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AD HOMINEM ARGUMENTS, RHETORIC, AND SCIENCE COMMUNICATION

Abstract. In this paper, I contend that evidence-focused strategies of science communication may be complemented by possibly more effective rhetorical arguments in current public debates on vaccines. I analyse the case of direct science communication – that is, communication of evidence – and show that it is difficult to effectively communicate evidential standards of science in the presence of well-equipped anti-science movements. Instead, I argue that effective rhetorical tools involve ad hominem strategies, that is, arguments involving claims of expertise. I provide a rationale, and sketch a methodology, for using ad hominem arguments in science communication.

Keywords: Ad hominem arguments, science communication, expertise, vaccine controversies, argumentation in science, scientific rhetoric.

Introduction

Science communication needs to be both accurate and effective. On the one hand, accurate scientific information is the product of strict epistemological, methodological and evidential requirements, like relying on strong evidence and good methodology. On the other hand, effectiveness in communication can be achieved through rhetorical devices, like powerful images, figures of speech, or amplification, aiming at getting the readers' attention and persuading them. By their nature, rhetorical tools can distort the contents of the message, and effectiveness can be achieved at the expense of accuracy, but the guiding principle in science communication is that the trustworthiness of science should not be compromised by resorting to sophism.

For example, attacking a scientist's stance on the effectiveness of a drug by referring to the scientist's ties to the pharmaceutical industry that produces that drug, does not show anything about the effectiveness (or lack thereof) of the drug. Yet, under appropriate circumstances, it may be enough to discredit the reliability of the scientist's claims. This type of argument is called "ad hominem": it attacks the source of information, not the substance of the matter – i.e., whether the drug is effective or not. Ad hominem attacks, even when fallacious, can be powerful. For instance, people opposing the use of vaccination routinely use ad hominem attacks, by alleging ties between the scientists defending the use of vaccines and the pharmaceutical industry (see Davies, Chapman and Leask 2002).

The recent controversy on the safety of vaccinations and their possible links to a number of conditions, including autism, presents a challenge for science communication. Critics of vaccines are well-equipped with rhetorical arguments and a wealth of supposed evidence in support of their various claims: e.g., that vaccines can cause autisms and that vaccines contain chemicals harmful to children. Anti-vaccination movements appeal to anecdotal evidence and powerful imagery to persuade the public and policy makers of their arguments, including alleging commercial ties between the medical profession and the pharmaceutical industry. Cases of bad science and pharmaceutical disasters (see Daemmrich 2002, Russell 2009) only make the anti-vaccination arguments stronger in the eyes of the public.

The scientific community has reacted to the most recent anti-vaccination wave[1] in a scientific way: i.e., by using scientific methods, like meta-analyses (see e.g., Taylor, Swerdfeger and Eslick 2004), to disprove connections between, for instance, the MMR vaccine and ASD (autism spectrum disorder). Despite these efforts, anti-vaccination movements still flourish, their message has spilled over across the political spectrum, and their societal influence has been linked to increases in disease incidence, for example measles, in countries like Italy and the UK (Anderson 2017).

In this paper, I contend that evidence-focused strategies of science communication may be complemented by possibly more effective rhetorical arguments in current public debates on vaccines. I analyse the case of direct science communication – that is, communication of evidence – and argue that it is difficult to effectively communicate evidential standards of science in the presence of well-equipped anti-science movements.

The coexistence of rhetorical and evidential arguments in science has long been recognized (see Walton 1997, Goodwin and Honeycutt 2009), but the fact remains that much of scientific rationality tends to rest on evidential standards. For instance, Davies, Chapman and Leask (2002) suggest improving communication about the safety and monitoring of vaccines in order to diffuse conspiratorial claims, while Black and Rappuoli's report focuses on the need for better communication of evidence (2010: 5); more on this below. In this article I focus on the case study of anti-vaccination movements to provide a rationale for the use of ad hominem arguments in science communication. I will problematize the claim that scientists, in science communication, should stick to only communicating of evidence. While this claim may not be an open problem in much of the literature on argumentation, the next section will make clear how scientists tend to stick to strict evidential standards focusing on evidence, rather than authority, in science. What is needed is a study that focuses on a concrete case study, rather than abstract analysis of the context of argumentation.

Scientific Communication and Rhetoric

Scientific argumentation and communication typically proceeds by evidential standards. We can define a scientific argument as the attempt to support or refute a claim, using methods and standards that are accepted by the scientific community (see, e.g., Driver, Newton and Osborne 1998). Methods and standards can vary across sciences, but it is safe to claim that they typically involve the presentation of data, and of the methods used for interpreting the data. For instance, a claim of causation – like the claim that the MMR vaccine can cause autism in children – could be justified via a statistical model showing correlation between the cause and the effect, or a mechanistic model explaining the causal mechanism through which the cause produces the effect, or some other suitable inference involving evidence and methodology accepted by the scientific community.

Use of evidence, data, models, reasons, logical arguments and reasons are distinctive of scientific argumentation; but the additional layer of rhetoric, which a scientist may use in presenting their arguments, is characteristic of scientific communication, whether it is directed at the community of peers, the general public, or policy makers. According to this categorization, science communication involves argumentation by evidential standards together with the use of rhetorical devices[2].

An illustrative example is Galileo's refutation of one of the principles of Aristotelian physics, which states that bodies fall towards the centre of the earth with a speed that is proportional to their weight. Historians of science have shown that Galileo performed experiments in order to confute Aristotle empirically, by showing that the speed of a falling body is independent of its weight. But in his *Dialogues Concerning Two New Sciences* (Galilei 1638 [2010]), Galileo did not only present his thesis as a result of empirical demonstration, but rather devised a clever thought experiment that provided a *reductio ad absurdum* of the Aristotelean principle.

The *reductio ad absurdum* argument must have sounded much more convincing to Galileo's audience, even though hardly any scientist today would take it as a proof of the empirical fact that Galileo was trying to demonstrate. Galileo did not consider the empirical arguments proceeding from his experiments as having as much rhetorical force as his *reductio ad absurdum*, at least in the ears of Scholastic philosophers trained in the art of *disputationes* (disputations) and likely suspicious of the relatively new empirical methods (Settle 1983: 8–9). What the example shows is that a scientific claim usually has evidential force and rhetorical force, and the two are not always correlated: by today's standards, Galileo's thought experiment would be considered as having weak evidential force, and also weak rhetorical force against Aristotelian physics; while in Galileo's times, the thought experiment had weak evidential force for Galileo himself – assuming he believed in empirical science – but strong rhetorical force in a disputation with Scholastic philosophers.

Scientific controversies

Genuine scientific controversies are cases in which there are significant disagreements within the scientific community on a certain issue; but many apparent scientific controversies are not genuine: for example, the controversy about climate change, where the scientific community strongly supports the anthropogenic stance, and the dissenting voices are largely coming from without the relevant community (see Oreskes 2004, 2010). The most recent MMR (measles, mumps and rubella) vaccine controversy presents a difficult case for science, because the controversy was initiated by a genuine doctor (see Flaherty 2011), and because, in the field of health and medicine, the lines between true and false expertise are sometimes blurred.

The controversy started when a paper, published in a prestigious medical journal, claimed a causal link between the administration of the MMR vaccine and the incidence of autism and bowel disease. The paper was later retracted and shown to contain severe flaws, but Pandora's box had been opened, and anti-vaccination movements saw a new boost to their cause. The vaccination controversy presents a difficult case for science because of at least three factors involved: (a) there are countless uncertified medical and health practices whose boundaries with effective medical science are not always clear-cut (Derkatch 2016), (b) in many countries, certified medical doctors have endorsed anti-vaccination positions (Kazan 2017), and (c) there is a history, albeit a limited one, of scientific fraud and collusion between the medical profession and the pharmaceutical industry (see Greene 2007 and Russell 2009: 58–59).

Point (c) is worth focusing on, because it bears on the issue of ad hominem arguments. Cases of bad science are limited, compared to the generally high success of science in the 20th century, and the pharmaceutical industry has contributed significantly to the discovery and development of effective drugs. However, documented cases in which economic interests have trumped safety or effectiveness concerns have given rise to a significant literature that casts doubt on the whole enterprise of collaboration between the medical profession and the pharmaceutical industry. As the saying goes, one rotten apple spoils the barrel, and time and again advocates of vaccinations have been accused of promoting vaccines for commercial interests.

Davies, Chapman and Leask (2002) conducted empirical research on anti-vaccination websites and found that one of the main rhetorical appeals of anti-vaccination movements is an alleged "unholy alliance for profit" between the pharmaceutical industry and the medical sector. According to anti-vaccination movements, the "promotion of vaccines is motivated by collusion for monetary gain between doctors, pharmaceutical companies, researchers, and public health bureaucrats towards totalitarianism" (2002: 23). This is only one of the many claims that anti-vaccination movements make to convince people of their stance against the use of vaccines, but it is a very powerful one. In their recommendation on how to respond, Davies, Chapman and Leask suggest that "[to] defuse conspiratorial claims the public should be made aware of efforts to address the issue of vaccine safety through more active surveillance of adverse events and studies investigating hypothesised links between vaccination and serious chronic diseases" (2002: 24). Their suggested answer to anti-vaccination movements is indeed an appeal to evidential standards: scientists have overwhelming evidence that vaccines are safe, and the communicative line against anti-vaccination movements should stress how good the evidential standards of science are.

The problem with this strategy is that it does not work in the case of the anti-vaccination controversy, at least not entirely. It seems obvious that scientists should, in the first place, pursue the scientific goal of discovering whether vaccinations are safe or not. At the communicative level, moreover, they should make their evidence and conclusions communicable and available to the public. But in the case of vaccines, there are health practitioners and even certified doctors who, posing as experts on immunology and pharmacology, claim independent evidence contrary to the safety of vaccines. These alleged experts have an easy game criticising defenders of vaccinations for their collusion with the industry sector.

Now we must consider the situation from the standpoint of the layperson who is exposed to unfiltered information both from vaccination supporters and anti-vaccination movements. Davies, Chapman and Leask (2002) report a 43% ratio of anti-vaccination to pro-vaccination websites in their empirical survey of online material for search terms "vaccination" and "immunisation", meaning that the layperson who looks for information on vaccination or immunisation is about as likely to find anti-vaccination information as they are to find pro-vaccination information, as of 2002, the year of their research[3]. The layperson is presented with (a) vaccination supporters, using scientific evidence and scientific arguments to support their positions; (b) anti-vaccination supporters, using pseudo-evidence and fallacious arguments to support their views; (c) anti-vaccination movements using rhetorical ad hominem arguments to discredit the credibility of vaccination supporters by alleging collusion with the pharmaceutical industry. If laypeople were able to discriminate between evidence and pseudo-evidence, and between scientific argumentation and fallacious argumentation, then the additional point in (c) would not make a big difference; but the layperson can only rely on the scientists telling them that the anti-vaccination movements use pseudo-evidence and fallacious arguments. The rhetorical force of ad hominem arguments against scientists is compelling, and the strategy of "speaking scientifically" and "communicating evidence" might not be enough to convince vaccine-hesitant parents.

Ad hominem strategies in scientific argumentation

Scientific controversies, like the anti-vaccination controversy, present a dilemma for science communication. On the one hand, science ought to stick to evidence and scientific argumentation, and the use of rhetorical devices should not draw scientists into sophistry. On the other hand, anti-vaccination movements resort to ad hominem arguments to undermine the credibility of scientists, and thus weaken their evidential stance. In their line of defence, scientists can and ought to pursue two strategies: the first strategy is to counter the ad hominem arguments made by anti-vaccination supporters[4]. The second strategy is to use ad hominem arguments to undermine the credibility of anti-vaccination supporters. The first strategy seems obvious. It is defended in Davies, Chapman and Leask (2002) and it will not be developed here. The second strategy needs to be defended, and I show by means of examples how scientists can legitimately resort to ad hominem argument against anti-vaccination supporters without undermining the credibility of science. To be sure, I am not here repeating the claim that there can be legitimate ad hominem arguments – the claim has been made in the argumentation literature (see Walton 1997 and the special issue of *Argumentation* "Rethinking Arguments from Experts" 2011). The point here is to apply effective ad hominem arguments to concrete case studies, along the lines of Goodwin & Honeycutt (2009).

There are different forms of ad hominem arguments, and there are good and bad ad hominem arguments. Walton states that "we must not reject an argument against the person without giving good reasons" (2002: 190), so we need to determine what could be good reasons for using ad hominem arguments an arguer (see also Walton 1997). An example of a successful argument is an attack on an arguer's impartiality: "Bob and Wilma are discussing the problem of acid rain. Wilma argues that reports on the extent of the problem are greatly exaggerated and that the costs of action are prohibitive. Bob points out that Wilma is on the board of directors of a U.S. coal company, and that therefore her argument should not be taken at face value" (Walton 2002: 185). Walton explains that the argument has force inasmuch as what it intends to show is not that acid rain is a serious problem, something that Wilma denies, but that the discussion is not an impartial discussion about acid rain and the environment. Until Bob pointed out that Wilma sits on a U.S. coal company's board of directors, it looked as if Wilma and Bob were taking part in an impartial discussion about the reliability of reports of acid rain. Wilma's membership, however, shifts the discussion to a matter of advocacy: Wilma may not be claiming known facts, but advocating for her cause. Walton notes that "there is nothing wrong with arguing for your own side in a persuasion dialogue, but if the dialogue is supposed to be an impartial investigation (inquiry) rather than a dispute, the situation is different" (2002: 186).

The argument against Wilma is not effective in showing something about the reliability of acid rain reports, but in casting doubt on whether the discussion Wilma and Bob are engaged in is one of advocacy or one of (scientific) inquiry. One must be careful about drawing the lines too sharply here. There may be types of discussions for which it is hard to find truly impartial experts, for example on theological issues, on the aesthetic value of a movie, or on the palatability of different flavours of ice cream. Yet, it seems fair that the merits – premises, methodology, strength of evidence – of acid rain reports can be kept separate, to some extent, from one's preferences for taking or not taking action against acid rain; since those preferences are most likely influenced by financial interests. The ad hominem argument against Wilma achieves the goal of showing that Wilma may have switched from discussing acid rain, to advocating against acid rain intervention. The fact the Wilma is on the board is not proof that she is advocating, but it should be taken as a warning sign: it shows something about the context of utterance and Wilma's compromised (expert) judgement about acid rain reports.

Ad hominem arguments are legitimate in scientific discussion if they show something about the expertise of the people involved in the discussion. Imagine the situation in which an astrophysicist reports the value of the latest measurement of a universal constant, and a biologist retorts "you are wrong, the value you're reporting is incorrect". Let us assume the astrophysicist has been diligent, and has checked the relevant literature; maybe they were themselves involved directly in the experiment that measured the constant. In that case, the astrophysicist could easily counter with an ad hominem argument "you are not an expert in astrophysics". The profession of the utterer (the biologist) has very little to do with the objective value of a universal constant, but the likelihood that the biologist has worked out the value of such a constant better than the physicist seems low.

Moreover, let's imagine that the biologist harbours a personal political rivalry with the astrophysicist, and is interested in discrediting the latter professionally. The astrophysicist could use this evidence, and utter the ad hominem "you are speaking out of your field of expertise to discredit me". The intentions of the utterer have little to do with the truth of what is uttered – maybe the biologist does have an interest in discrediting the astrophysicist, but is right about the value of the universal constant – but clearly the conflict of interest casts doubts on the ability of the biologist to have an impartial discussion with the astrophysicist about universal constants.

Scientific discussions usually occur among peers, and when there are non-peers involved, the burden of proof is on the non-expert to prove their worth. Moreover, even when the discussion involves true peers, other factors can disqualify or weaken an expert's judgment. Walton (1989), Goldman (2001), and Martini (2015) provide lists of criteria for the admission or rejection of expert judgment. For example, conflicts of interest, speaking outside one's field of competence, and defending claims against the consensus of one's own peer community (when such consensus exists), are all good causes for dismissing or diminishing an expert's judgment. Clearly, lack of expertise is an even stronger reason for the dismissal of judgment. Ad hominem arguments that undermine a speaker's expertise or epistemic authority to speak on a certain matter are legitimate arguments in science communication, and there are several criteria for dismissing a source of information as a legitimate source of knowledge. Walton (1997) and Walton and Godden (2005) usefully frame the problem in terms of "critical questions", but that is only one way of framing the problem: psychologists, philosophers and sociologists have debated at length about criteria of expertise and their validity in ad hominem argumentation schemes (see Shanteau 1992, Shanteau et al. 2002, Goldman 2001, Reiss 2007). The next section will show how ad hominem arguments can reasonably be used by the scientific community to counter anti-vaccination movements.

An example from the recent controversy about vaccines

One of the claims of anti-vaccination movements has been that adjuvants, commonly contained in vaccines, are unsafe and are linked to a number of health issues affecting children. The scientific community considers vaccines adjuvants safe, but a quick search on the internet will reveal a large amount of information on the alleged harms of many adjuvants routinely used in vaccines. One of the strategies of anti-vaccination movements is to refer to "scientific evidence", not only in alternative health and medical literature, but also in established journals and publishers (see Davies, Chapman and Leask 2002). In fact, the strategy has been so successful that in many instances the lines between legitimate scientific publications and frauds are blurred, as well as the lines between legitimate scientific experts and quacks. This is nothing new: in the 70s and 80s the tobacco industry was actively engaged in a campaign to convince the public that alleged scientific disagreement about the harms of smoking did not warrant tobacco regulation and preventative health policy (see Jacobs 2000, Freudenburg et al. 2008).

On the topic of vaccine safety, Lucija Tomljenovic and Christopher Shaw are often cited in anti-vaccinations social media posts, blogs, and advocacy websites. In one of their papers (Tomljenovic and Shaw 2015), they state that there are health risks associated with vaccine-derived aluminium adjuvants, a claim often repeated in anti-vaccination circles. Tomljenovic and Shaw's paper has all the hallmarks of a legitimate scientific publication: it appears in a volume entitled *Vaccines and Autoimmunity*, published by a respectable publisher of academic and scientific books: Wiley. The authors have academic and scientific credentials – both of them work at the University of British Columbia –, and the paper contains all the scientific keywords that a science paper usually contains, as well as a respectable list of scientific references.

From the standpoint of the layperson, and even of most scientists not working in the field of immunology, the paper is an instance of the alleged disagreement within the relevant scientific community on the possible harms of vaccines. If there is scientific disagreement on the safety of vaccines, and if the supporters of vaccinations are colluding with the pharmaceutical industry, so argues the vaccine sceptic, that should be enough evidence to take a precautionary stance and oppose vaccinations. Someone with knowledge of experimental methodology, the scientific literature on adjuvants, and autoimmune disorders, could probably detect the problems with a paper that had all the apparent features of a scientific publication, but whose methods or conclusions were flawed; but all that a layperson can rely on are the article's conclusions, which are diametrically opposed to those of a number of other equally scientific-looking articles showing the safety of vaccine adjuvants.

It will be of little help to those scientists supporting vaccinations to explain how a publication is flawed on methodological or evidential grounds, because the language and the evidence is likely too arcane to be understood by the layperson. It takes many years of study and interaction in the relevant field of expertise only to reach the status of a competent *interactional expert* – i.e., someone who is able to understand and debate within a certain field of expertise (see Collins 2010, Collins and Evans 2008, chapter 3). If understanding evidence and methodology requires interactional expertise, or at least a level of competence close to that, then we can only expect a layperson to take information about methods and evidence on grounds of trust, not of understanding.

From the epistemic standpoint of the layperson the position of the real expert is indistinguishable from the one of the quack. The strategy against this impasse is to bring epistemic balance into the picture, and show why some putative experts are not real experts, or why their claims cannot be taken as scientific claims uttered from a position of genuine expertise. In Tomljenovic and Shaw (2015), the first sign of caution should be the author's funding sources, listed at the end of the paper: "The authors thank the Dwoskin Family Foundation, the Katlyn Fox Foundation, and the Luther Allyn Shourds Dean Estate for support." All three foundations are advocacy groups against vaccinations, which creates a conflict of interest and potentially shifts the focus of the paper from scientific inquiry to advocacy. The second sign should be the citation count of the paper, which has one citation on *GoogleScholar* (as of January 2018) and does not appear in two searches in *Web of Science* – the first search used the full title of the article, and the second search used the following terms "Toxicity Aluminum Adjuvants Vaccines" (field of search: *title*). It is a fact that many scientific papers receive few citations, but the almost total absence of notice from the peer community is an indicator that the paper is not considered valuable by the science. It seems obvious that this criterion must be used in a context-dependent manner, as citation rates vary widely across disciplines, but in medical research complete lack of citations must be taken as a warning sign.

Funding sources and almost complete lack of citations are not grounds for dismissing the conclusions of the paper, but they should raise some concern about the epistemic authority of the paper itself in the scientific community. Thus, citing Tomljenovic and Shaw (2015) as evidence of the harms of vaccine adjuvants is not epistemically justified, because the circumstances in which the claim is made diminish its epistemic authority for the reasons presented in this section: lack of support from the peer community, and a clear conflict of interest. To be sure, this does not imply that the contents of the paper, and its scientific claims, cannot be discussed and checked for merit within the relevant peer community; it rather means that someone outside the field of relevant expertise cannot justifiably use the paper in public communication – i.e. anti-vaccination communication.

Goodwin and Honeycutt identify two phases in which scientists enter the public debate: the "strategy of technical argument" and the "strategy of the appeal to authority" (2009: 27). When vaccine-sceptics appeal to authority – either their own, if they have credentials, or that of others – they are claiming that the putative expert they refer to also has genuine expertise. In other words, they are claiming that the authority they are appealing to also has epistemic authority. But a claim to epistemic authority has to be substantiated by referring to principles of expertise, and it should therefore be open to objections; to wit, ad hominem objections. The strategy of appeal to authority is open to correction, thanks to reasoned use of ad hominem arguments based on critical questions (see Walton 1997) and principles of expertise.

Ad hominem arguments in science

The two previous sections argued that there are legitimate ad hominem arguments to be made in science, and moreover, that because of the epistemic standpoint of laypeople, ad hominem arguments ought to supplement evidence-based arguments in science communication. The case study motivated and illustrated those claims; however, a possible objection should be mentioned.

Walton (2002) points out that ad hominem arguments can often, and effectively, be met with counter ad hominem arguments, and this can lead to an endless and fruitless cycle of rebuttals: "Unfortunately, the argument against the person is often so effective and devastating that it is a conversation-stopper, closing off the possibilities of objective argument and further reasonable discussion of an issue" (2002: 188). Jackson 2008 and Ceccarelli 2011 have analysed the problem. Ceccarelli writes that pointing out how the carbon industry attempts to manipulate the climate change debate, thus highlighting a conflict of interests, can be countered by the same credibility-damaging arguments voiced on the opposite side of the narrative (2011, 216). Jackson points out how in the debate over abstinence-only sex education in the USA, remarks by the Union of Concerned Scientists – about the lack of qualifications of science advisors appointed by the Bush Administration – were routinely met by counterclaims alleging the falsity of those claims (2008, 223). The debate was then stuck into an argumentative predicament: the Union of Concerned Scientists saying "the Bush-appointed experts are not qualified", and John H. Marburger (see Jackson 2008, 220) replying "they are".

The risk of fruitless rebuttals and argumentative predicaments is a risk that must be evaluated carefully, but the main point of this paper is in disagreement with Jackson's conclusion: "One obvious and highly generalizable rule of thumb is to refrain from opening any disagreement space at all around other people's motives for acting as they do. What is wrong with such a move is not that it is irrelevant to the truth of a proposition the opponent is trying to prove, but that it creates a separate and unproductive debate space whose resolution, if it were even possible, would not return a usable result to the main dispute." (2008, 225).

The point that Walton makes about conversation-stopping ad hominem arguments highlights some constraints on the argumentative context: scientists or science journalists who use ad hominem arguments cannot be themselves discreditable, and thus open to counter ad hominem arguments. Imagine the following scenario: Rob claims that Andrew, a critic of vaccines, is paid by litigation groups, and because of that Andrew's judgment lacks credibility (cf. the dialogue between Bob and Wilma in Walton 2002: 185). Andrew replies that Rob is paid by Big Pharma, hence his argument also lacks credibility. This looks like a vicious circle, but Andrew's counter ad hominem is effective only if Rob was, indeed, paid by Big Pharma. In fact, Rob is not paid by Big Pharma, while Andrew is receiving money form legal litigation groups. The counter ad hominem does not work in this case, because the allegations Andrew makes are false, while the ones that Bob makes are true: ad hominem arguments still have to meet minimum standards of veridicality.

Clearly the situation that Jackson (2008) presents is more complicated than out simplified example, and we cannot thoroughly analyse it in the space of this paper. But we think that claims about someone's motives, or someone's qualifications, ought to be nonetheless veridical, even if they do not bear on the substance of the debate. For example, we could ask whether the doctors that the Union of Concerned Scientists deemed unqualified to give advice on sex education were, in fact, unqualified. This is something that only an account of expertise can provide an answer to. To deal properly with legitimate ad hominem arguments we should have an account of expertise that helps us discriminate between genuine and fake expertise.

To avoid a situation in which the discussion stalls into a vicious circle of ad hominem arguments and rebuttals, the arguments that scientists make need to be substantiated, and, at the same time, using ad hominem arguments forces the scientist to take the moral high ground. Substantiating an ad hominem argument can be done by using the strategy of argumentation provided in this paper, and the principles of expertise proposed in Walton (1989), Goldman (2001), and Martini (2015), give us the criteria for accepting or dismissing a putative expert's epistemic authority.

To conclude, in cases of pseudo-scientific controversies, evidential arguments in science communication can be supplemented with ad hominem argument to reduce the epistemic authority of the opposite side. These arguments are legitimate insofar as they do not attempt to prove the point of the matter (e.g., vaccinations are safe), but are meant to bring focus to the circumstances of the utterance – i.e. the utterer is not a legitimate expert, or the utterer is not interested in facts but in advocacy. According to Walton "The argument against the person can be a powerfully convincing or influential form of attack [...] when it is successfully deployed by a clever arguer" (Walton 2002: 171). At the same time, "it is such a powerful argument in everyday dialogue that there is a strong temptation to be overcome or bullied by it, instead of carefully examining how the attack was mounted" (Walton 2002: 203). Using the ad hominem requires great care not to abuse the rhetorical power of the argument itself. This paper has presented a case study in which ad hominem arguments, if grounded on principles of expertise, are not only powerful, but also a legitimate strategy of science communication.

NOTES

[1] It must be noted that anti-vaccination movements have existed almost as long as vaccines have. The first ones were opposed to the smallpox vaccinations campaigns of the early 1800s (Wolfe and Sharp 2002).

[2] It is clear that science communication can involve other factors – for example, translation, according to the model of the knowledge broker (see Meyer 2010) – but for the purposes of this article it is sufficient to claim that it involves argumentation and rhetoric.

[3] More recent literature finds a similar ratio, see Dubé et al. 2013, and, for the HPV-vaccination, Okuhara et al. 2017.

[4] It is clear that allegations of collusions between scientists and the pharmaceutical industry must be false for the ad hominem arguments against scientists to fail. This imposes very high standards of honesty and transparency on the scientific profession.

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