were very critical about the dominant consensus in climate science and sought to avoid reviewers making assumptions based on this. In their defense, they referred to William Gosset, whose employment contract with Guinness prohibited him from publishing any research. Under the pseudonym “Student” he published work now known as Student’s t-test. Despite this, the inability to publish without losing one’s job is not easily comparable with the desire to avoid association with controversial intellectual views.

Radical new thinking can be hard to promote. When, in the 1930s, a group of young French mathematicians wanted to revolutionize mathematics, they lacked individual authority. They chose to publish under the pseudonym Nicolas Bourbaki and the Bourbaki group ultimately grew transparent about the flexible collective behind the pseudonym (Mashaal 2006). Bourbaki became influential and successful in and beyond mathematics. Aubin argues that the Bourbaki endeavor, despite arguing for isolated pure mathematics, can only be understood in the context of social changes following WWI in France (Aubin 1997). Following the Bourbaki example, other collectives hidden behind a fictitious name have emerged in various disciplines including Arthur Besse (geometers, French), Branche Descartes (mathematicians, British), M. Lothaire (mathematicians, international), Isodore Nabi (evolutionary biology, North America) (Nature 1981), and very recently, D. H. J. Polymath (mathematics). The pseudonyms in these and other groups serve as an organizational tool to assemble (or to keep together) existing teams. Identities of contributors were either known from the start (e.g. Polymath) or emerged over time voluntary (almost always), or involuntary (e.g. Isodore Nabi). On a superficial level these pseudonyms resemble more modern group author identities, although the latter are for the most part administrative tools, whereas the former are about shared intellectual identities, programmes and goals as well as social cohesion and, given the amount of satire published under these aliases, a great deal of fun.

However, not all publishing under pseudonym is meant to contribute in the same way. Consider, for instance, the blogger and author *Neuroskeptic*. Neuroskeptic (gender unknown) discusses, critiques and sometimes ridicules, scholarly work in neuroscience. To avoid retaliation against her “normal” professional activities, she uses the pseudonym. She defended this practice in a scholarly publication discussing the merits of anonymous/pseudonymous publication (Neuroskeptic 2013), but the moral status of this activity, as well

as her motives, have also been actively questioned (da Silva 2017). Another recent example is “Lars Andersson”, who published a controversial article in the *Indian Journal of Medical Ethics*. He claimed to present new evidence casting doubt on the efficacy of a vaccine used in Sweden. When its claims were quickly debunked, it also became apparent that Andersson did not actually work at the Karolinska Institute,³ nor did he exist. When this was revealed, the journal’s editors initially claimed that the use of a pseudonym was normal when authors wish to protect themselves against a professional backlash. They even added the following statement to the digital paper: “Under the current circumstances where publication of any information critical of vaccines can have serious personal repercussions, the author has chosen to publish under this pseudonym.” However, shortly after, the article was retracted (Editors 2018).

The obvious guest

While pseudonyms obscure the identity of an author for a variety of reasons, the obvious guest actively questions which contributions to science warrant authorship. In his seminal work “The invisible technician”, Shapin shows how the contribution of technicians, who are among those who provide support and continuity in laboratories, is often forgotten or hidden (Shapin 1989). In stark contrast, the contributions of others are regularly inflated, exaggerated or even plainly invented, while junior researchers suffer often extreme pressures to comply (Kovacs 2017; Penders 2017a). A whole body of literature on ghost and guest authorship practices exposes credit distributions strategies in research to be highly problematic at (Biagioli 1998, 2000, 2002, 2012; Biagioli and Galison 2003; Cutas and Shaw 2015; Marušić, Bošnjak, and Jerončić 2011; Penders 2017a; Street et al. 2010; Youtie and Bozeman 2014; da Silva and Dobránszki 2016). In line with this system of perverse incentives toward authorship, for the most part, guest authors attempt to keep up appearances in the sense that they either claim to have contributed significantly, or where such claims are invisible, the sentiment is conveyed. Their guest status is never publicly displayed and always structurally denied. These are not the guest authors we mean here.

In contrast, some guest authors are added to a publication very visibly. This visibility usually relies on the identity of the added author, and while it may not be clear or obvious from the very start, it is not actively obscured. We can discern three categories here: (1) the fictitious guest, (2) the animal guest and (3) the celebrity guest.

In the 1980s, a number of physics papers by William Hoover were coauthored by Stronzo Bestiale. Hoover had lots of trouble publishing his new computational techniques, experiencing many rejections. Overcoming the conservative force of editorial and peer review decisions (Lee et al. 2013;

Luukkonen 2012; Shaw and Penders 2018), Hoover added a foreign coauthor, suggesting wider support for the new work. The papers were accepted. Stronzo Bestiale, however is fictional. His name roughly translates from Italian into “colossal turd” and he does not exist. The physicist Alois Kabelschacht’s publishing career is less banal and more recent, with its latest entry at 2008. As a coauthor, he first emerged in 1979 on a paper first-authored by Peter Breitenlohner and Prof. Kabelschacht managed to publish a sole-authored paper on a programming technique in 1987. Kabelschacht translates from German into “cable duct”, and Alois Kabelschacht does not exist. His identity was drawn from a nametag beside a door at the Max Planck Institute for Physics in Munich and he was used in the institute in discussions as a fictional straw man at the time.⁴

Predating the authorships of Bestiale and Kabelschacht are those of F. D. C. Willard and G. Mirkwood. Physicist Hetherington received peer review comments in 1975 requesting to change the plural “we” in his paper to the singular “I” because there was only one author. Hetherington objected to this editorial judgment. Additionally, predating digital text editing tools, this presented a lot of work. Hetherington decided to add his cat as a second author, both objecting to the editorial judgment and alleviating the need edit the text. In a similar vein, immunologist Matzinger was unwilling to write in the passive voice and later argued that she lacked confidence to use the singular “I”, so she added coauthor Galadriel Mirkwood. Mirkwood was her dog. Other examples include coauthorships by H.A.M.S. ter Tisha. (hamster Tisha), parrot Madge J. Janzen and bonobos Wamba K., Wamba P., and Wamba N. (Erren et al. 2017).

Less fictional and more human is Colin Firth. The actor known for the King’s Speech, and Bridget Jones’ Diary is a coauthor on a 2011 neuroscience paper despite having no background in the field (Kanai et al. 2011). As a guest host of a BBC radio show, Firth and guest on the show Rees, talked about whether brain scans could be correlated with political preferences. Rees and colleagues proceeded to do the work and listed Firth as an author. While other Hollywood celebrities have also coauthored research papers (for instance, Nathalie Portman under her birth name Nathalie Herschlag, and the former emperor of Japan), they were involved in the actual conduct of the work, whereas Firth’s authorship is arguably more tactical. It does bring up the opportunity to (mis)use coauthorships to bring to attention that the type of contributions to science one can make, need not match the criteria for authorship. That a lot of scientists are unwilling to demote potential coauthors to the acknowledgments results not only in Firth’s authorship, but also in so-called kilo-authorship.

The kilo-author and authorship distribution

The term kilo-author was introduced by biologist Zen Faulkes, to refer to papers that list over 1000 authors, a phenomenon with increasing frequency. So many of such papers have appeared especially in the last years, that our focus here is on two specific cases of kilo-authorship. First is the publication policy of CERN crediting all lab members alphabetically on all papers. Authorship decisions in 5000+ teams are likely to be difficult every time. Preemptively, CERN opted to choose for a strategy that arguably presents a problem for distributing credit and accountability – to list every team member as an author. In case of collaborations between teams, all members of all teams are listed as an author, resulting in the “authorship top score” of 5154 authors (Aad et al. 2015). It also made a star scientist out of the French physicist Georges Aad, whom due to the alphabetical listing, appears first on scores of well-cited papers. CERN’s deviation from authorship conventions to sidestep debates on credit is widely known, yet formal evaluations and metrics classify Aad as a superstar scientist.

In a similar vein, unwillingness to hide contributions (that formally do not warrant authorship status) in a study in *Drosophila* genetics also produced a long authorship list. Elgin, the researcher leading the project (and who took last authorship on the 1014 author paper), enlisted the help of over 900 undergraduate students to help master the volume of analysis and data as part of their regular education programme. In the final paper, they are listed alphabetically, following the main researchers involved and preceding the principal investigator (Leung et al. 2015). Here, first and last authorship position conform to dominant life science conventions in authorship distribution, while the bulk of authorships in between have been assigned in disregard of formal criteria.

Authorship assignment is supposed to follow strict rules or procedures. In the life sciences, the first author conducted most of the work, whereas the last position is reserved for the most senior contributing collaborator. Formulas and guidelines for such attribution and legitimization of these attributions exist in various forms (Brand et al. 2015; Trueba and Guerrero 2004). However, on the one hand, these rules can be difficult to implement in a multitude of scientific practices (Tang 2018), on the other hand practitioners might evaluate them as not fitting their particular practices (Penders 2017a).

Consequently, scientists have been assigning authorship according to a variety of criteria. Some of those reveal blatant abuses of power (Kovacs 2013, 2017; Macfarlane 2017), but those are not the types of examples we are after here. Scientists admit disregarding these rules and conventions by revealing how they attributed authorship, often in the

Table 1. Deviant author assignment strategies (selection), listed chronologically.

Year	Authorship assigned by	Reference
1972	"by the flip of a coin"	(Dayton and Hessler 1972)
1974	"from a twenty-five-game croquet series held at Imperial College Field Station during summer 1973"	(Hassell and May 1974)
1977	"the outcome of a backgammon contest lasting two days"	(Godley and May 1977)
1978	"by a tennis match"	(Griffiths and Anderson 1978)
1982	"by Longstreth's flip of a coin"	(Longstreth and Madigan 1982)
1983	"by one round of Game of Chicken"	(Riechert and Hammerstein 1983)
1990	"by simulated coin tosses"	(Jassby and Powell 1990)
1991	"by free-throw shooting"	(Fauth and Resetarits 1991)
	"by flipping a coin"	(Kummer and Cords 1991)
1992	"by brownie bake-off"	(Young and Young 1992)
	"by coin-flip"	(Miller and Ballard 1992)
1995	"by five flips of a coin and does not reflect priority with respect to contribution to the manuscript"	(Eisenberg and Maszle 1995)
	"by an arm-wrestling competition"	(Shulman and Bermingham 1995)
	"randomly with the S-plus sample function"	(Schulman, Campbell, and Kostello 1995)
1998	"by proximity to tenure decisions"	(Roderick and Gillespie 1998)
2002	"by scramble competition for peat-flavoured spirit"	(Belyea and Lancaster 2002)
2003	"by random fluctuation in the Euro/Dollar exchange rate"	(Feder and Mitchell-Olds. 2003)
2004	"by rock, paper scissors"	(Kupfer, Webbeking, and Franklin 2004)
2005	"authorial order by height"	(Marston, Jones, and Woodward 2005)
2007	"by a game of Rochambeau"	(Claibourn and Martin 2007)
2010	"by coin-flip"	(Rooney and Leach 2010)
	"was determined by the result of the South Africa–England cricket ODI on 27 September 2009, which England won by 22 runs"	(O'hara and Kotze 2010)
	"by lottery"	(Corcoran, Conner, and Barber 2010)
2011	"by rolling dice"	(Mandle et al. 2011)
2018	"was determined by executing the following commands in R: "set.seed(7,998,976/5271) x <- sample(c("Anne", "Peder"), 1) print(paste("The winner is", x, "!"))"	(Lakens, Scheel, and Isager 2018)
2019	"We thank Bear, the dog, for helping us randomize the order of all authors who contributed equally to the manuscript. We also thank Bear's owner, D. Luo, for aiding in Bear's author determination activity."	(Rochman et al. 2019)
2020	See footnote 1	this paper

first footnote of the paper, or the acknowledgments. Some famous examples are provided in Table 1, a list that is far from complete. Empirical research on how these and other rationales for authorship decisions are actually used by scientists may be required, building on the conceptual work in this paper.

The moral status of civil disobedience in science

Science has many rules that are set, evolve and are updated by the collective of practitioners. Those rules are not always perfectly uniform, nor do all

those rules weigh the same. Some are written down into guidelines, whereas others are borne out of (local) conventions. As well as civil disobedience, there are (at least) two other means of challenging the rules and conventions of science: these are raising concerns (whistleblowing) and conscientious objection. Before returning to civil disobedience, it will be helpful to note parallels and dissimilarities between these three phenomena, while recognizing that clear boundaries are difficult to draw.

In whistleblowing, concerns are raised when a researcher suspects scientific or professional misconduct; it involves a confidential process where concerns can be aired and (hopefully) an investigation conducted to determine if the concerns are justified, and if so sanctions can be applied. Unfortunately, whistleblowers are often not given sufficient protections and can find their careers are adversely affected by their attempt to act ethically. Raising concerns differs from civil disobedience both in its visibility and in its scope. Civil disobedience occurs (or ought to) publicly and attempts to draw attention to systemic failures; whistleblowing normally occurs in private and is aimed at a specific transgressor (though if internal institutional systems are deeply flawed, whistleblowers sometimes do need to go public). Furthermore, raising concerns is basically what occurs when the violations of the system's rules are observed, rather than when an attempt is made to challenge those rules.⁵

In biomedicine, conscientious objection concerns clinical care rather than research. Doctors may invoke a formal procedure to avoid providing care to which they hold moral objections. Some common types of withheld care are abortion, provision of contraception, and provision of assisted dying. Here again, this is a private, rather than a public, procedure concerning individual actors. However, repeated and concerted conscientious objection can manifest as a type of civil disobedience in an attempt to force systemic change, as each case of objection essentially amounts to a claim that something permitted by the current system is unethical.

To summarize, civil disobedience highlights unethical features of a system or its rules, whistleblowing spotlights breaches of a system's rules, and conscientious objection exempts individuals from a system's rules.

Let us return now to authorship. The exact phrasing of the current ICMJE guidelines differs slightly from conventions over previous decades. Nevertheless, deviations from authorship rules and guidelines are constant across time and these rules are broken regularly. Many deviations from authorship rules arise from unethical violations of research integrity, of the type that might concern potential whistleblowers. But some of these transgressions serve a specific purpose: to expose rules, guidelines, conventions and traditions as inappropriate, unjust, impractical or outdated. Other transgressions are about scientists having a laugh together, although they may have, inadvertently, similar effects. Where are the boundaries between these

categories, and how does the notion of civil disobedience travel from the public to the scientific domain?

The use of pseudonyms is about sidestepping power asymmetries ingrained in authorship practices, and the use of guest authors, whether fictional, animal or celebrity, can reveal dogmatism, or expose credit politics, ironically or otherwise. Authorship attribution, whether through a kilo-author route or through creative attribution criteria, complements the strategies to counteract, sabotage or disrupt credit distribution politics and, accordingly, evaluation metrics.

However, some disobedience has ulterior motives. After all, these particular papers are still discussed, sometimes decades after appearing precisely because of their deviance (as we do now). In most cases, unearthing the motivation is difficult or impossible. Accordingly, establishing their status as legitimate civil disobedience is equally difficult. However, starting at Schuyt's criteria for permissible civil disobedience in the public domain, we can rearticulate them for the benefit of the scientific domain. Schuyt's seven requirements are (1) that the act is borne out of moral conviction, (2) is well-considered, (3) other means to resist have been used before, (4) the act is transparent and publically visible, (5) a symbolic relationship exists between the transgression and the rule resisted, (6) one accepts possible consequences or ramifications and (7) the act is without violence (Schuyt 2019).

On the category level some cases of pseudonym use, the obvious guest author, and the deviant attribution of authorship can fulfil all criteria: (1) moral outrage with legitimate access to authorship and distribution of credit, (2) well-considered actions, (3) authors failed to accrue access or credit within existing infrastructures or could legitimately expect unfair treatment, (4) at least within the confines of the scientific community, these acts are out in the open (see below), (5) deviance in authorship is directly related to access and credit in science, (6) papers have been withdrawn because of deviant attribution of authorship and authors have been exposing themselves to critique, and (7) their activism is without physical violence.

However, in the context of scientific publication, these seven requirements are insufficient. Schuyt and Thoreau were discussing individual participation in the public domain. To object, refuse, protest and more, are personal choices and so are, most likely, the consequences. However, publication practices in the scientific domain, especially in the context of the exact and life sciences, are far from individual (even though some evaluation metrics pretend so). To add a guest author to a publication exposes all other legitimate authors to the consequences of this decision. Those risks include retraction of the paper, accusations of fraud (or at least of sloppy science), or subjection to institutional investigations and ensuing career damage. Scientific publication, not unlike science at large, is increasingly a collective

endeavor in which actions affect collectives rather than individuals. As a consequence, for applicability in scientific publishing, Schuyt's list needs expansion with an eighth requirement: (8) the activism is agreed upon by the other (human) authors (a consent requirement).⁶

However, the consent requirement, not unlike the transparency requirement or the nonviolence requirement, cannot pragmatically be absolute. For instance, to be contemporaneously transparent, authors would have to disclose to editors the nature of their civil disobedience. This is problematic because the disobedience itself is likely to be in violation of the journal's policies or the editor's principles. This creates a paradox: to qualify as civil disobedience, the act must be disclosed, but disclosing it to the editor would prevent the act reaching the public audience. One way of addressing this issue would be delayed disclosure of disobedience, following publication. This would fulfill the transparency requirement in a less timely manner, while avoiding disclosure at the time of manuscript submission. However, as mentioned above, this approach does run the risk of allegations of misconduct being raised against civilly disobedient researchers, who will have to tell untruths on author disclosure forms in the short-term even if they feel they have a good reason for doing so. This also highlights one of the dimensions in which civil disobedience stands out as a special form of resistance, since Ese (2019), describing forms of resistance in the university, often points out how they happen in secret: "We never tell management, they wouldn't understand" (127).

One way of avoiding all these problems might be to use a different avenue for civilly disobedient texts, and preprint servers or other open science solutions might be the best such alternative. Beyond the confines of traditional publishing, authors are not subject to the same authorship procedures or norms, and can engage in civil disobedience more safely. However, one disadvantage of this approach might be that such acts might be less visible if these venues are chosen over high-profile journals. Indeed, higher visibility is generated by the very fact that researchers might get into trouble for delayed disclosure of civil disobedience and related authorship infractions, even if that route is higher-risk in terms of researcher reputation.

Civil disobedience, initially defined as the act (or activism) of purposefully and visibly breaking norms, rules or guidelines with the political purpose of exposing these as unjust, wrong, or corrupted in themselves or in the context of their use can and should be redefined to act as a positive label for resisting injustices in the context of science. To be civilly disobedient in science would mean to break norms or guidelines governing scientific behavior intentionally, to demonstrate that infrastructures of science produce or maintain injustices, including, but not limited to gatekeeping, reward, and incentive. Civil disobedience in science can border on, but also act through, satire. To act civilly disobedient would require that all eight aforementioned

requirements would have to be upheld, with the caveat that the requirement to act disobediently in the open (even if openness is required only inside the scientific community) and to do so with consent, are counteracted itself by the structures of science. It seems reasonable to ask that one attempts immediate openness and consent, but if openness impedes or prevents the act, it would be equally reasonable to tolerate delaying openness or limiting this openness.⁷

While each of the categories can fulfill all eight requirements, many of the empirical cases listed above (or others beyond those who made the cut) do not. A case like that of Anderssen would certainly already fail to meet the first criterion. In fact, he wrote a series of similar anti-vaccination articles in many journals, raising another ethical issue regarding the use of the pseudonym: it prevents readers assessing whether the author has any potential conflicts of interest. It is possible that Anderssen was being supported by an organization devoted to fighting vaccination, which we might never know. Alois Kabelschacht's role as a heuristic in internal epistemic struggles at the Max Planck Institute may have been huge, yet it is unclear how his authorship is an act of activism. Again, the moral conviction is absent, rendering the subsequent requirements useless. In contrast, while CERN's authorship practices are borne out of pragmatism, the sheer impossibility of discriminating between contributions in such large teams, the requirement to individualize contributions is a real problem and the activity following it actively resists this. Of course, given the rise in the amount of papers published with hundreds or even thousands of authors on them, it is questionable whether each and every single one of them made an active and deliberate attempt to expose broken rules; furthermore, the phenomenon of guest authorship suggests that some such authors may be unaware that their names even feature on the author list. But even when unintentionally breaking authorship attribution rules, on the institutional level of CERN, they still expose the problems embodied by such rules. One cannot, however, be unintentionally civilly disobedient, because of the first requirement of moral outrage. The ways in which moral outrage is shown are quite flexible though. This way, scientists having a laugh about authorship lists may, in some circumstances, still qualify as a case of civil disobedience. Humor has been argued to serve as a tool against oppression (Sorensen 2008). While oppression in the context of power or labor distributions in laboratories differs from oppression by violent rulers, the logic legitimating its use can be extended into science, allowing the use of humor to fall within the confinements of civil disobedience in science.⁸

Conclusion

Whether in the form of pseudonyms, guest authors or creative authorship attribution processes, civil disobedience in authorship serves the explicit purpose of demonstrating how many of the written and unwritten rules governing the distribution of credit and other resources in academia reinforce a long series of inequalities. The unwillingness of some authors to accept that they cannot give credit to those whom they feel legitimately deserve it, or cannot receive credit when they legitimately feel they should, and their willingness to act in a variety of ways, constitutes a critique of scientific infrastructures and their undesirable fall-out. Civil disobedience calls for critical examination of these infrastructures and invites them to reflect upon themselves. We do not claim that all the examples we included meet the formal criteria for civil disobedience provided by Thoreau, Schuyt or others. Many of them do not: some resemble civil disobedience but are based on laziness or annoyance rather than moral outrage, and others game the system rather than attempting to expose its weaknesses. In many cases the boundaries are very fuzzy.⁹ If anything, the examples have served as a training set for our redefinition of the notion for the context of science: the cases we discuss support a modification of their conception of civil disobedience for this particular academic context – although the consent requirement would most likely also benefit the conception of civil disobedience in many other sectors of society structured around collective action.

We believe that these modifications retain the conceptual core of civil disobedience as put forth by Thoreau and Schuyt, thereby allowing the retention of the label: the acts of resistance are not part of conventional academic practice, but neither do they constitute conscientious objection or whistleblowing. While they may appear limited in their practical effect in terms of changing the culture of science, they consistently draw attention to issues affecting researchers and also act as a means of combating the moral attrition imposed on researchers by injustices in science. Assembling these seemingly disparate actions under the label of civil disobedience in science will ease critical evaluation of deviant actions as well as helping us evaluate deviance, defiance and discontent in science beyond issues of authorship. To avoid abuse, an empirical focus remains vital, so that the label itself does not act as a legitimization in and of itself.

Scientific publishing practices will continue to evolve, and so will the policies, rules, guidelines and conventions that prescribe specific behavior. Along with prominent scholarship on the detrimental effects of the current socio-political infrastructures of science, civil disobedience is a critical voice that is easily ignored, or dismissed as harmless fun. We must realize though, that many of these policies, rules, guidelines and conventions are national and sometimes even regional (or limited to a single institute). The discussion

of whether or not breaking a rule qualifies as civil disobedience is thus an empirical one, requiring the study of local practices and conventions as well as the motivations of particular agents, for instance: does an actor's annoyance constitute moral outrage or not?

Answering these and other questions about civil disobedience requires data and the need for data also presents a lesson for how to legitimately shape and initiate civil disobedience. When documented, moral outrage, acts of deviance, communication about them and considerations underpinning all of them constitute such data. In the absence of such evidence, when authors are revealed to be guests only after the fact, and transparency about disobedience is lacking, the presumption must be that this is not a case of disobedience but of research misconduct (or at least detrimental research practice), with all the sanctions that that might entail. While we support the use of civil disobedience in science when done ethically, those engaging in it can actively articulate the boundary between practices that could be misconstrued as misconduct and those that represent civil disobedience by engaging with the question as an empirical matter.

We also cannot ignore the political dimensions of the problem. Power asymmetries in science place early career researchers at huge disadvantages, even in their ability to engage in civilly disobedient behavior when legitimately morally outraged. Tenure and other protective measures makes civil disobedience safer for senior faculty than for young researchers.¹⁰ To them, incomplete adherence to the aforementioned criteria may offer a proxy for that safety (especially the transparency and consent requirements) and manifestations in the form of satire offer similar protection – but they too can document the process. Ideally, we would see civil disobedience in faculty members such as in the case of Sarah Elgin, who included hundreds of students as authors on a publication. In fact, her actions are exemplary of civil disobedience: she has publically defended her actions when the contributions of all students were challenged as not living up to minimum requirements for authorship. As part of this, she referred to the mismatch between the reality of large-scale research and credit-distribution mechanisms. Her actions sparked immediate debate in the community about credit politics and inequality in science (for a list of examples, see Woolston 2015). In fact, she has done so more than once, as her lab's web pages disclose. Despite the availability of such a, perhaps paradigmatic, example, in the international, global domain of science, uncertainties and disagreements on the status of resistance, digression, deviant behavior and the attribution of the label "civil disobedience" are likely to remain. Researching the rebellious makes fraud, fun and civil disobedience into strange bedfellows and urges us to take great care in attributing said labels.

Notes

1. Consider, for instance, the scientific “hoax” as a candidate act of civil disobedience, in which researchers produce hoax papers to expose (in their view) problematic current practices or disciplines. These hoaxes range from the submission of non-sensical, computer-generated abstracts or entire papers, to expose journals that do not adhere to publication or review standards, to well-crafted fake papers specifically designed to delegitimise entire fields (such as the Sokal hoax, or the more recent “Grievance studies” hoax).
2. Interestingly, this dynamic is reversed in, for instance, academic philosophy (Cutas and Shaw 2015).
3. In fact, the Karolinska Institute affiliation remains possible as his/her identity remains unknown.
4. Fictional authors exist in a second form, described as “Plagiarized Names” (although fabricated names might be more apt) by Biagioli (2019). Biagioli describes instances where in grant applications or paper submissions, fake coauthors with impressive (but fake) affiliations, are used to boost chances. The goal here is not to expose any structural flaws in the system – but to game that system.
5. Scheuerman (2014) suggested that Edward Snowden’s whistleblowing was also an example of civil disobedience, and in fact we would tend toward it being the latter: although his disclosures caused great controversy and exposed unethical practices, those practices were not in contravention of the NSA’s internal rules while his raising concerns was, so civil disobedience seems a better fit. Clearly, the boundary between whistleblowing and civil disobedience is somewhat unclear, as well as the public use of both labels.
6. One could argue that the requirement to be transparent would isolate coauthors from repercussions and direct to consequences of the disobedience to the disobedient individual. However, such consequences – most notably retraction – are elements of an infrastructure that does not have an individual form. Retraction cannot not affect coauthors. We would extend this consent requirement to all civil disobedience where repercussions or consequences are expected to be collective rather than individual.
7. Not unlike the tolerance toward some degree of violence, given restrictions, of course, by Schuyt (2019).
8. In fact, even when it would fall outside of the realm of civil disobedience (which would have to be determined empirically, by inquiring about the motivations, convictions and actions of the authors), it could still contribute to draw attention to structural inequalities in science. In general terms, even if some acts do not amount to civil disobedience in a strict sense, they can nonetheless give their perpetrators a sense of satisfaction that makes academic life a little easier: a form as resistance (Ese 2019).
9. Shrum’s proposed citation circles, for instance, very much resemble existing attempts to game the system. These circles have been around for decades, yet have not had a significant effect on authorship and evaluation cultures. Shrum’s proposal could only qualify as civil disobedience and be potentially effective if the proposed breach was both extreme and transparent.
10. This asymmetry is also part of all other manifestations of Civil Disobedience outside of science – where those with the least power and resources have the most to lose by being civilly disobedient.

Disclosure statement

In the context of their analysis of the phenomenon of civil disobedience in this paper, the authors have themselves engaged in (a parody of) it in their authorship statement (see *footnote on 1st page*).

Funding

We report no specific funding supporting this paper.

ORCID

Bart Penders  <http://orcid.org/0000-0002-2661-9181>

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