Transparency, Subjectivity and Objectivity in Academic Texts

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Biodata

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Abstract

In this exploratory study, we present our approach to understanding the way 'subjectivity' and 'objectivity' are operationalized in written reports of scholarship and research. We initially assume that the authors' (implicit) understanding of so-called 'objectivity' is one aspect of a belief system that may be inferable from a text analysis. Much of our discussion revolves around understandings of 'objectivity' and 'subjectivity'. In this introductory paper, we explain our qualitative approach to inferring the way claims of knowledge and truth are represented in written reports in relation to the authors' own transparent presence in the text. We engage in a critical discussion of 'subjectivity' and 'objectivity' in relation to 'transparency', using extracts from scientific text. We consider guiding concepts often associated with 'objectivity', such as value-freedom, freedom from bias, community consensus or trust, in relation to the evidence available in the texts and the literature. As linguistic evidence, we mainly consider the authors' transitivity choices and their use of epistemic modality. Some recent journal instructions to authors (see *Nature* and *Science* for example) explicitly recommend the avoidance of impersonal language for a more transparent approach to agency (Nunn et al., 2015, 2018) We conclude that, while 'subjectivity' is an inevitable part of any act of understanding, we question whether 'objectivity' is a useful or tenable guiding concept for authors to embrace when reporting a contribution to knowledge. We propose transparency in displaying and thereby acknowledging assumptions, agency and inevitable subjectivity as an integral part of reporting knowledge creation as a more tenable position.

Introduction

> For Scheler, the problem in modernity is that only one type or form of evidence is regarded as objective or true, the mode of rational proof. Inherent to the practice of phenomenology is the openness to distinctive modes of evidence. Any presupposition about what counts as objective or subjective, as true or merely psychological must be held in abeyance.
> (Davis and Steinbock, 2014, n.p.)

The aim of this paper is to examine the notions of 'subjectivity' and 'objectivity' as represented in academic texts. In our review of the literature, we have identified three key characteristics assigned to 'objectivity': faithfulness to facts, value-freedom, and freedom from bias (Reiss and Sprenger, 2016). Trust, 'consensus' or agreement among specialists is also evoked as a supporting characteristic (Eisner, 1992; Reiss and Sprenger, 2016). This immediately raises the question of whose trust or agreement is being evoked. 'Academic communities' are groups of people that may come to share values in their quest to create knowledge. Sharing values is partly what holds a traditional community together. However, it is increasingly difficult to suggest that there is one 'community' in any international area of interest (See Nunn, 2015). The multi-centric nature of global academic activity makes us reluctant to refer to a single entity called a community, capable of providing anything approaching consensual trust in new knowledge. We cannot assume that a published peer-reviewed journal paper is fully 'accepted' within an 'academic community'. All we can assume is that a convincing case has been proposed by the author(s)/researcher(s) that is thought to be worthy of dissemination within and beyond a so-called 'community', through the review process of a journal.

Texts are hermeneutic objects of investigation in that they are published as 'finished' texts that can be analysed and re-analysed. Tool (2007) in his discussion of Dilthey's hermeneutics emphasizes that it is not so much the lived experience that is available as an object of investigation, but the expression of this experience (Tool, 2007). Typically, we do not have the actual lived scientific experiences available to us, so we must look to their published written expression. Journal papers therefore provide access to provisional public displays of values of 'objectivity'. By using a 'finished' journal text, we may therefore characterize the way an abstract concept is operationalized in writing. We have attempted to establish a small number of textual features to facilitate a broader discussion of 'objectivity'. Our findings may then be translatable to other texts and disciplines. We do not however assume that a published

text is in any way a 'final' text in the sense that it is intended to represent the final word by its authors.

In the long term, by determining where there is agreement and disagreement in values within and across texts and disciplines, we hope to shed light on the characterization of 'objectivity' in terms of faithfulness to facts, value-freedom and freedom from bias and trust. One ultimate aim is to consider whether a concept embedded in the word 'objectivity', which is so widely used in both daily and academic discussion, is still of use in the constant academic quest to create new knowledge. All words that represent concepts embedded in language are subject to erosion of meaning. They are useful only to the extent that they help us better understand our attempts to create new knowledge or validate previously accepted knowledge.

What do we mean when we refer to objectivity?

'Objectivity' is often presented as a fundamental concept in relation to epistemology of science, that is, to its claims, methods and results (Daston and Galison, 2007; Hanna, 2004; Longino, 1990; Porter, 1996; Rykiel, 2001; Vogt, 2013). The concept is multifaceted and complex, encapsulating the assumption that claims, methods and results can be stated free from the influence of "particular perspectives, value commitments, community bias or personal interests, to name a few relevant factors" (Reiss and Sprenger, 2016, n.p.). The term connotes: "[…] disinterestedness; emotional detachment; rule-governed procedures; quantitative methods; openness to criticism; responsiveness to evidence, or accountability to a mind-independent reality, among others." (Hacking, 2015, p. 25). All but the first are sometimes said to express a positive value (Hacking, 2015). Different meanings of the term may be emphasized, depending on context (Eisner, 1992). There is a further assumption that 'objectivity' is incompatible with 'subjectivity', which is commonly opposed to it as an inferior value. We will also use the term 'objectify' in our data discussion in the second part of this paper. By 'objectify', we refer to attempts to disguise what is actually subjective intervention by making only impersonal language choices.

If we are 'objective', we have:

> […] taken pains to try to diminish or eliminate bias. To be objective or to do an objective study is to be or do something that is not primarily about ourselves, but about the world itself. Objectivity means in some contexts being fair, open to all sides

> of the argument. In other contexts, objectivity refers to a method or procedure through which we acquire information; an objective test is an example of such a procedure. In common discourse, to be objective or to have an objective view is to see things the way they are. When we conceptualize objectivity, we ineluctably imply its opposite, subjectivity, and between the two there is no doubt about which one comes out on top. We want to be objective in our views, objective in our methods, and above all, to have objective knowledge. To use the vernacular, we want to see and to tell it like it is.
> (Eisner, 1992, p. 9)

To accept this argument we need to accept that "seeing and telling it like it is" is possible, regardless of the person who is doing the seeing or telling. There is an assumption that claims of objectivity are valid, that objectivity is attainable and worth striving for, and that claiming it is desirable and even necessary:

> Claims, methods and results can be more or less objective, and, other things being equal, the more objective, the better. Using the term "objective" to describe something often carries a special rhetorical force with it. The admiration of science among the general public and the authority science enjoys in public life stems to a large extent from the view that science is objective or at least more objective than other modes of inquiry.
> (Reiss and Sprenger, 2016, n.p.)

'Objectivity' is therefore a value that normally enjoys a positive connotation (in the sense that it is seen to be important and something we approve of). Whether fully deserved or not, this reputation has made it more widely valued and trusted and, therefore, accepted (Reiss and Sprenger, 2016). "[Objectivity] is so important that if our work is accused of being subjective, its status as a source of knowledge sinks slowly into the horizon like a setting sun" (Eisner, 1992, p.9). 'Objectivity' is also represented as a value that academics strive for but never fully achieve, something that comes in degrees (Weber and Word, 2001). We can therefore also detect an assumption that 'subjectivity', if it is really in opposition to 'objectivity', must also be a question of degree in inverse proportion to the achievement of 'objectivity'.

Scientists, particularly in their methods, are assumed to be 'objective', through both their processes and in their published 'community' products, which express some or all of the following features:

> […] limitations of variables; identification of constants; careful measurement of significant variables under controlled conditions (or as controlled as possible); standardization of instrument bases; comparison via past or parallel studies; field versus laboratory studies, or the disciplinary literature to triangulate and thus validate observations; careful and detailed recording methods for both conditions and data; use

> of analysis tools, e.g., spectrograph or mathematical analysis, shown by experience to render trustworthy and plausible results; write ups designed for reproducibility; peer review; publication in the open literature; and so on.
> (Weber & Word, 2001, p. 492)

Owing to the high regard in which the ideal of 'objectivity' is held, and to its assumed application to many other fields besides science, such as law, journalism, art and history, the concept has been a matter of intense scrutiny and debate for many years, in particular in relation to its value and its attainability (Reiss and Sprenger, 2016, n.p.). Reiss and Springer suggest that the degree to which faithfulness to facts, value freedom and freedom from bias are reflected in the work leads to concomitant trust. Each of these is therefore discussed in turn next.

Objectivity and faithfulness to facts

Claims of objectivity have long been associated with a process of establishing the unbiased, value-free, facts (Post, 2014; Rykiel, 2001; Tsou, Richardson, and Padovani, 2015; Ziman, 1996), with a kind of "immaculate perception" (Eisner, 1992, p.11) or "absolute conception" (Reiss and Sprenger, 2016, n.p.) that has 'truth', or faithfulness to the facts, as its ultimate aim (Galison, 2015). This understanding of objectivity is founded particularly on the belief that there are facts "out there" in the world and that it is the task of a scientist to discover, analyze and systematize them (Reiss and Sprenger, 2016.). In this view, "knowledge is treated as something outside rather than inside the minds or brains of individuals" (Chalmers, 1982, in Webb, 1992, p. 748). One consequence of this understanding is the associated greater trustworthiness of the presented facts and their certainty: "The aim of epistemology, as the Greeks conceived of it, was to achieve true and certain knowledge. Such an achievement was what differentiated knowledge from belief" (Eisner, 1992, p.10).

Galison, writing about the field of journalism, notes that while both 'objectivity' and 'truth' are goals of the journalist, objectivity may be distinguished from truth, being the performance standard against which the journalist's striving towards truth may be measured. Galison argues that truth is a thing, "an unattainable asymptote", while "objectivity is a process that can be followed and even reached, honorably, […]" (Galison, 2015, p.66). This view of objectivity suggests that it is both desirable and achievable (Post, 2014, p. 3) and, because it may be achieved by degree, it could result in more, or less, approximate accounts of reality:

> […] many concede that [objectivity] may not be fully attainable, […]. [However] they argue that even if the truth may not be captured perfectly, it can still be approximated. In this view, it is possible to distinguish more from less appropriate accounts of reality (Lichtenberg, 2000: 241; Popper, 1965 [1959]: 49–50).
> (Post, 2014, p.3)

The ability of scientists to provide accounts of reality that are at least approximately faithful to observable and verifiable facts is seen as one of their strengths. One of the main aims of science is to achieve universality where a scientific truth or scientifically supported claim made in one set of circumstances counts as such in any other, no matter how different the scientists' cultural values (Longino, 2004, p. 128), arriving at an "intersubjective, that is, a more or less indisputable [aspect] of reality" (Post, 2014, p. 5). Achieving universally accepted claims is one of science's traditionally distinctive accepted characteristics (Eisner, 1992). It relies on the ability of others to test hypotheses, methods and results (and therefore claims), distinguishing itself in this regard from, for example, journalism, such that "everybody can reproduce the outcome under the same or similar conditions" (Post, 2014, p. 6).

The Climategate Case

The existence of real opportunities for other scientists to reproduce outcomes under the same or similar conditions and to critique the work of others were critical issues that emerged in a case dubbed 'Climategate' by journalists and climate skeptics in 2009 (Leiserowitz, Maibach, Roser-Renouf, Smith, and Dawson, 2013; Ryghaug and Skjølsvold, 2010). As a result of hackers obtaining illegal access to the server at the University of East Anglia (UEA) in the UK, several thousand files and emails sent by members of a group of scientists employed by the Climate Research Unit (CRU), and others associated with them, were made publically available. Several investigations and public enquiries established eventually that the researchers had committed no fraud or scientific malpractice (Grundmann, 2013). However, a number of questions were raised about the university's practices and several damaging allegations were levelled at the scientists. These included the allegation that they had resisted complying with some Freedom of Information applications with regard to their raw data (e.g. from weather stations), thereby impeding others' ability to test and replicate the results of the original research. For example:

> When requests for data release under the new Freedom of Information Act came in, Phil Jones [the director of the CRU] convinced his senior managers at East Anglia

> University [sic] to ignore them: 'I think I've managed to persuade the UEA to ignore all further Freedom of Information Act requests if the people have anything to do with Climate Audit' (June 19, 2007).
> (Grundmann, 2013, p.85).

Concern about how data that had been obtained under Freedom of Information requests would be used also led the CRU director to suggest that his collaborators should delete related emails (Grundmann, 2013). This has been described as a willingness to "dismiss critical enquiries all too quickly, which was problematic and counterproductive" (Grundmann, 2013, p. 71). There also appear to have been efforts on the part of the scientists to suppress their critics, in particular, those identified as climate-change skeptics, in order to keep "unwelcome papers out of the peer reviewed literature" (Grundmann, 2013, pp. 70-71). One of the scientists wrote in an email to his colleagues that he "[…] would prevent research articles by competitors from being published, even if he had to redefine what peer review means (email, 8 July 2004)."

One of the most important enquiries into the case was the Muir Russell Review in the UK, which examined CRU practices. Referring to an increased demand on the part of scientists in general for openness, the reviewers observed that without such openness:

> […] the credibility of their work will suffer because it will always be at risk of allegations of concealment and hence malpractice.Therefore, the Review would urge all scientists to learn […] to be open in providing the information that will enable the debate, wherever it occurs, to be conducted objectively.
> (Muir Russell, 2010, pp. 41-42, in Grundmann, 2013, p. 71)

We can therefore call into question the attainability of an ideal scientific environment in which data should be made available and where methods should be explicit, enabling replication of investigation, and criticism of results and claims, leading to the production of eventually more or less indisputable knowledge, that is, so-called facts that are as faithful as possible to the 'truth'. If data are withheld, for whatever reason, opportunities to replicate studies, confirm results and claims made, or offer a critique are obstructed or prevented; and so, therefore, is the production of reliable knowledge.

The Climategate case illustrates the tension between the norms of science and the personal interests and values of both the researchers and their critics, which seem to have influenced the requests for access, the lack of willingness to cooperate with those requests, and the desire to suppress criticism from particular quarters. This tension is particularly evident in the

reply of one of the scientists to a critic who had requested data: "Why should I make the data available to you, when your aim is to try and find something wrong with it?" (Grundmann, 2013, p.80). As Grundman continued: "This is not a violation of a cognitive norm but rather of a social norm" (p. 80).

The ability to claim 'objectivity' in relation to published verifiable factual knowledge was severely tried in the Climategate case. If the so-called climate-change skeptics had obtained the CRU scientists' data and used the same methods to carry out their own investigations, it is reasonable to conjecture that the results would indeed differ. One explanation for this could be that:

> […] scientists do not have special normative standards:
> Central to this disaster has been scientists' insistence that they are unsullied providers of truth in an otherwise corrupt and indecipherable world. It was never so. ... [I]n practice, science is competitive, backbiting, venal, imperfect and, indeed, political. Science, in other words, is replete with the same human failings that mark all other social activities.
> (Thernstrom (2009) in Grundmann, 2013, p. 83)

If results differed, it could be because each group (in light of their different biases) might approach the same problem from a different perspective, or framework, leading to different views of the same reality:

> For instance, one cannot calibrate the way to ascertaining the exact degree to which human activity is responsible for global warming. First one needs to define "human activity," then what one means by "responsible," not to mention global "warming" scenarios that involve the triggering of a new ice age in Europe. And finally, if we may borrow from a recent president, it depends on what the meaning of "is" is.[1] All those decisions produce alternative answers, and each is necessarily value laden.
> (Allen, Tainter, Pires, and Hoekstra, 2001, p. 476)

Eisner argues that in any case the human condition makes it impossible for us to find out if our views of reality really do correspond to it, because:

> To know that we have a correspondence between our views of reality and reality itself, we would need to know two things. We would need to know reality, as well as our views of it. But if we knew reality as it really is, we would not need to have a view of it. Conversely, since we cannot have knowledge of reality as it is, we cannot know if our view corresponds to it.
> (Eisner, 1992, p. 11)

[1] https://www.youtube.com/watch?v=Yp3TQf2xDc8

Eisner concludes that: "Related to the impossibility of knowing that we know the world in its pristine state – a kind of immaculate perception – is the framework-dependent character of perception. Perception of the world is perception influenced by skill, point of view, focus, language, and framework" (Eisner, 1992, p. 11). It may therefore be the case that: "The obsession with objectivity is itself a distortion of reality" (Boyer, 1981).

Our concern is to examine the notions of 'subjectivity' and 'objectivity' as they are operationalized in written text. We consider the phenomenological view that there is (some degree of) inevitable bias in any act of scientific publishing. We will also consider the view that 'objectivity' may not be opposed to 'subjectivity', given that it is all the more unattainable when bias is denied or disguised. A better understanding of our subjectivity can lead to knowledge that is more trustworthy. Such influences on the production of knowledge are therefore considered next.

Objectivity, value-freedom and the inevitability of bias

Many accounts of the role of objectivity in science have focused on the need for scientists to recognize and transcend personal, social or cultural values, which might influence their pursuit of knowledge and its outcomes:

> Science is able to serve as an objective source of unbiased information precisely because either the individual scientist is able – qua scientist – to transcend all social, moral, and political values, or more plausibly, the institution of science is able to insulate itself from social values that would bias it and render it subjective.
> (Tsou et al., 2015, p. 2)

Attempts to present value-freedom as an attainable ideal serve to support a view of impartial science that is universally valid, holding true for anyone, anywhere (Longino, 2004). This is problematic because:

> […] we fear that certain kinds of values will lead to acceptance of representations of the natural and social worlds in theories, hypotheses, and models that favor the interests of certain members of or groups in society over those of others. The ideal of value freedom is also bound up with the ideal of universality: what counts as a scientific truth or scientifically supported claim for one person or community should count as such for any other, no matter how different their cultural values.
> (Longino, 2004, p. 128).

Procedural Objectivity

Longino (1983) notes that the ideal of value-freedom seems to have led to the belief among scientists that they should try to keep their own values out of their research and that doing this would be sufficient to guarantee value-free science (Longino, 2004). Eisner refers to this as "procedural objectivity", which: "[…] is achieved by using a method that eliminates, or aspires to eliminate, the scope for personal judgment" (Eisner, 1992, p. 10). Longino, however, in earlier work, presents four cases (those of *interferon*, *biological risk assessment*, *plutonium* and *sex hormones*), demonstrating through each that, in different ways, values and scientific practice are inextricable (Longino, 1983), as was illustrated in the Climategate case above. She concludes that:

> In the cases reviewed […] non-epistemological, personal, social, or cultural values have affected scientific practice internally rather than externally. [I have] presented a series of interactions in which contextual values and scientific practice have become progressively more entwined. At one extreme – that of least interaction – are traditions that have sound epistemological (as well as moral) justification abandoned for non-epistemological (commercial or social) reasons. At the other extreme are inferences from data mediated by values often so deeply ingrained that their assumptive character goes unrecognized.
> (Longino, 1983, p.13)

Another Case Study

To illustrate, the risk assessment carried out in the case of oral contraceptives is instructive. The selection of risks to be measured appears to have been influenced by the "extra-scientific values of those performing or supervising the testing" (Longino, 1983). In particular, in one well-documented case, that of Enovid, testing was carried out by a scientist known to have strong opinions about the dangers of unchecked population growth. Despite available data showing a relationship between estrogens and cancers, and between estrogens and blood coagulability, this researcher emphasized the drug's prophylactic and therapeutic properties and downplayed the risks, providing such extensive qualification of and explanation for the data on conditions such as cervical erosion and thromboembolism that it appeared Enovid could be absolved of any contribution or connection to the conditions (Longino, 1983). The researcher's bias in favor of oral contraceptives appears to have led him to look for reasons to support their use, rather than discredit them, albeit for altruistic rather than commercial motivations (Longino, 1983). In this case, it seems that the scientist was unable to transcend social and moral values, and so the outcome of his work was not a source of unbiased

information. Longino notes: "[…] the oral contraceptive [case illustrates] that where we do not know enough about a material or phenomenon […] to choose appropriate methods for predicting its activity, the opportunity arises for the determination of scientific procedures by social and moral concerns having little to do with the factual adequacy of those procedures" (Longino, 1983, p.15). This may not be all that uncommon (Tsou et al., 2015).

Paradoxically, also, the concept of 'value-freedom' can be seen as a value-laden concept in itself, as it expresses the assumption that value-freedom is possible. Similarly, claiming freedom from bias depends on the problematic assumption that we are able to commence any reflection without some prior assumptions. How could the researcher into Enovid have removed, or mitigated against, his bias in favour of oral contraceptives? How could the CRU researchers have countered their strongly held belief, supported by their own ongoing research, that there have been significant recent changes to the climate and that the causes of these changes are anthropogenic? The claims of the truth of our own prior assumptions must also therefore be subject to scrutiny, as we cannot claim they are 'objective'.

A second paradox is that making a strong claim to be unbiased may be a kind of bias in itself. Admitting inevitable bias and attempting to minimize its consequences is potentially the least problematic starting position to take. Reiss and Sprenger (n.d.) review a range of approaches to statistical and inductive inference considered useful in reducing or eliminating bias, including measurement and quantification which:

> […] help to reduce the influence of personal biases and idiosyncrasies [but] [s]tandardizing scientific procedures becomes difficult when their subject matters are not homogeneous, and few domains outside fundamental physics are. [Attempts to quantify procedures] often lack a certain degree of responsiveness to the peculiarities of their subjects and the local conditions to which they are applied.
> (Reiss and Sprenger, 2016, n.p.).

They also consider inductive and statistical inference, concluding that: "[…] no statistical theory of evidence manages to eliminate all sources of personal bias and idiosyncrasy" so "[…] perhaps all science is necessarily perspectival. Perhaps we cannot sensibly draw scientific inferences without a host of background assumptions, which may include assumptions about values" (Reiss and Sprenger, 2016, n.p.).

This view is further underlined by Gadamer (1975) who emphasizes the need to admit inevitable prejudice as an essential stage of academic reflection. We note that Gadamer still

uses the term ‘objectivity’ here, but we detect a connotation in context that is less than positive:

> A person who believes he is free of prejudices, relying on the objectivity of his procedures and denying that he is himself conditioned by historical circumstances, experiences the power of the prejudices that unconsciously dominate him as a vis a tergo. A person who does not admit that he is dominated by prejudices will fail to see what manifests itself by their light (Gadamer, 1975, p. 354).

The final pillar of ‘objectivity’, that is said to follow from faithfulness to facts, value-freedom and freedom from bias, is trust. We will consider ‘trust’ in relation to the difficulties already explored above.

Objectivity and the question of trust

In ‘scientific communities’, objectivity and trust are closely related (Douglas, 2004; Potter, 2010; Reiss and Sprenger, 2016, n.p.). Trust is particularly necessary because “without trust the research enterprise could not function… Research is a collegial activity that requires its practitioners to trust the integrity of their colleagues” (Relman, n.d., in Hardwig, 1991, p. 693). Trust in this case refers not only to trust among colleagues, but also to trust in scientific processes and procedures. It is foundational as, without trust, knowledge is likely to be perceived as flawed:

> Modern knowers cannot be independent and self-reliant, not even in their own fields of specialization. In most disciplines, those who do not trust cannot know; those who do not trust cannot have the best evidence for their beliefs. In an important sense, then, trust is often epistemologically even more basic than empirical data or logical arguments: the data and the argument are available only through trust. If the metaphor of foundation is still useful, the trustworthiness of members of epistemic communities is the ultimate foundation for much of our knowledge.
> (Hardwig, 1991, pp. 693-694)

Hardwig argues (in his appeal for trust to be considered foundational to knowledge in epistemology) that much of our knowledge relies on trust, particularly given the two contextual issues of the high levels of specialization and collaboration among researchers (Hardwig, 1991; Ziman, 1996). Hardwig cites one study in physics investigating charm quarks that was reported in an article by 99 authors, not least because it required approximately 280 person/years to complete the research (Hardwig, 1991). Extensive collaborative research such as this, what has come to be referred to as ‘big science’, became relatively widespread during the latter part of the twentieth century. It is exemplified by the

Manhattan Project (Longino, 2016), undertaken during the Second World War to develop an atomic weapon in the United States, and by the Human Genome Project, the world's largest collaborative biological research project (Tripp and Grueber, 2011) involving twenty universities and research centers around the world ("Human Genome Project Completion: Frequently Asked Questions," 2010). Increasingly, therefore, scientific texts are the product of a community of researchers (Myers, 1985). In such cases, trust is a significant issue because:

> Each member or subgroup participating in such a project is required because each has a crucial bit of expertise not possessed by any other member or subgroup. [….]. The other members are not in a position to evaluate the results of other members' work, and hence, all must take one another's results on trust. The consequence is an experimental result, (for example, the measurement of a property such as the decay rate or spin of a given particle) the evidence for which is not fully understood by any single participant in the experiment.
> (Hardwig, 1985, in Longino, 2016, n.p.)

Longino observes that: "questions of trust and authority arise in a particularly pointed way in the sciences" (Longino, 2016, n.p.) noting that most people believe that scientific information is reliable because of independent verification through replication. However, she notes that this is misguided because:

> In practice, however, only some results are so checked and many are simply accepted on trust. Not only must positive results be accepted on trust, but claims of failure to replicate as well as other critiques must be also. Thus, just as in the non-scientific world information is accepted on trust, so in science, knowledge grows by depending on the testimony of others.
> (Longino, 2016, n.p.)

Not only are few results actually checked by replication, but when replication is attempted, not all efforts to do so are successful, as reported in a recent edition of *The Economist*: "When staff at Amgen recently attempted to reproduce the results of 53 high-profile cancer-research papers, they found that only six lived up to their original claims." ("The Scientific Method: Let's just try that again," 2016).

We trust knowledge therefore, not as a system, but because it has been generated in accord with recognized practices and by people qualified to do so (McDonell, 1997; Schmitt, 1988). As such it is:

> […] the output from an ordering of communication behaviour conforming to procedural criteria: one accepts, one trusts, one takes for granted, the results of the processes of the various social systems (in which, again, accepting, trusting, taking-

> for-granted, are 'due' processes), because they have been expressed in procedurally correct forms by persons appointed in procedurally correct ways.
> (McDonell, 1997, p. 840)

These procedurally correct forms, and people appointed in procedurally 'correct' ways, that underlie trust, evoke the phenomenological notion of intersubjectivity, as it is clear that trust depends on the 'other' rather than the 'self' (McAllister, 1995; Tsou et al., 2015). The 'other' in this case is not a singular concept; it is related to a so-called 'community of practice' (Wenger, 2009). Thus:

> From a sociological perspective, trust must be conceived as a property of collective units (ongoing dyads, groups, and collectivities), not of isolated individuals. Being a collective attribute, trust is applicable to the relations among people rather than to their psychological states taken individually. Therefore, we may say that trust exists in a social system insofar as the members of that system act according to and are secure in the expected futures constituted by the presence of each other or their symbolic representations.
> (Lewis and Weigert, 1985, p.968)

Common notions of 'scientific objectivity' appear to depend on the view that some claims of reality and truth are tenable independently of individual biases or interpretations in that they are trusted by a 'scientific community of practice'.

We have already problematized the notion of single impervious academic communities in our introduction. We have argued that it is difficult to identify any single entity that may be called a cohesive community even within a single discipline. Trust must therefore be linked to multiple rather than single communities. Given the difficulties in eliminating the influence of idiosyncratic perspectives, values or interests while striving for faithfulness to facts that we have raised above, we question the basis on which trust may be founded. Even laudable attempts to reconceptualize objectivity in terms of community remain problematic where they assume that bias may be avoided: "[…] a community-wide *intellectual virtue* viz., an enduring commitment to salient and accurate information about reality [which] allows us to better appreciate what failures of objectivity – such as epistemic failures due to implicit bias – amount to and how they might be avoided" (Tsou et al., 2015, p.10).

Objectivity: some alternatives

The separation of components of so-called 'objectivity' (faithfulness to facts, value-freedom and freedom from bias, trust) is not without its difficulties and limitations. Objectivity is a complex concept, possibly irreducibly so: "No one concept emerges as core, however, and no one mode or sense can serve as the surrogate for the others. Thus, I will argue that there is no single sense that captures the meaning of objectivity. The bases for epistemic endorsement and trust are varied" (Douglas, 2004, p. 455).

Because of such complexities, Reiss and Sprenger suggest that we need a different starting point because:

> […] these conceptions [faithfulness to facts, value-freedom and freedom from bias] have the logical order of the ideas mistaken. They look at some privileged feature of science, define this feature as "objectivity-making" and then leave the issue of whether or not the feature also promotes trust to fate. The obvious alternative is to reverse that order, start with what we want and then look for features that might promote the thing in which we are ultimately interested.
> (Reiss and Sprenger, 2016, n.p.)

Longino suggests that this can be done by accommodating the constructive role of values in order to allow for their critical examination (Longino, 2004). This, she claims, would "do more to advance the aims in relation to which value-free science was an ideal – impartiality and universality – than appeals to narrow methodology ever could" (Longino, 2004, p.140). While she notes that scientific communities institutionalize some critical practices (for example, peer review), Longino argues that these practices "must satisfy conditions of effectiveness in order to qualify as objective" and that scientific norms should be expanded to include a range of norms that apply to communities. These are:

> (1) The provision of venues in which critical interaction can take place
> (2) The uptake of critical intervention as demonstrated in change of belief distribution in the community over time in a way that is sensitive to the critical discourse taking place within that community
> (3) Public accessibility to the standards that regulate discourse, and
> (4) Tempered equality of intellectual authority. […] [meaning] that any perspective has a prima facie capacity to contribute to the critical interactions of a community, though equal standing can be lost owing to failure to engage or to respond to criticism. […]. Thus the interactions subject to community norms extend not only to discussion of assumptions in finished research, but to the constructive processes of research as well.
> (Longino, 2016, n.p.)

We note that, while questioning its current effectiveness, Longino still uses the term 'objective' as potentially viable in relation to value-freedom.

'Objectivity' in scientific writing: a phenomenological and hermeneutic perspective

A common theme of phenomenologists is the view that so-called 'objective' reasoning cannot be detached from those who reason. Davis and Steinbock (2014), with reference to the work of Max Scheler, argue that the subjective (which includes the affective or emotional) inevitably precedes all acts of reasoning (Davis and Steinbock, 2014). Accepting this entails the view that claims of objectivity in any examination of experience, even scientific experience, are very difficult to substantiate. Every analysis or evaluation of real experience starts with some subjective or intersubjective premises which may be seen as biases or hidden assumptions. A phenomenological approach encourages us to factor in some degree of inevitable bias in all academic endeavor. In other words, the likelihood of bias or partial knowledge is so great that a suspension of judgment is required. A more radical claim is made by Husserl (cited in Vallack, 2010, p. 113):

> Subjectivism can only be overcome by the most all-embracing and consistent subjectivism (the transcendental). In this (latter) form it is at the same time objectivism (of a deeper sort) […].
> (Husserl, 1927, p.34).

This view is developed by Merleau-Ponty (1962, p.xi), who uses both singular and plural first-person in his own text to reflect the inevitable subjective and intersubjective aspects of any academic argumentation. The author's own 85-word, 4-sentence intervention includes eight first-person uses in various forms (I, my (own), myself):

> I am not the outcome or the meeting-point of numerous causal agencies which determine my bodily or psychological make-up. I cannot conceive myself as nothing but a bit of the world, a mere object of biological, psychological or sociological investigation. I cannot shut myself up within the realm of science. All my knowledge of the world, even my scientific knowledge, is gained from my own particular point of view, or from some experience of the world without which the symbols of science would be meaningless.

We assume therefore that he himself is presenting 'his own particular point of view' in this text. He is looking inside himself to evolve an intersubjective argument (using 'we')

> The whole universe of science is built upon the world as directly experienced, and if we want to subject science itself to rigorous scrutiny and arrive at a precise assessment of its meaning and scope, we must begin by reawakening the basic experience of the world of which science is the second-order expression. Science has not and never will have, by its nature, the same significance qua form of being as the world which we perceive, for the simple reason that it is a rationale or explanation of that world.
> (Merleau- Ponty 1962, p.xi)

As authors, we should add that by citing Merleau-Ponty in support of our argument, we are partially endorsing his. We cannot find anything to oppose the argument itself as expressed, except the view that as a philosopher he is assuming philosophical thought is a kind of first-order expression while science is 'second order'. This ranking may be an expression of bias. However, we endorse the argument that the 'science' in the text of an experimental report authored by a scientist, is 'the second-order expression' because it must inevitably be first filtered through the author's assumptions about how to do science and how to report it. This does not mean it is lower in importance. We may emphasize or deemphasize the first-person appearance of the author or researcher in the text by making depersonalizing word choices, but the author is never absent from her text.

Scientific reasoning as we have represented it embodies a claim to minimize the subjectivity of all lived experience. In this respect Heidegger's notion of 'Dasein' is important (Heidegger, 1953). Dasein is roughly translatable as the experience of existence or being. The concept also involves an attempt to understand 'being' or existence itself. While experience is individual, the 'Dasein' concept itself is presented as a universal that we all have in common. It is in this sense perhaps that Weberman (2000) provides a defense of Gadamer's position that "objectivity is not possible because the object of understanding is not determinate, but rather constituted anew by each act of understanding" (Weberman, 2000, p.46). A research result exists as an 'object' upon which we may then exercise our interpretation as an act of understanding.

But our pervasive presence in the text is more basic than this. Assuming, from our phenomenological insights, that every act of understanding is initially mediated within the 'self', we become aware that it is very difficult to claim 'objective' knowledge, in the sense that it is assumed to exist independently of individual understanding. Our common experience of 'Dasein' makes intersubjectivity both possible and essential, hence any

discussion of 'objectivity' needs to consider its relationship with both 'subjectivity' and 'intersubjectivity'. As Eisner notes:

> Recognizing and accepting the inevitable transaction between self and world seems to me more realistic and more useful. This recognition would underscore the constructed, tentative, and framework-dependent character of perception and knowledge. It would contribute to a more pluralistic and tentative conception of knowledge, one more dynamic and less dogmatic, one with a human face.
> (Eisner, 1992, p.15)

Malpas, (2011, p.viii) suggests that Husserl was not only concerned with subjectivity. He was also responsible for "one of the most careful and detailed studies of inter-subjectivity and objectivity that has ever been given". Malpas emphasizes the close relationship between the three concepts: "For him, as for Davidson, subjectivity, inter-subjectivity and objectivity were intimately intertwined." It is difficult as an individual to determine what 'objectivity' is or whether an argument is 'objective'. Even inter-subjectively, or within a so-called community, it is difficult. 'Objectivity', like any other concept, is inevitably conceived and recreated individually, inter-subjectively and within social groups that we may call communities. 'I' cannot put forward my own undisputed view of the meaning of objectivity or a claim 'I' make about something being objectively determined. Even 'we', as a group of individuals, implicitly assume that participation in some type of academic 'community' is needed to understand the dependability of an intersubjective claim.

Gadamer (2004 [1975]) refers to the nature of understanding our experience through 'transcendental reflection' in a holistic sense as reflection *after* the experience:

> [I]ts construction of the totality of all determinants of thought is by no means the thinking out of some arbitrary view of the world, but desires to bring into thinking the absolute a posteriori character of experience, including experiment. This is the exact sense of transcendental reflection.
> (Gadamer, 2004, p.166)

Written reports necessarily include a degree of reflection after the experience.

Objectivity in scientific writing: a rhetorical and linguistic approach

It is commonly assumed that there is no place for rhetoric in scientific practice and discourse, because the goal of rhetoric is to persuade, while scientific writing aims to explain and demonstrate (Allen, 2015). As Allen (2015) notes: "Many people, as Charles Bazerman

points out, think that writing based on scientific premises is not really writing at all […], that it is an unbiased vessel for transmitting truth" (p. 94). This view certainly arises from the assumption that scientific writing is objective, "an apparently sound connection: scientific writing is scientific; science is objective; therefore, scientific writing is objective" (Allen, 2015, p. 95). While so-called objectivity is likely to remain one of the key claims of science, as we have seen, it is difficult to eliminate the subjective human element, not only in terms of its impact on the production of the knowledge, but also in how that knowledge is reported. Closer consideration of scientific writing reveals that all writing expresses a judgement (Dobrin, 1985, pp. 244-245) and that writers of science do, in fact, aim to persuade (Kelly, Chen, and Prothero, 2000; Myers, 1985). However, the claim of 'objectivity' remains prevalent:

> […] the authors of scientific papers […] demonstrate the validity and objectivity of their findings and make them seem interesting and relevant to already-established conclusions. In effect, this is a rhetorical situation: a speaker (the author) communicates knowledge about a particular subject to an audience via the scientific paper, intending, on some level, to persuade that audience.
> (Allen, 2015, p. 94)

Latour and Woolgar completed an ethnographic study of the making of scientific knowledge (1986). They describe scientific practice as involving:

> [….] a tribe of readers and writers who spend two-thirds of their time working with large inscription devices. They appear to have developed considerable skills in setting up devices which can pin down elusive figures, traces, or inscriptions in their craftwork, and in the art of persuasion. The latter skill enables them to convince others that what they do is important, that what they say is true and that their proposals are worth funding. They are so skillful, indeed, that they manage to convince others not that they are being convinced but that they simply follow a consistent line of interpretation of available evidence.
> (Latour and Woolgar, 1986, p.70, in Ryghaug and Skjølsvold, 2010, p.289)

Ryghaug & Skjølsvold note that "fact-construction [therefore] relies on the persuasive skills of scientists" (Ryghaug and Skjølsvold, 2010, p. 289) and that:

> […] the products of science are contextually specific constructions marked by the situational contingency and interest structure of the process by which they are generated, which cannot be adequately understood without an analysis of their construction. Thus, laboratory studies have showed that technical objects are not only 'technically' manufactured in laboratories, but also inextricably symbolically and politically constructed, for instance through the literary techniques of persuasion embodied in scientific papers, […].
> (Ryghaug and Skjølsvold, 2010, pp. 289-290)

Schuster and Yeo (cited in M. Allen, 2015, p.96) observe that "scientific argumentation is essentially persuasive argument." It is:

> […] rightly termed *rhetorical* […] where 'rhetoric' denotes the entire field of discursive structures and strategies used to render arguments persuasive in given situations" (xii). As scientists write reports of original research, all the while conforming to certain accepted structures and styles, such as logic, clarity, and empiricism, they still give a rhetorical shape to their writing. Gerald Holton describes this process as a "proactive rhetoric of assertion"—when a scientist becomes convinced of something, he or she hopes to persuade others about that same idea or phenomenon when the work is published (176).
> (Allen, 2015)

How this shape is achieved by means of 'literary techniques of persuasion' is described as occurring in the "central persuasive activity [of] the production of papers" through:

> Laboratory work [which] is described as 'constantly performing operations on statements; adding modalities, citing, enhancing, diminishing, borrowing, and proposing new combinations', resulting in new statements being different or merely qualified, providing the focus for similar operations in other laboratories, regularly observing how their own assertions were 'rejected, borrowed, quoted, ignored, confirmed, or dissolved by others'.
> (Latour and Woolgar, 1986, p.87, in Ryghaug and Skjølsvold, 2010, p. 289)

Several rhetorical and linguistic features and devices facilitate the adding of modalities, the citing, enhancing, diminishing, borrowing, and proposing of new combinations. These include choices that the writer makes with regard to:

1. Adherence to IMRAD (Introduction, Methods, Results and Discussion) structure (Allen, 2015; Holton, 1991; Kelly et al., 2000)
2. Establishing a research space (Martín, 2003), e.g. via creating an exigence (Allen, 2015)
3. Epistemic modality in presenting evidence and making claims (Fowler, 1986, 1991, Nunn, 2008, in Brandt, 2008; Hyland, 1996)
4. Person: first or third (Eisner, 1992; Goldbort, 2006; Hyland, 2002; Johansson and Svensson, 2006; Webb, 1992, Nunn and Brandt, 2016, Nunn, Deveci and Saleh, 2015, Deveci and Nunn, 2014, Nunn, 2014)
5. Voice and agency: active or passive (Allen, 2015; Goldbort, 2006; Harwood, 2005, Nunn et al., 2015)
6. Denoting vs. connoting (Goldbort, 2006)
7. Concrete vs abstract wording (Goldbort, 2006)
8. Purpose, positionality and reflexivity (Dobrin, 1985; Latour and Woolgar, 2013; Rose, 1997)

In the last section of our paper, we mainly consider 3, 4 and 5 from this list. In doing this we are attempting to "stop asking whether social values play a role in science and instead ask

which values and whose values play a role *and how*." (Longino, 2004, p.127, italics added). These features address the 'how': they provide a window to the writer's claim (possibly of objectivity) in scientific research report writing and to how he or she perceives his or her relationship with the reader. As human science specialists, we have chosen to study text from natural sciences, as it has been suggested that differences in researchers' attitudes toward objectivity depend on the subjects they deal with:

> Their attitudes toward objectivity, by contrast, largely depend on the subjects they deal with. […] professionals dealing with cultural phenomena appreciate the strength of objectivity – its function as a means to ensure reliability – least. Those dealing with social phenomena appreciate the strength of objectivity more and those dealing with natural scientific subjects appreciate it most.
> (Post, 2014, p.13)

Extracts from science papers

In Nunn et al. (2018), we proposed a 4-stage academic analysis of two papers published in *Nature*, one on climate change, *The carbon footprint of traditional woodfuels,* (Bailis et al., 2014) and an experimental paper, *Carbonic anhydrases, EPF2 and a novel protease mediate CO2 control of stomatal development* (Engineer et al. 2014). In this shorter discussion of text here, we will mainly refer to some extracts from the first of these. The article proposes a new approach to identifying and estimating potential areas of woodfuel-driven deforestation in order to mitigate climate change effects. The selection of a 'climate change' topic is a deliberate choice, given our discussion of 'Climategate' above.

We use the following colour coding to clarify what we choose to emphasize in our text analyses and discussions.

- Red = references
- Green = first-person use
- Blue = active use
- Pink = passive use
- Hunter green = modality (levels of certainty in claims)
- Yellow = Verb to be as main verb

Authors' transparent presence in deciding what is "known"

We emphasize that aspect of reporting research that is essentially about knowledge claims. We assume that all research reports make some kind of claim that the reported research adds

to our knowledge. The degree to which we can claim something is true or is 'known' depends on our interpretation of the strength of the evidence that supports our claims (Fowler, 1986). Epistemic modality choices vary from the expression of absolute certainty (with no modal term employed) through all possible degrees of lesser certainty (with modal terms such as 'may'). The important issue for research reporting is to identify an appropriate level of certainty that is supported by the evidence available.

In Extract 1 below, the authors openly acknowledge 'unknown uncertainties' in their first-person discussion of limitations of their study. Interestingly, they transparently admit meta-communicatively to difficulties in communicating what is 'known'. They are also transparent in explicitly acknowledging 'the uncertainty in the results'.

Extract 1 (Article 1): The authors' transparent intervention

One limitation of the study is a lack of reliable woodfuel consumption data. When possible, we used national and sub-national data sets. However, for most countries, we relied on data compiled by international organizations containing unknown uncertainties that make it difficult to communicate the uncertainty in these results.

We note in Extract 2 below that the authors again explicitly acknowledge uncertainty and state assumptions transparently using a first person voice. (Here we see two of the six uses of 'we assume' in the paper).

Extract 2 (Article 1): Epistemic modality choices (high levels of uncertainty)

Neither process has been explicitly accounted for in previous woodfuel assessments. When deforestation occurs in regions accessible to woodfuel users, the cleared woody biomass may be used as timber and woodfuel. Similarly, afforestation adds DEB equivalent to the MAI of the surrounding land class. However, the degree to which LCC by-products are actually used as woodfuel is unknown. To accommodate this uncertainty, we explore two scenarios, described in Table 1. In Scenario A, we assume LCC by-products are not used. In Scenario B, we assume they are used, yielding two NRB components (NRBB1 and NRBB2): NRBB1 indicates the use of LCC by-products; NRBB2 indicates the wood harvested in excess of MAI to satisfy the demand that remains after accounting for the use of those by-products. In populated regions experiencing high rates of deforestation, large volumes of DEB are accessible, and NRBB2 may be zero (Supplementary Section 5).

In Extract 3 below, we note that the authors of a different experimental paper explain their criteria for interpreting the data requiring identifications to be established with almost 100% certainty. Impersonal passive voices are (appropriately) used in support. The authors therefore establish the degree of uncertainty that could be acceptable in their own field.

> **Extract 3 (Article 2): Modality (high levels of certainty)**
> Oxidation of methionine and the iodoacetamide derivative of cysteine were specified as variable modifications. Scaffold (version Scaffold_3.6.4, Proteome Software) was used to validate MS/MS-based peptide and protein identifications with identifications accepted if they could be established at greater than 99.0% probability and contained at least two identified peptides.

In the extracts above it can be seen that the authors express caution in relation to their own contribution, in direct proportion to the evidence available. This gives the reader a balanced interpretation about the evidence, potential facts and information being presented. More importantly, it provides narrative information about how they arrived at this interpretation. Making claims based on well-argued interpretations of evidence is central to scientific or academic writing. Interpretations, like arguments, do not, however, represent claims of 'objectivity'.

> **Extract 4 (Article 2): Impersonal transitivity (passive voice use)**
> RapiGest SF (Waters) was added to the mixture to a final concentration of 0.1%, and the samples were boiled for 5 min. Tris-(2-carboxyethyl)phosphine (TCEP) was added to a final con- centration of 1 mM, and the samples were incubated at 37 uC for 30 min.

In spite of the journal's explicit instruction to authors to use an active voice, extract 4 from article 2 (an experimental paper) illustrates the way an impersonal passive can also be used to represent the 'impersonal' procedures of an experimental process in the method section. Passive voice dominated only in this section of the paper. In Nunn et al. (2018), we note the common use of an impersonal passive voice to describe a step-by-step impersonal experimental procedure similar to Extract 4 above, across 11 experimental papers. In spite of the journal's preference for first-person, which is commonly used in other sections of experimental papers in our samples, we see a strong case for choosing the passive here as we assume that it is a factual description of what was done and could therefore probably be replicated in a similar manner. While this could be seen as 'procedural objectivity' (Eisner, 1992), we would nonetheless note that the process itself is conceived and instigated by the researchers. There is an authorial choice to emphasize the procedural process**.**

Text creation is complex and is not reducible to single phenomena except for the purposes of analysis. Extract 2 illustrates this point. We repeat this extract here for the reader's convenience, but will emphasize the complexity of choices in the current stage of discussion.

Extract 2 (Article 1): Epistemic modality choices (high levels of uncertainty)
Neither process has been explicitly accounted for in previous woodfuel assessments. When deforestation occurs in regions accessible to woodfuel users, the cleared woody biomass may be used as timber and woodfuel. Similarly, afforestation adds DEB equivalent to the MAI of the surrounding land class. However, the degree to which LCC by-products are actually used as woodfuel is unknown. To accommodate this uncertainty, we explore two scenarios, described in Table 1. In Scenario A, we assume LCC by-products are not used. In Scenario B, we assume they are used, yielding two NRB components (NRBB1 and NRBB2): NRBB1 indicates the use of LCC by-products; NRBB2 indicates the wood harvested in excess of MAI to satisfy the demand that remains after accounting for the use of those by-products. In populated regions experiencing high rates of deforestation, large volumes of DEB are accessible, and NRBB2 may be zero (Supplementary Section 5).

In Extract 2, there were 3 first person uses with an active form, alongside 5 impersonal active forms. There were also 7 passive voice uses, of which 2 are abbreviated. One of these was with a modal verb 'may'. We note that 2 'impersonal' passives were actually subordinated to 'we assume'. The (impersonal) verb 'to be' was the main verb 3 times. However, it was used once with an explicit epistemic modal choice (may), and once with 'unknown', which we label as an implicit use of epistemic modality. The authors also used the noun 'uncertainty' to emphasize further their relationship to the knowledge.

Extract 2 hence illustrates the way the authors engage in subtle and complex choices when building their arguments. By using a whole range of choices available in complex combinations, including first-person use, impersonal uses and modal language expressing uncertainty, their argumentation is transparently exposed without obfuscation. We could also add that our analysis is not a full analysis of the complexity of even this one paragraph. Nonetheless, we do emphasize that there is nothing in this competent and complex scientific argumentation that we can identify as a claim of 'objectivity'.

Use of references

References (as used in Extract 5 below) provide an intersubjective component, but we observe a complex intermeshing between first and third person. The authors use references selectively in the building of their own argument. There is therefore an interesting balance between subjectivity and intersubjectivity:

Extract 5 (Article 1): Subjectivity and intersubjective referencing of other voices
We then define local balance assuming subsistence users do not travel more than a few kilometres to access woodfuels 46,47 (Supplementary Section 4, Fig. 1a and

> Supplementary Fig. 4). Then we assess the commercial supply demand balance in urban centres and rural regions with large deficits by defining a `woodshed', which represents the region that a commercial demand centre needs to exploit to satisfy demand assuming that the full MAI is used 27. We assume a threshold of 12-hour one-way travel.

The role of referencing above is in support of an interpretive argument made by the authors themselves, who at the same time are making their own assumptions transparent with referential support. There is transparency through explicitly stated assumptions, but no attempt to 'objectify' the language in that there is no attempt to disguise inevitable subjective intervention by making only impersonal language choices.

Conclusions 1

We conclude that the authors do not make exaggerated claims to have created new, objectively determined, scientific facts. Instead, they transparently provide their own interventions in the argumentation alongside the previous contributions to the field that they reference in support of their arguments. They explicitly attempt to state their assumptions and do not therefore claim value-freedom or even freedom from bias. By using a frequent first person voice and by making their assumptions as transparent as possible, they implicitly acknowledge their own (inevitably subjective) intervention in their argumentation and the developmental nature of knowledge creation. Their transparent interventions therefore support a view that so-called 'subjective' narrative interventions are an essential and necessary condition of reporting knowledge contributions. Our analysis showed that the authors used (intersubjective) references extensively to build their narratives, support their arguments and contextualize their novel findings. Impersonal transitivity was used to describe experimental procedures employed and is often in contrast to the first-person uses expressing the authors' novel contributions and arguments.

In terms of epistemic modality choices, it is not important to claim absolute certainty. What is important is to choose language that expresses appropriate levels of certainty in relation to the evidence available to support claims. The extracts we analyzed above indicate that modality is often (but not of course exclusively) used with first-person use and active voice indicating that assumptions are being made explicit by the authors' transparency. The authors make use of a varied range of linguistic choices available and do not appear to exclude any per se. We therefore concluded in our detailed analysis (Nunn et al., 2018) that both texts are

competently argued in terms of referencing, transitivity and modality choices, whether these are analyzed independently or considered in combination. The authors avoid spurious representations of impersonal (so-called objectively determined) conclusions. They provide a valuable scientific contribution that implicitly acknowledges the impossibility of value-free assumptions and freedom from bias.

Conclusions 2

In more general terms, we conclude that the clear and transparent presentation of inevitable 'subjectivity' paradoxically leads us to the phenomenologists' conclusion that 'subjectivity' is not opposed to knowledge creation, even in the natural sciences. When the inevitable authorial interventions and assumptions are made transparent, they support the readers' attempts to work out what can be retained and relied upon for future study. We therefore propose two possible conclusions:

1. Transparent 'subjectivity' is not opposed to 'objectivity' – it is, rather, an inevitable and essential component that may even support an otherwise unhelpful concept. Transparency exposes inevitable bias and therefore makes it a textual object of scrutiny. We are aware that a word as commonly used as 'objective' is not likely to disappear from the academic lexicon. As a comparative term, that does not easily tolerate absolutist claims, 'objectivity' is less problematic.
2. We could of course also conclude that 'objectivity' is an intrinsically flawed concept that does not advance (even scientific) knowledge. However, in this preliminary study, we have not discarded the notion of 'procedural objectivity' in experimental studies, although we do have our reservations, as procedures are also the result of the researchers' own choices.

Our preliminary investigations reported here support the view that claims of impersonal 'objective' scientific conclusions may be an important obstacle to advancing our knowledge of what we may usefully claim to be true. Ironically, while questioning the usefulness of 'objectivity' as a value-laden word or concept, partially because it has a connotation of being an absolute value, we have not been able to argue that its apparent 'opposite', 'subjectivity' can be usefully discarded. Some degree of subjective intervention alongside intersubjective argumentation appears to be inevitable, and could therefore be exposed and displayed

transparently. There is therefore little that we can find in support of 'objectivity' as a productive concept that stands in opposition to 'subjectivity'. While it may never disappear from the lexicon, our hope is that it may at least be used with more caution.

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