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LINGUISTIC PRIVILEGE AND JUSTICE: WHAT CAN WE LEARN FROM STEM?[1]

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The linguistic privilege of native speakers in scientific communication, both oral and written, has been widely reported to influence researchers' publications and careers in and beyond academia. I analyze social structure and communication in the STEM field through the example of big science and attempt to answer the question of why language injustice has a less significant effect on non-native scientists and engineers than on humanity scholars, scrutinizing the role of signs and nonlinguistic boundary objects in STEM practice and written communication and how they mitigate the emphasis on linguistic eloquence. I suggest that although big science is relatively linguistically inclusive, for collaborative publications and presentations the rhetoric component requirements nevertheless remain at a level comparable to that of the humanities. I draw on the theory of justice to argue that to increase L2 speakers' and writers' satisfaction, language standards for international communication must be adjusted to a level convenient for an average L2.

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Introduction

The phenomenon of language injustice, in the first place in relation to the use of the English language, has received extensive attention in recent philosophical literature. Nowadays, the English language dominates academic publishing worldwide and plays the role of *lingua franca* for contemporary scientific communication Increasingly large numbers of non-native (ESL) English writers offer examples of the negative impact of their non-native research writing style on peer review and acceptance of their submissions by scientific journals [Clavero 2010; Clavero 2011]. Statistics indicate that the chance of acceptance for papers by authors whose first language is not English is approximately 30 percent lower than that for papers authored by native English speakers. Consequently, it is argued that ESL scientists "support all the costs of having English as a common scientific language" [Primack et al. 2009] and that linguistic skills give native English speakers (NES) an advantage in scientific debates because their linguistic abilities surpass those of ESL scientists. Others dispute those statements, arguing that ESL speakers must work harder on improving their English proficiency and attempt to become editors of scientific journals [Guariguata, Sheil, and Murdiyarso 2011]. The authors who suggest that novice L1 writers experience difficulties similar to those of any L2 writers nevertheless concede that for both types of writers the difficulties are not so much due to grammatical accuracy as to "rhetorical knowledge" and social and political contexts [Hyland 2016].

A question closely related to that of injustice in academic publishing is the prejudice against ESL speakers with non-native accents, which is another form of linguistic injustice. Although accent does not have a clear definition and is often understood as a certain way of speaking characterized by patterns of stress and rhythm, accents in English are often classified as either L1 (for instance, New Orleans, Black English Vernacular, Maine) or L2 (a foreign accent understood as a breakthrough of one's native phonology into English) [Lippi-Green 2012]. In addition to phonology issues, L2 accents are also usually associated with grammatical incorrectness and L2 speakers' limited or imperfect vocabulary usage (so-called "foreigner's talk"). Native English speakers are reported to be able to trace foreign accents in as little as 30 milliseconds [Flege, Munro, and McKay 1999]. It has also been argued that "accent is just shorthand for variable language" and that therefore so-called "standard English" is an abstraction [Lippi-Green 2012, 44. Nevertheless, accents serve geographical and sociopolitical markers and expose speakers to stereotype treatment. Implications for academia include undergraduates' perceptions of foreign accents as "broken" or "bad" English [Lindemann 2005; Bresnahan et al. 2002], while ESL academics experience extraordinary difficulties finding faculty positions in English-speaking countries. The situation with ESL academics is especially complicated in the humanities [Ayala 2015]. Nevertheless, cases of linguistic injustice are rarely reported to occur in the STEM field. In this paper, I undertake an analysis of differences between discourses in the humanities and STEM fields (based on scrutiny of the social structure of the high-energy physics community) and propose a mitigation of language injustice based on my analysis from the position of egalitarian ethics.

Linguistic features and ethnic status

Among important features of accents and other typical linguistic flaws are that they often serve as references to the ethnic backgrounds of speakers and writers and invoke ethnic stereotypes for readers and interlocutors [Lippi-Green, 2012]. Making a guess about an interlocutor's ethnicity, one can unconsciously rank him or her on an ethnic scale. In an early work, Gerhard Lenski [1954] introduced the notion of status crystallization (or status consistency) as well as an ethnic scale. He defined statuses as relative positions in four hierarchies: income, occupational, educational, and ethnic. Lenski defined those groups that have either low or high scores in all hierarchies as those with high crystallization or consistency. He classified groups with high scores in one hierarchy and low scores in another—for example, businessmen, Hollywood actors (high income and low educational or ethnic rank), or clergy (high educational level and low income) as those with low consistency. Lenski constructed the ethnic scale on the basis of a University of Michigan sociology study (uncited), describing it as one in which be perfectly appropriate. Groups with northwestern European backgrounds were ranked first, followed by groups with southern and eastern European backgrounds, and finally by people of non-European backgrounds" [Lenski 1954]
A more recent study of social distance between ethnic groups in US culture [Parillo and Donoghue 2005] that used the Bogardus social distance scale has shown that in 2001 the ethnic ranks were as follows: first in the list were White native-born English speakers and Italians (at the top of the list), followed by other European groups. The second half of the list consists of Hispanics/Latinos, Asians, Russians, and Arabs. Lenski categorized university professors as having low-status consistency because of high occupational and educational levels accompanied by a relatively (for skilled workers in 1954) low income. One of Lenski's important observations was that low-status consistency is correlated with political liberalism. Markers of a non-native condition in a research paper (e.g., grammatical imperfectness, misused vocabulary) can serve as indicators of the author's status inconsistency in terms of high educational status and low ethnic rank and, therefore, more liberal views. I suggest that because STEM papers contribute less significantly to political debates than

those in the humanities and, most importantly, have lower social visibility, the authors' alleged liberal political views, as indirectly revealed by their low status consistency, play a less important role for journals and their reviewers. In the next section I will discuss how STEM discourses are organized and how this affects their linguistic features.

STEM and division of labor

The structure of discourse in STEM fields is supervenient on the socio-ontological and operational structure of these fields themselves. The operational structure of big science and megascience (the historiography of which, for example, Hoddeson, Kolb, and Westfall [2008] admirably described in detail) is based on the division of epistemic labor. Hoddeson et al. examined big science, which usually means fundamental science done by large collaborations in multiple facilities over a long duration and at significant cost with an organizational structure similar to that of industry. They found that big science is gradually turning into a special degenerate kind of science called megascience characterized by the growing role of social factors and micro-politics. They emphasized the importance of considering the interests of groups of scientists in the experiment for understanding the logic of the development of research projects in modern high-energy physics. They also highlighted the need for further study of the social structure arising in scientific collaborations in this field, as well as its epistemological implications.

Epistemic labor in big science is divided between the three main communities that are involved in contemporary physics experiments, according to Peter Galison's [1987] classification: theorists, experimentalists, and instrumentalists. The particularities of the experimentalists labor boil down to the choice of instruments, assignment of modes of operation corresponding to the implementation of a specific measurement, and data analysis. The part of the collaboration engaged in the creation of accelerators or detectors in particle physics stands out as a separate community called instrumentalists. The community preoccupied with creation of a theory, as well as definition (in general terms) of the phenomena that this theory proposes, consists of theorists. One of the important modes of communication in STEM is the communication between these technical cultures.

The specific work of the experimentalists in a contemporary experiment mainly can be summarized as the selection of instruments, setting their operating modes corresponding to the implementation of a specific measurement, and data analysis. This last item (data analysis) did not attract philosophers' attention until the middle of the last century, since it could practically be reduced to instrument reading, but in today's experiments it has become a central focus. In the past, extraneous events that could distort readings (the so-called experimental background) were considered negligible, because experimentalists of the past usually managed to establish experimental conditions such that the influence of these events could be eliminated. The structure of a scientific experiment is a three-part scheme, at the center of which is the phenomenon (or a theoretical model of the phenomenon). The operational parts, such as preparation and measurement of the phenomenon, are peripheral; the operational parts are artificial (i.e., technical). The central, theoretical, part of the scheme belongs to the "first nature" (i.e., natural processes). The operational, technical, part belongs to the "second nature." This heterogeneous structure, which combines the theoretical and operational parts, was one of the most important features of the scientific revolution of the 17th century, during which the transformation of natural philosophy to the natural science of the Enlightenment occurred.

In contemporary experiments, the choice and development of instruments has become so complicated, and began to demand such a large amount of research and theoretical work, that part of the community of experimentalists (those involved in creating detectors in particle physics, for example) fractured into a separate community called instrumentalists. This activity is distinguishable by periods of normal development (improvement of the known types of detectors) and revolution (creation of new types of detectors) [Galison 1997]. In comparison, since the beginning of the last century, the theorist's task has, qualitatively speaking, undergone little change and now focuses on theory creation and general definition of that theory's observables. The contemporary experiment is considered within the framework of that division. At the same time, observed the emergence in technical fields of so-called "trading zones" [Galison 1997], spaces where representatives of the various communities exchange the products of their labor, analogous to trade between culturally different tribes. Therefore, the language of communication between these groups must imply a certain hierarchy and inequality, which is both linguistic and epistemic.

Boundary objects in science communication

In analyzing Hoddeson et al.'s [2008] description of megascience, I suggest that big science and megascience *experiments can also be identified as trading zones* in the aforementioned sense. In high-energy physics, interaction in trading zones is carried out by means of "boundary objects" [Star and Griesemer 1989]. A boundary object has different meanings and values in different cultures, and representatives of those cultures interact with one another indirectly, thereby assigning different meanings to the interaction process. In particular, in accelerator-based experiments, the proton beam can play the role of a boundary object for interactions between accelerator physicists and experimenters. We point out that for the accelerator physicists (instrumentalists), the proton beam is the goal of their research, while experimenters consider the proton beam the raw material for their research. As elements of the experiment's scheme, such boundary objects separate not only the theories underlying experimental practice (instrumental theories responsible for the functioning of particle accelerators, detectors, data processing procedures) but also the respective communities of practitioners. Because of this separation by boundary objects, for example, the theories and practices of accelerator and detector building fall outside of the epistemic scope, interests, and expertise of the detector users and data analysts. Therefore, the latter are not involved in designing new accelerators, beam lines, or target systems but rather tend to use their current apparatuses to the extent possible for data production. Thus, in addition to the flow of questions and answers between those communities, trading zones are characterized by the flow of boundary objects such as protons, devices, numbers, and formulae from one community to another and back.

The epistemic disunity the experiment scheme reveals is associated with the stratification of the scientific community; therefore, certain practitioner communities in megascience isolated by boundary objects from phenomenal (high-level) theories turn out to be more epistemically disadvantaged than others. As producers and providers of boundary objects (apparatuses, beams, data) rather than knowledge makers, such communities become non-epistemic with regard to phenomenal theories. Anderson [2012] suggests that in society at large, testimonial injustice (exclusion of certain groups as agents of knowledge) occurs that is related to the identity prejudice of certain speakers, and that such segregation is unjust, while the epistemic justice is a virtue of social institutions. Based on the cultural approach to the scientific community, and bearing on the scheme of experiment as a social institution in megascience, the scientific community comprises a number of professional role identities (accelerator scientists, detector makers, data analysts), and therefore the ethical requirement of testimonial justice is relevant to megascience. I assert that the exclusion of accelerator beam and detector maker groups from the data analysis practice and discourse, as well as the exclusion of all the aforementioned groups from the phenomenal theory discourse and vice versa, are examples of epistemic stratification and inequity. Such exclusion creates linguistic inequity, but not so much in the sense of natural language (English) as in the sense of language of theoretical concepts, which can essentially be expressed in mathematical language.

Therefore, each community works to its functional end. Instrumentalists are producers of accelerator or detector parts (for intracommunity exchange) and particle beams (for intercommunity exchange with experimentalists). In the course of intercommunity contacts and exchanges, communities acquire so-called interactional expertise [Collins, Evans, and Gorman 2010], the mechanism that provides limited intercommunity communications with adjacent communities, an alternative to the formation of scientific pidgins and creoles in Galison's [1997] model of experiment communities. Experimentalists produce measured data and make them available to smaller groups of data-analysis experimentalists, who in turn process data and express results in terms of phenomenal theories and communicate them to both broad audience and theoretical physicists. As the flow of ideas continues through the trading zones, theorists create theories of phenomena and communicate observables and signatures of processes of interest [Roy 2017] to experimentalists.

The communication and socio-ontological structure of big science

Figure 1 depicts the socio-ontological structure of an experiment. In a paper or verbal communication, for instance, accelerator physicists and experimentalists describe properties of accelerators they have built or used for certain purposes employing the following elements of scientific discourse: 1) **equations** (elements of mathematical language); 2) **numbers** (numerical values of quantities under scrutiny); and 3) **graphs, diagrams, and tables** representing numerical values and their relations and dependences (often instead of equations and numbers for their more compact and visual portrayal). Hence, STEM texts contain signs (numbers and formulae) and their graphic representations, which are elements of mathematics or physics and can be comprehended on the basis of acquaintance with those fields. As Figure 1 shows, each sub-community has two modes of discourse: the first addressed to members of the same community (and, therefore, containing signs comprehensible by scientists or engineers of the same specialty); the second addressed to the communities adjacent in the scheme and accompanying the exchange of boundary objects. Signs found in the theoretical discourse deeply affect searches for experimental phenomena because they serve as representations of concrete operations of preparation and measurement of phenomena; in addition to that, as Roy [2017] argues, the "class of signs reflect[s] the presence of objects" in particle physics research [77].

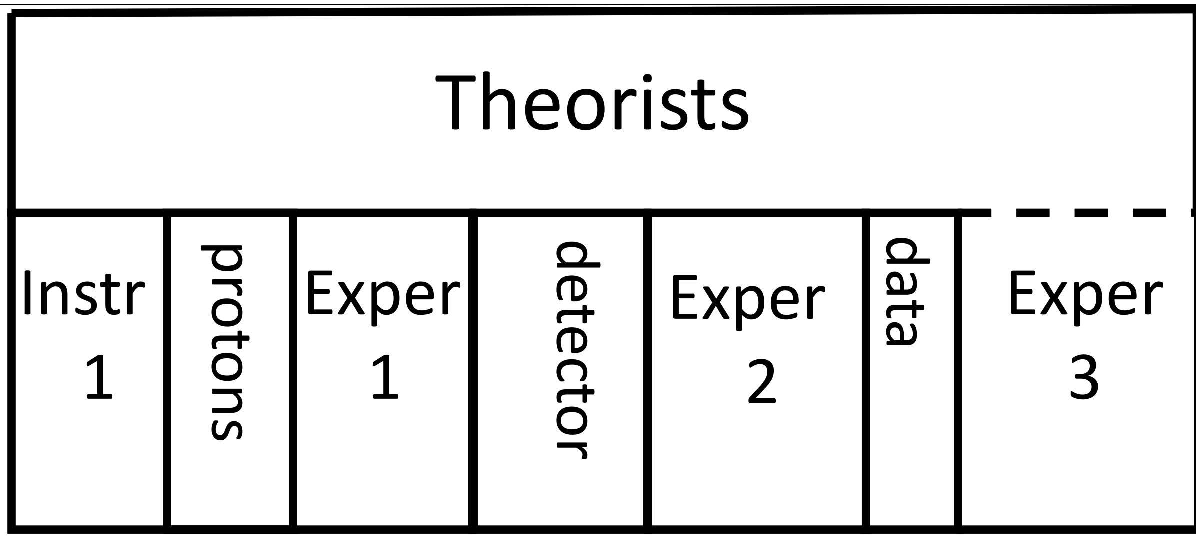

Figure 1. The socio-ontological structure of accelerator-based experiment in physics. Communities in the scheme include Instr 1 (accelerator physicists producing accelerated particle beams), Exper 1 (the experimentalist group ensuring that particle beams produce measurable effects in the detectors), Exper 2 (the experimentalist group harvesting data from the detectors), and Exper 3 (the experimentalist group performing data analysis). The community of theorists communicates signatures of the processes of interest to experimentalists and receives measured quantities characterizing those processes. The communities are separated by boundary objects: protons, detectors, and data. The dashed line represents terms of theoretical language for describing experimental results as a form of communication between data analysts and theorists (and the broader community).

One more feature of the STEM discourse that makes it more linguistically inclusive and egalitarian is that its function differs from that of a humanities text. In the humanities, a text is often a vehicle for authors to **exercise rhetoric** and therefore abounds with figures of speech and compositional art which may be almost impossible to acquire if one is an L2 speaker[3]. On the contrary, writers in STEM use either the **language of signs** (numbers, formulae, graphs) or **nonlinguistic forms** of communication (the exchange of boundary objects).[4] In contrast to the humanities, eloquence in STEM can be demonstrated with those elements, more so than with figures of speech. Much like in a natural language, competence in the language of

[3] There exist well-known exclusions, i.e. the L2 speakers who presumably completely mastered the nuances of new languages. For example, Joseph Conrad, who wrote *Heart of Darkness*, was an L2 speaker.

[4] In Galison [1997], devices used by scientists are also classified as languages, pidgins, and creoles. I do not rely on this definition because, according to my analysis, devices, protons, and so on have different meanings for communities involved in the exchange akin to boundary objects and not languages.

phenomenal theories can be associated with language proficiency, thus identifying theoretical physicists (upper level in Figure 1) as L1 speakers and writers of "the physics language" and instrumentalists and experimentalists as L2 speakers and writers of it. An argument in support of this position is that *theorists (L1) can comprehend every detail in experimentalists' or instrumentalists' language, whereas the opposite is impossible*. Experimentalists and instrumentalists are not generally able to fully understand and scrutinize the arguments of theoretical physicists. Nevertheless, a STEM discourse between communities in Figure 1 can be effectively conducted without resorting to figures of speech (big science is the exception that will be discussed below).

Because they are more proficient in language of physics, theoretical physicists direct large-scale collaborative physics research. The role that theorists play in scientific laboratories depends on the cultural traditions of particular scientific institutions. In Western cultures, theorists usually oversee scientific programs by guiding activities through the ideas that they provide (often expressed as signatures of expected phenomena) in papers, presentations, and expert recommendations. In such cases, official leaders of large national or international laboratories can be experimentalists (for example, CERN or Fermilab). In Eastern scientific cultures, theorists are usually appointed directors of institutions—for example, Joint Institute for Nuclear Research (JINR, Dubna), where out of six directors, five have been theorists. Only one of JINR's past directors, D. Kiss, was an experimentalist; however, as a foreigner (Hungarian), he presumably enjoyed a higher social status than locals. This underscores that experimentalists hold a higher linguistic status—and in relation to that, a higher epistemic status—than instrumentalists. Theorists hold a higher status than the other two in STEM. Therefore, the modes of speech available to each of the communities is structurally determined and can be explained in the line of structural speech affordances [Ayala 2016].

Rhetoric in big science

Linguistic injustice and native speaker privilege is essentially masked in publications by big experiments and collaborations, which are a special case of STEM publication and presentation. Galison [2003] observed that by the end of the twentieth century, big science collaborations, amounting to thousands of participants, not only were divided according to function but also created different modes of discourse depending on target audience. Collaborations' first publications usually included those by engineers and other technical personnel; however, later works describing discovery claims have usually been authored only by experimentalists. The meaning of "experimentalist" has also changed since the mid-twentieth century: experimentalists now can be computer programmers, data analysts, managers, modelers, or simulators. Those collaborations have publication boards preparing, reviewing, and discussing publications, and service on such boards can constitute a significant workload especially for L1 experimentalists. Because a publication by a contemporary collaboration claiming important physics results to the outer world must contain, in addition to mathematical language, masterfully refined and polished arguments (because the highest recognitions are at stake and any verbal or grammatical flaws could jeopardize the outcome), native speakers must represent a significant fraction of membership on such a collaboration's publication board. As a result, collaboration publications are linguistically perfect; however, that eloquence is due to the presence of dedicated L1 writers on publication boards. **Big science publications do incorporate significant narrative and rhetoric components similar to those in the humanities or social sciences**.

At least one more context exists in STEM where proficiency in mathematical language becomes insufficient and more sophisticated natural language communication techniques come to the fore. Eloquence is an ability of primary importance in communicating funding requests to funding agencies and departments, convincingly presenting results to a general audience (taxpayers), engaging in research policy discussions, and serving in a broad range of managerial positions requiring communication to interlocutors outside of the field. First, such modes of discourse rely essentially on rhetoric abilities to reach communication goals. Second, in such contexts (akin to communication to college or high school students), accents reportedly make a negative impression [Lindemann 2005; Bresnahan 2002]. Hence, the existence of such contexts in STEM imply the certain (although not very noticeable) stratification of practitioners to those performing more technical tasks (non-native speakers) and those engaged in managerial and representative roles (native speakers).

This issue is more noticeable in investment and venture funding. Huang [2013] showed that "nonnative speakers were found to have a significantly lower likelihood of receiving new-venture funding, and this was fully mediated by the coders' assessments of their political skill. The entrepreneurs' race, communication skill, and collaborative skill had no effect" [p.1005]. Huang recommends that non-native speakers address their political skills during interviews, however, this recommendation does not seem realistic because political skills require L1-level fluency to speak convincingly to other L1 speakers. Therefore, while technical communication in STEM requires only a modest level of natural-language proficiency (provided that the level of mathematical competence and/or ability to produce boundary objects is high), organizational- and managerial-level communication still often requires L1 proficiency, which confers linguistic privilege on native speakers for such roles.

The need for political skills comes to the fore not only in venture funding but also in the field of high-energy physics because of the rise of micro-, meso-, and macro-politics in big science and megascience. In addition to macro-politics (i.e., national-level interests and influences as well as interactions between scientific communities of different countries) and meso-politics (e.g., competition for funding among national laboratories), micro-politics (i.e., use of power by groups of scientists in experimental collaborations and individual scientists' push for resources such as experimental facilities or beam time within laboratories) also play an essential role in the daily practices of megascience collaborations [Hoddeson 2008]. Micro-political activity consists of interactions and collaborations with laboratory management and authorities that require eloquence both in formal and informal contexts. Inasmuch as conducting managerial functions in laboratories (as discussed above) often requires L1 proficiency for efficient participation in meso- and macro-political discourses, influencing laboratory management to attain an internal collaboration's micro-political goals also demands L1 language abilities.

Nevertheless, even a collaboration's central management often includes a significant fraction of non-native speakers in addition to native speakers. For example, in the LIGO[5] collaboration (three members of which received the 2017 Nobel Prize in Physics for detection of gravitational waves), presumably only 65 percent of the executive committee are native English speakers [LIGO 2017]. Identifying whether a person is a native speaker can be challenging if one does not know him or her personally, so for the sake of this work the following criteria have been employed: if either the first or last name of a scientist, or both, were identifiably Anglo, such scientists were assumed to be native English speakers. Such a significant fraction of non-native speakers can presumably be explained by macro-politics (i.e., by the need for a collaboration to effectively and eloquently communicate with other experiments and foreign scientific authorities across state borders).

Language as a utility for international communication

The role that English has played since the end of WWII in international scientific communication as a utility and a public good unequally distributed (i.e., acquired at different levels of fluency) is worth examining from the perspective of theories of justice. However, whether the notion of distributive justice as a virtue of social institutions [Rawls 1971; Anderson 2012] is instantly relevant for discussions of language ability is not obvious.

First, because although language courses and textbooks are easily distributable (akin to utilities) and widely available, adults' ability to acquire an L1-level grasp of a foreign language is strictly limited (L1 can be achieved only during puberty []). One

[5] The Laser Interferometer Gravitational-Wave Observatory is a large-scale physics experiment and observatory to detect cosmic gravitational waves.

characteristic of the English language that creates complications for non-natives is that although the basics of English grammar are relatively easy to learn, it has a very complicated system of tense (absent in most other languages), which makes its intuitive use impossible for L2 speakers. Another important characteristic is its system of articles, whose many rules and exclusions make it almost impossible for non-native speakers to comprehend fully. A third characteristic (that is extremely important for verbal communication) is the language's distinctive pronunciation, which requires very particular articulation of consonants and vowels (12 vowel monophthongs and eight or nine diphthongs). For example, L1 speakers cannot discern non-Anglo names and surnames by ear and require them to be spelled, which complicates communication. Therefore, for a post-puberty adult native speaker of a foreign language, the ability to speak English cannot be considered a redistributable public good.

Another approach to the theory of justice that seems more relevant for language communication discussion is that achieving equality in an egalitarian community should be not so much about language as about **satisfaction** of communication and its outcomes. In discussing Rawls's theory of justice, Arrows [1973] claims that "Rawls and Bentham and I would certainly all agree that justice should reflect individual satisfactions; hence, the social choice made in accordance with any of these theories of justice is 'a conflation of all desires'" [p. 257]. In line with Arrows's reading of Rawls and Bentham, in a discourse including both native and non-native speakers of English, one can redistribute the satisfaction of all discourse participants and stakeholders. I assume that those participants who experience the most notable dissatisfaction are non-native speakers who have been silenced and excluded from academia [Ayala 2015], excluded from discourse [Lippi-Green 2012], subjected to social distancing aggravated by correlations of accent with low ethnic status [Lenski 1954; Parillo 2005], and rejected for academic publication [Clavero, 2010]. I suggest that where English is used for international communication, language standards should be adjusted to make it more convenient for non-native speakers and writers: for example, to eliminate or make non-compulsory the requirements to use articles or to distinguish simple and perfect tenses. The number of vowels in spoken "global" language can be reduced to a few; their pronunciation rules should not be strict. Non-native speakers already implicitly and unofficially use such rules for communication in STEM, which does not compromise the quality of jointly-produced knowledge, provided more than rhetoric is at stake.

Objections that can be raised to such a proposal are at least twofold. First, native English-speaking people have the right to use their language in as complex a manner as they prefer. Second, the overall quality of communication in such a "global" language (especially, its rhetoric aspect) would be worse than that in "genuine" English, whether British, American, Australian or some other variations (as the conception of a “genuine” English may seem problematic I dub “genuine” the varieties used as native languages, especially historically). To rebut the first objection, one may argue that the “global” English suggested here is not intended to replace “genuine” English, but only to serve as a standard for journals, organizations, and modes of communications intended to be international, with its only purpose to eliminate linguistic discomfort, injustice, and inequity for their participants. All other L1–L1 communications (national journals, organizations, private communications) would be conducted in the variation of English preferred. This proposal is aimed only at eliminating non-native stigma from international discourse and not to create undue complications for L1 speakers of any language. Moreover, as far as the “global” version is to be less linguistically complex than spoken versions of L1, L1 speakers of any “genuine” variation would still have a natural advantage in not having to learn the new language. As for the second objection, one may turn to Derek Parfit’s ethical argument [Parfit 1997] that “though the better-off would lose more, the gains to the worse-off count for more” [p. 221]. In his theory, called priority view, Parfit gives an example in which a group, half of which (better off) has in its possession some utility at the level of 200, while the other half (worse off) has only 100 (situation 1). After a proposed change, both halves of the group would have that utility at the level of 145, which is even slightly lower than the average (situation 2). Parfit argues, “Benefits to the worse off do more to make the outcome better. That could be why (1) is worse than (2)” [221]. Therefore, the benefits of having the group of L1 speakers communicate with non-natives in the “global” language far outweigh its disadvantages in ethical terms. The STEM example (excluding only big-science discovery claim contexts) supports the view that mitigating certain linguistic requirements for global communication does no notable harm either to L1 or to L2 speakers and writers while increasing L2 satisfaction.

Conclusion

This analysis of language privileges of native speakers has shown that such privileges affect the STEM fields (taking high-energy physics as an example) less significantly and critically than, for example, the humanities. This can be explained by a specific socio-ontological structure of the big-science community and its epistemic hierarchy of sub-communities with their respective structural speech affordances. In the course of such communication, and due to its structural traits, the rhetoric component is significantly curtailed. Instead, the role of signs in such texts is elevated and emphasized. Also, an essential part of STEM communication proceeds nonverbally through the exchange of boundary objects. However, high-stakes big-science publications do require eloquence in addition to technical proficiency and are narratives with a political dimension; therefore, big science collaborations enjoy native and non-native member participation that is somewhat balanced. I suggest that because of the presence of sign and non-verbal elements, as well as structural features, STEM communication should allow for less stringent linguistic requirements. Such requirements are satisfactory for L2 speakers and writers and do not compromise the technical quality of communication. Drawing on the egalitarian theory of justice, I argue that it is ethically justified to mitigate linguistic injustice in other fields and increase L2 participants' satisfaction by reducing rhetorical (including grammar and vocabulary) and phonetic formal prerequisites for academic and scientific communications in contexts involving L2 speakers and writers.

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