https://doi.org/10.46938/tv.2021.504

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LONGINO'S CONCEPT OF VALUES IN SCIENCE

Abstract: *While classical neo-positivists reject any role for traditionally understood values in science, Kuhn identifies five specific values as criteria for assessing a scientific theory; this approach has been further developed by several other authors. This paper focuses on Helen Longino, who presents a significant contemporary critique of Kuhn's concept. The most controversial aspect of Longino's position is arguably her claim that the criterion of empirical adequacy is the least defensible basis for assessing theories. The de-emphasizing of the importance of external consistency as a value and the introduction of socio-political considerations into the processes of an assessment of scientific theories are also considered problematic issues. I provide arguments against Longino's conception, identify some of its problems, and argue for refusal of her approach.*

Keywords: *values in science; empirical accuracy; bias; Longino; Kuhn*

Koncepce hodnot ve vědě Helen Longino

Abstrakt: *Zatímco klasičtí novopozitivisté odmítají jakoukoli roli tradičně chápaných hodnot ve vědě, Kuhn identifikuje pět konkrétních hodnot jako kritéria pro hodnocení vědeckých teorií a jeho přístup byl dále rozvinut několika dalšími autory. Tento příspěvek se zaměřuje na Helen Longino, která představila jednu z nejvýznamnějších současných kritik Kuhnova pojetí. Nejkontroverznějším aspektem její koncepce je pravděpodobně tvrzení, že kritérium empirické adekvátnosti je nejméně obhájitelným základem pro hodnocení teorií. Za problematické je považováno také snížení významu externí konzistence jako hodnoty a zavedení sociálně-politických úvah do procesu hodnocení vědeckých teorií. V příspěvku přináším argumenty proti koncepci Helen Longino, identifikuji některé slabiny jejího přístupu a argumentuji pro jeho odmítnutí.*

Klíčová slova: *hodnoty ve vědě; empirická přesnost; předsudek; Longino; Kuhn*

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1. Introduction

While the classical neopositivists rejected any role of traditionally understood values in science (e.g., Carnap[1]), later philosophers of science revised this view. In his most famous book, Kuhn extensively discussed the criteria for accepting a particular scientific theory and came to the conclusion that, simply put, the opinion of the scientific community is decisive.[2] However, this view has received a number of critical reactions, some of which claim that it situates deciding which alternative theories to accept or even the whole scientific revolution as "*a matter for mob psychology*,"[3] or that it denies the possibility of accepting scientific theories on any rational grounds.[4] In one of his following works, Kuhn returned to the problem once again and gave his critics a more detailed answer.[5] More specifically, he defined five characteristics that are considered in the assessment of scientific theories, which, in his opinion, cannot be part of a precise algorithm, but should instead be understood as *values* that guide this assessment. This approach was subsequently developed and enhanced by a number of other authors.[6]

While the values that have been proposed by some authors to govern the assessment of scientific theories have sometimes been called epistemic values or theoretical virtues,[7] the term *cognitive values* has ultimately gained established use.

[1] Rudolf Carnap, "The Elimination of Metaphysics through Logical Analysis of Language," in *Logical Positivism*, ed. Alfred J. Ayer (Glencoe, IL: Free Press, 1959), 77. See also Ernan McMullin, "Values in Science," *Philosophy of Science* 1982, no. 2 (1982): 3.

[2] Thomas S. Kuhn, *The Structure of Scientific Revolutions* (Chicago: Chicago University Press, 1994), 148, 150–51, 159. Note that the second edition differs from the first one.

[3] Imre Lakatos, "Falsification and the Methodology of Scientific Research Programmes," in *Criticism and the Growth of Knowledge*, eds. Imre Lakatos and Alan Musgrave (Cambridge: Cambridge University Press, 1970), 178.

[4] Dudley Shapere, "Meaning and Scientific Change," in *Mind and Cosmos: Essays in Contemporary Science and Philosophy*, ed. Robert G. Colodny (Pittsburgh: University of Pittsburgh Press, 1966), 67.

[5] Thomas S. Kuhn, *The Essential Tension: Selected Studies in Scientific Tradition and Change* (Chicago: University of Chicago Press, 2000), 320–39.

[6] W. V. Quine and J. S. Ullian, *The Web of Belief* (New York: Random House, 1978); Larry Laudan, *Science and Values: The Aims of Science and Their Role in Scientific Debate* (Berkeley: University of California Press, 1984); Hugh Lacey, *Is Science Value Free? Values and Scientific Understanding* (London: Routledge, 1999).

[7] Longino uses term "theoretical virtues" in Helen E. Longino, "In Search of Feminist Epistemology," *Monist* 77, no. 4 (2014): 476.

Kuhn writes about "the characteristics of a good scientific theory"[8] and calls these characteristics "scientific values."[9] McMullin provides a list of "the values that are implicit in contemporary scientific practice." These values he calls "epistemic," and they "are presumed to promote the truth-like character of science, its character as the most secure knowledge available to us of the world we seek to understand."[10] Lacey says that "Cognitive values are characteristics (criteria) of 'good' (rationally acceptable, desirably held) beliefs and 'good' (soundly accepted) theories."[11]

Longino, whose approach will be discussed in this article, uses the term *constitutive values* in her older texts and contrasts them to what she calls *contextual values*. For Longino, constitutive values are values "generated from an understanding of the goals of science"[12] and accordingly "the source of the rules determining what constitutes acceptable scientific practice or scientific method."[13] Contextual values, on the contrary, are "personal, social, and cultural values, those group or individual preferences about what ought to be,"[14] and belong to the social and cultural environment where science is practiced. In later texts, however, Longino also uses the more common terms of cognitive and non-cognitive values to point out their problematic definition.[15]

Meanwhile, Kuhn defined a list of five core values (see below), which he did not consider closed or final. Other authors have added additional items to this list of values governing the assessment of scientific theories or modified Kuhn's list (e.g., Quine and Ullian,[16] Laudan,[17] Lacey[18]). In most of these cases, however, these lists rarely contain any personal, social, political, or cultural values. One of the most important contemporary theorists of values, Lacey, accepted and specified the distinction between cognitive and

[8] Kuhn, *Essential Tension*, 321.
[9] Ibid., 335.
[10] McMullin, "Values in Science," 18.
[11] Lacey, *Is Science Value Free?*, 45.
[12] Helen E. Longino, *Science as Social Knowledge: Values and Objectivity in Scientific Inquiry* (Princeton, NJ: Princeton University Press, 1990), 4.
[13] Ibid.
[14] Ibid.
[15] Helen E. Longino, "Cognitive and Non-Cognitive Values in Science: Rethinking the Dichotomy," in *Feminism, Science, and the Philosophy of Science*, eds. Lynn Hankinson Nelson and Jack Nelson (Dordrecht: Springer, 1996), 39–58.
[16] Quine and Ullian, *Web of Belief*.
[17] Laudan, *Science and Values*.
[18] Lacey, *Is Science Value Free?*

non-cognitive values, but also tried to integrate certain considerations of non-cognitive factors into cognitive values.[19]

Notably, Longino is more radical than the above-mentioned authors: in addition to revising the list of fundamental values for the evaluation and selection of scientific theories, she at once disagrees with the rejection of the noncognitive values in scientific theory assessment and finally also rejects the cognitive and non-cognitive division of values in her later texts.[20] By doing so, she is able to include values traditionally considered non-cognitive – that is, values with a social or ideological nature or motivation – among the values that science should use to choose among competing theories.

In this text, we first outline the classical Kuhn approach to values in science and briefly define the cognitive values that he presents in his text, which Longino explicitly discusses.[21] The following section focuses on the theory put forward by Longino, starting with the key question of the criterion of empirical adequacy. Next, we gradually parse the values Longino proposes instead of Kuhn's, and subsequently discuss additional pragmatic criteria. The text concludes with a critical evaluation of Longino's approach and provides several recommendations.

2. Kuhn's Account of Values in Science

As mentioned above, Kuhn described five basic characteristics of scientific theory, which he understands as *values* that we consider when evaluating a scientific theory and generally as a basis for deciding between alternative scientific theories. He does not claim that these values are his discovery but instead presents them as a description of the grounds on which the scientific community itself usually decides on the adequacy of theories. The exception is the fifth characteristic, which he characterizes as somewhat non-standard.[22] Kuhn also does not present his list as final, admitting that it is usual to consider other characteristics "of much the same sort."[23] For our purposes, it is important to note that the five values that he proposed were *accuracy, consistency, broad scope, simplicity*, and *fruitfulness*. Let us now briefly look at these proposed values.

[19] Miroslav Vacura, "Lacey's Concept of Value-Free Science," *Teorie vědy / Theory of Science* 40, no. 2 (2018): 211–29.
[20] Longino, "Cognitive and Non-Cognitive Values in Science," 50.
[21] Ibid., 41.
[22] Kuhn, *Essential Tension*, 322.
[23] Ibid., 322.

Accuracy means that "consequences deducible from theory should be in demonstrated agreement with the results of existing experiments and observations."[24] This value is the most significant of all that Kuhn describes and has the highest weight when choosing between alternative theories – put differently, accuracy is "the most nearly decisive of all the criteria."[25] This is so not only for its lowest equivocality, but especially because it is the most relevant for the predictive and explanatory functions of scientific theories most important to scientists. If we omit the requirement of accuracy, then we may choose some theories based on the remaining criteria, but we would no longer be within practicing science as it is usually understood – as Kuhn puts it: "Subtract accuracy of the fit to nature from the list, and the enterprise that results may not resemble science at all [...]."[26] Other values used for choosing between scientific theories come to the fore, from Kuhn's point of view, only when two competing theories have similar results in terms of accuracy.

Consistency of the theory can be divided into internal and external consistency. Internal consistency means that the theory does not contain any contradictions from a logical point of view. In general, this characteristic is considered necessary and is not usually rejected even by Kuhn critics. External consistency indicates consistency with other scientific theories or disciplines. Kuhn considers this property to be important, but he shows with an example that sometimes the theory that showed a lower degree of external consistency than the alternative theory was chosen as the most acceptable.[27]

Broad scope is the requirement that "a theory's consequences should extend far beyond the particular observations, laws, or subtheories it was initially designed to explain."[28] Put differently, a theory should cover well beyond the narrow range of observations in the context of which it was proposed. This is also related to the requirement of falsifiability of the theory, because a theory with a broad scope has a higher possibility of falsification.

Simplicity is a characteristic related to Ockham's razor, a principle that recommends choosing explanations that use fewer entities, that is, simpler explanations in the ontological sense, when explaining phenomena. Kuhn, however, uses simplicity in a broader sense, relating not only to the number of entities used but also to the complexity of mathematical constructions

[24] Ibid., 321.
[25] Ibid., 323.
[26] Ibid., 331.
[27] Ibid., 323.
[28] Ibid., 322.

(e.g., Ptolemy's system was significantly more complex than Copernicus', requiring a two-sphere system and other specific constructions for each planet).[29]

Fruitfulness means that the theory should "disclose new phenomena or previously unnoted relationships among those already known."[30] Fruitfulness is therefore related to the *broadness of* a theory's *scope*. Kuhn understands fruitfulness primarily as a value describing the opening of new opportunities for possible future research by the theory.

3. Longino's Theory of Values in Science

Longino lists a different list of values proposed in feminist writings for judging scientific theories. This list includes the following items: empirical adequacy, novelty, ontological heterogeneity, mutuality of interaction, applicability to human needs, and diffusion or decentralization of power.[31] The first item – empirical adequacy – roughly corresponds to the accuracy of Kuhn's list, yet it is introduced in a specific way. The other values that she proposes, however, deviate from Kuhn's original list. In the following text, we will discuss these new proposed values. We will also show that Kuhn comments on some of them in his analysis of scientific values and often also provides reasons why he did not include them in his list. Meanwhile, Longino says the values she included in her list have already been discussed or suggested by other authors; however, no one has presented them as a whole. In the following sections, we will look at these values in more detail.

3.1 Empirical Adequacy

Empirical adequacy is the only value that is both on the list proposed by Longino and on Kuhn's original list (as accuracy). Nevertheless, this item is very problematic; Longino's opinion on its role is exactly the opposite of Kuhn's. As we mentioned above, Kuhn considers accuracy not only a value that defines science as a specific kind of human rational activity, but also the most important value when generally assessing and comparing scientific theories.

[29] Ibid., 323–24.
[30] Ibid.
[31] Longino, "Cognitive and Non-Cognitive Values in Science," 44.

Longino takes exactly the opposite view, stating that "empirical, that is, observational and experimental, data constitute the least defeasible grounds of theory assessment"[32] and that "[e]mpirical adequacy is not a sufficient criterion of theory and hypothesis choice."[33] Let us first look at the structure of the argument that Longino presents:

Her main premise is that the evaluation of empirical data with regard to evidential relevance is always necessarily influenced by *background assumptions*, which include non-cognitive values or unscientific beliefs and prejudices.[34] From this premise she derives two main consequences for assessing scientific theories: 1) we should turn away from empirical data[35] and 2) we should give greater consideration to other values, such as correct non-cognitive values.[36]

In the following sections of this text, we first look at the premise of Longino's inference, then at both consequences. Longino also concludes that *knowledge-producing community*, which in practice assesses scientific theories and chooses among them, should be specifically constructed under certain given conditions. However, in this text we will not address this problem.

3.2 Influence of Background Assumptions on the Evaluation of Empirical Data

When we take a closer look at the different ways of evaluating empirical data for the purpose of comparing alternative theories or for assessing a given scientific theory, it turns out that the criticism presented by Longino is in many ways justified. First, however, we must distinguish several different types of problems associated with the assessment of empirical theories.

[32] Ibid., 39.
[33] Longino, "In Search of Feminist Epistemology," 477.
[34] Longino, "Cognitive and Non-Cognitive Values in Science," 39; Longino, *Science as Social Knowledge*, 60.
[35] I.e., turn from Kuhn's empirical adequacy as "the most nearly decisive of all the criteria" to Longino's empirical data as "the least defeasible grounds of theory assessment." See Kuhn, *Essential Tension*, 323; Longino, "Cognitive and Non-Cognitive Values in Science," 39. See also Helen E. Longino, "Gender, Politics, and the Theoretical Virtues," *Synthese* 104, no. 3 (1995): 384. We will discuss this topic again in the section 3.2.
[36] Longino ultimately rejects distinction between cognitive and non-cognitive values altogether and claims that this distinction is unjustified. See Longino, "Cognitive and Non-Cognitive Values in Science," 50. This opens door for values previously classified as non-cognitive into the process of theory assessment. We will discuss this topic in more detail in the section 3.3.

Today, the generally accepted rejection of foundationalism (see, e.g., Quine[37]) implies the rejection of the idea that the foundation of a scientific theory can be evidentiary statements allowing direct empirical verification, with other statements of the theory pyramidically developed from such empiricals.[38] It also implies that every scientific theory is also based on assumptions that are not independently empirically verifiable. These assumptions could be, for example, theses of other scientific theories, definitions of terms used, etc.

Longino takes this position as starting point and says that "Evidential relevance of data is secured instead by background assumptions, with the consequence that the same data can in different contexts serve as evidence for different hypotheses."[39] This statement is based on the *thesis of the underdetermination of theory by data*, traditionally associated with Quine,[40] but whose roots can nevertheless be traced to Duhem[41] and Mill.[42] This thesis states that the empirical data we have are always insufficient to unambiguously verify the theory that we have chosen to explain these data. Thus, there may always be another theory that is also in full agreement with the same empirical data, but that has not been chosen to explain them for reasons based on assumptions other than those related purely to empirical accuracy.[43]

Thus, in her initial assumptions, Longino does not go far beyond Quine's critique of foundationalism and the thesis of the underdetermination of theory by data, which she uses as points of departure of her conception. What goes beyond these is the emphasis that background assumptions, as she understands them, also include non-cognitive assumptions, such as

[37] Willard V. O. Quine, "Two Dogmas of Empiricism," *The Philosophical Review* 60, no. 1 (1951): 20–43.
[38] Moritz Schlick, "The Foundation of Knowledge," in *Logical Positivism*, ed. Alfred J. Ayer (New York: Free Press, 1959).
[39] Longino, "Cognitive and Non-Cognitive Values in Science," 39.
[40] W. Newton-Smith and Steven Lukes, "The Underdetermination of Theory by Data," *Aristotelian Society Supplementary Volume* 52, no. 1 (2015): 71–108.
[41] Pierre Maurice Marie Duhem, *La Théorie Physique: Son Objet et Sa Structure* (Paris: Marcel Riviera & Cie., 1914); Pierre Maurice Marie Duhem, *The Aim and Structure of Physical Theory* (Princeton: Princeton University Press, 1954).
[42] John Stuart Mill, "System of Logic," in *The Collected Works of John Stuart Mill*, ed. J. M. Robson (Toronto: University of Toronto Press, 1974).
[43] See also David Bloor, "Relativism and the Sociology of Knowledge," in *A Companion to Relativism*, ed. Steven D. Hales (Chichester, UK: Wiley-Blackwell, 2011); Martin Carrier, "Values and Objectivity in Science: Value-Ladenness, Pluralism and the Epistemic Attitude," *Science & Education* 22, no. 10 (2013): 2547–68.

those related to cultural, social, and political influences.[44] However, these non-cognitive influences are often unconscious and hidden from scientists themselves.[45] Longino calls this approach *contextual empiricism*.[46]

Since the evaluation of the accuracy of fit to empirical data as part of the method for choosing between alternative theories is burdened by background assumptions that include non-cognitive ones, theories chosen in this way will secretly carry these values. Longino says: "background assumptions are the vehicles by which social values and ideology are expressed in inquiry and become subtly inscribed in theories, hypotheses, and models defining research programs."[47] Furthermore, in her text, she presents several specific examples of influences of non-cognitive values on scientific research, mostly taken from other authors.

Longino argues that scientific theories unencumbered by cultural, social, and political influences are not exceptional, but impossible even on a purely theoretical level. This is also not a completely new statement. Bacon, in his *Novum Organum*,[48] has already stated the requirement for the identification of anthropomorphic elements, which are projected into the scientific method and thus also into the results of scientific research, in his conception of "idols." He also assumed that, although they could be detected in individual cases and their influence can be thus limited, which is highly

[44] "I argued in *Science as Social Knowledge* that social or non-cognitive values could and did serve as cognitive values." Longino, "Cognitive and Non-Cognitive Values in Science," 85. "Background assumptions are the means by which contextual values and ideology are incorporated into scientific inquiry." Longino, *Science as Social Knowledge*, 216. See also ibid., 104, 203.

[45] Longino claims that common assumption that "in scientific inquiry inferences relying on hidden background assumptions are disallowed" is "unjustifiable." See Longino, *Science as Social Knowledge*, 45. She also says that "background assumptions may not always be explicit, but they are articulable" (ibid., 60) and that "when, for instance, background assumptions are shared by all members of a community, they acquire an invisibility that renders them unavailable for criticism" (ibid., 80). She says also that "values held by all members are invisible (as values, interests, or ideology)" and about need for "uncovering such assumptions." See Longino, "Gender, Politics, and the Theoretical Virtues," 384.

[46] Longino, *Science as Social Knowledge*, 215–16; Longino, "Cognitive and Non-Cognitive Values in Science," 39.

[47] Helen E. Longino, "Essential Tension – Phase Two: Feminists, Philosophical and Social Studies of Science," in *The Social Dimension of Science*, ed. Ernan McMullin (Notre Dame: University of Notre Dame Press, 1992), 204.

[48] Francis Bacon, *The New Organon* (Cambridge: Cambridge University Press, 2000).

desirable, their influence cannot be completely eliminated; as a necessary part of human scientific endeavor, they must be reckoned with.[49]

What makes Longino different from other authors are her suggestions on how to deal with this problem. Some previous authors, such as neo-positivists, believe that non-cognitive influences can be completely eliminated and that we should strive to eliminate them. Other authors, beginning with Bacon, consider non-cognitive influences non-removable in their entirety; however, this does not mean that we should not try to identify them, diminish their influence, or be as aware of them as possible. In a sense, Longino also accepts this proposal – but with a specific addition: we should not only reduce the influence of wrong non-cognitive values, but, at the same time, we should strengthen the influence of correct non-cognitive values.

3.3 The Demand for the Lower Importance of Empirical Data in the Assessment of Scientific Theories

One of the consequences that Longino deduces from her assumptions, as we mentioned above, is that we should pay less attention to empirical data when assessing scientific theories. She says: "experience (experiment, observation) constitutes the least defeasible legitimator of knowledge claims in the sciences."[50] This does not mean that we should completely look away from empiricals; instead, Longino rejects their dominant role, as stated, for example, by Kuhn.

However, it is not entirely clear how this conclusion follows from the presented assumptions. Although the thesis of the underdetermination of theory by data implies that specific empirical data may, in other contexts, serve as evidence in favor of different theories, this does not mean that these theories may be completely random. In all cases, these theories must be fully consistent with the given empirical data. The fact that we may have more theories that are consistent with the observed empirical data and that all these theories are thus candidates for acceptance by the scientific community does not mean that a theory that is not consistent with the empirical data may also be such a candidate.

The thesis of the underdetermination of theory by data on which Longino builds her position refers to a situation where there are more theories consistent with the observed empirical data, not to a question of the extent

[49] McMullin, "Values in Science," 5.
[50] Longino, "Gender, Politics, and the Theoretical Virtues," 384.

of the accuracy of fit of empirical data by theories that are candidates for acceptance by a scientific community. This thesis is based on the assumption that all alternative theories being considered by a scientific community as candidates correspond completely to the empirical data that we have at our disposal. It does not follow at all from this thesis that we should place less emphasis on the compliance of the scientific theory with empirical data and prefer other criteria.

In order to fully substantiate her thesis, Longino would have to present an example of two theories wherein one theory is less well-supported by empirical data than the other, but still accepted because it is better supported with regard to other values (especially non-cognitive ones) than the other. Longino fails to provide such example. As Ruphy shows in her critique, in all the examples given by Longino, theories that exhibit racist or sexist characteristics always also demonstrate a deficient consistency with empirical data.[51] In all such cases, it is therefore sufficient to give preference to theories that best fit empirical data and there is no need to take special account of non-cognitive values.

Even the case of a new theory is not one that would support Longino's thesis: often, less empirical supporting data is available for new theories than for established ones. Here, we can consider as a candidate theory a theory that has a lower empirical accuracy than established theory because of its novelty. However, even here it is difficult to find a case of a theory that should be chosen among other candidates which, after careful examination and in the longer term, is in worse agreement with empirical data than competing theories. Along these lines, Kuhn also states that new theories should be less critically considered at first, because a great deal of time and work in both theoretical and experimental areas is required for the new theory to be developed to high empirical accuracy.[52] However, this does not contradict the declared priority of empirical accuracy as a fundamental cognitive value; in the long run, compliance with empirical data is the primary characteristic in assessing theories (we return to the question of new theories below in the section on novelty as a value).

[51] Stéphanie Ruphy, "'Empiricism All the Way Down': A Defense of the Value-Neutrality of Science in Response to Helen Longino's Contextual Empiricism," *Perspectives on Science* 14, no. 2 (2006): 197.
[52] Kuhn, *Essential Tension*, 332.

3.4 The Requirement for the Higher Importance of Non-Cognitive Values

Another consequence that Longino draws is that a stronger role in evaluating alternative scientific theories should be given to values other than empirical adequacy. These values can be other cognitive values, but she also suggests including the right non-cognitive values (e.g., values motivated by opposition to racist or sexist biases). If non-cognitive values (e.g., in form of background assumptions of which we are not aware) can no longer be completely ruled out, then, according to Longino, feminists can argue that the political and social factors that are correct should have a priority influence on the selection and evaluation of scientific theories.[53] We can then ensure this by appropriately selecting values from those that will be used to evaluate theories. Longino proposes such an innovated list of values herself, which we will address in the following sections. For these values, in some cases, the question is whether we can characterize them as cognitive; in one of her later texts, Longino ultimately rejects this distinction altogether and claims that the difference between cognitive and non-cognitive values is unjustified.[54]

It is perhaps a true observation that scientific theories are at least in some cases burdened with background assumptions of a non-cognitive character, that is, of a social and political nature, and that these assumptions also influence the selection and evaluation of theories. However, these assumptions can be (at least in some cases) revealed and made conscious, which makes it possible to reconsider the choice of theories and subsequently reject certain theories.[55] To be sure, the very fact of burdening scientific theories with non-cognitive influences and background assumptions is not a new problem (Bacon) or a problem that somehow fundamentally disqualifies the standard methods of scientific research.

In addition, we have already cited Ruphy's critique that shows that in all the cases that Longino cites as examples of situations where a theory is burdened with non-cognitive background assumptions, considerable shortcomings can be shown with regards to the fit of the theory to empirical data, that is, its shortcomings can also be stated in terms of cognitive values: "all

[53] This can be accomplished by applying a set of values that Longino presents, instead of Kuhn's list: "I argued about the second set [of feminist values] that they are neither uniquely nor intrinsically feminist, but that feminists could argue that theories exemplifying them would be more likely to satisfy feminist cognitive aims (which are also sociopolitical aims)." Longino, "Cognitive and Non-Cognitive Values in Science," 51.

[54] Ibid., 50.

[55] Longino's approach can be in this sense considered quite good example how to do so.

her examples of biased theories, including those qualifying as 'good' science according to Longino, can be shown to fail on constitutive [i.e., cognitive] grounds."[56] Thus, according to Ruphy, the recipe for dealing with this problem is just the opposite of that proposed by Longino: we have to pay careful attention to the accuracy of fit of the theory to empirical data, because the most problematic theories, that is, those most influenced by non-cognitive values, always also demonstrate very bad consistency with empirical data.

Therefore, if the identification of biased theories requires a) an intensified effort to identify biased background non-cognitive assumptions and b) a greater emphasis on cognitive values and especially on the fit of the theory to empirical data, then Longino's proposal to include non-cognitive values that take into account the right social and political factors among values that we use to assess scientific theories is not justified. We also leave aside the difficult question of how to determine which social and political values are the right ones.[57]

3.5 Novelty

Longino proposes including novelty on the list of values used to assess scientific theories. Novel theories are those that "differ in significant ways from presently accepted theories, either by postulating different entities and processes, adopting different principles of explanation, incorporating alternative metaphors, or by attempting to describe and explain phenomena that have not previously been the subject of scientific investigation."[58] The understanding of novelty as a value of scientific theories is based on Longino's belief that at least some older theories (including current ones) are deeply burdened with entrenched assumptions that cannot be removed from their core and that the path to science void of these biased assumptions only emerges with the adoption of completely new theories. The new theories will also rest on some background assumptions, but on those lacking an incorrect or rather unwanted biases. For example, according to Longino, current scientific theories "neglect female contributions to processes biological and social" and "treat as natural alleged male superiority in various

[56] Ruphy, "'Empiricism All the Way Down,'" 199.
[57] Also, as we already noted above, Kuhn comments on the possibility of removing empirical accuracy from the list of values used to choose among alternative scientific theories, saying: "Subtract accuracy of the fit to nature from the list, and the enterprise that results may not resemble science at all, but perhaps philosophy instead" (Kuhn, *Essential Tension*, 331).
[58] Longino, "Cognitive and Non-Cognitive Values in Science," 45.

dimensions"[59]; however, to be sure, biased assumptions are not reducible to sexism or racism. Longino refers to the work of Haraway, who argues that current scientific theories are burdened by the idea of the immutability of the boundaries that appear to distinguish the animal and the human or the organism and the machine.[60]

According to Longino, the requirement for novelty thus expresses deep skepticism about the current state of science, admitting that its basis is primarily socio-political.[61] The emphasis on novelty does not mean completely abandoning the requirement of empirical accuracy, claims Longino, however, the role of empirical data in the context of the novelty of a theory may be different: "The empirical data associated with the more standard theories might just lose their salience or even dissolve in the context of an alternative model."[62]

The question of novel theories was also mentioned by Kuhn in connection with his warning against setting poor standards for replacing existing theories with new ones: "With standards for acceptance set too low, they would move from one attractive global viewpoint to another, never giving traditional theory an opportunity to supply equivalent attractions."[63] Longino, however, is unlikely to share these concerns.

Are all novel theories more valuable than older ones? At one point, Longino takes up this question with the example of Haraway's[64] critique of Hrdy's[65] new theory in the field of primatology. More specifically, Haraway argued that because Hrdy's theory privileges middle-class gender relations and conservatively adheres to traditional theories, it is politically regressive.[66] Longino says "paying attention to females, making them more central to the analysis" may satisfy a cognitive aim that she considers central, because it "corrects omissions of androcentric field work."[67] Nevertheless, Haraway

[59] Ibid., 46.
[60] Donna Haraway, "The Promises of Monsters: A Regenerative Politics for Innappropriate/d Others," in *Cultural Studies*, eds. Lawrence Grossberg, Cary Nelson, and Paula Treichler (New York: Routledge, 1992).
[61] Longino, "Cognitive and Non-Cognitive Values in Science," 51.
[62] Ibid., 52.
[63] Kuhn, *Essential Tension*, 332.
[64] Donna Haraway, "Primatology Is Politics by Other Means," in *Feminist Approaches to Science*, ed. Ruth Bleiber (Elmsford, NY: Pergamon Press, 1986).
[65] Sarah Blaffer Hrdy, *The Langurs of Abu: Female and Male Strategies of Reproduction* (Cambridge, MA: Harvard University Press, 1990).
[66] Longino, "Cognitive and Non-Cognitive Values in Science," 51–52.
[67] Ibid., 52.

would probably not consider it sufficient, because it "fails to challenge the ways in which sociobiological analysis naturalizes the social relations of capitalism."[68] A new, more progressive theory would be necessary.[69]

It seems that Longino's criterion of novelty, in fact, is associated with the criterion of the theory's compliance with new progressive political concepts (and this compliance may differ from one author to another). Another question is whether the criterion of novelty as a value for assessing theories remains applicable when the current theory already adheres to appropriate social and political views – Longino says: "It may be that this criterion is appropriate only so long as feminism has oppositional status."[70] Thus, it is possible that novelty is positive in value only until current theories are replaced by new ones that fully reflect, for example, feminist criticism. Subsequently, it will be possible to abandon the value of the novelty.

3.6 Ontological Heterogeneity

What is the ontology of a scientific theory? Every scientific theory works, either explicitly or implicitly, within a certain delimitation of entities that are considered to be real and causally efficacious in the context of this theory. The domain of these entities is then the ontology of this scientific theory.

A theory that satisfies the value of *ontological heterogeneity* is, according to Longino, one that "grants parity to different kinds of entities,"[71] "permits equal standing for different types, and mandates investigation of the details of such difference."[72]

In contrast, theories characterized as *ontologically homogeneous*:[73]

1. "posit only one sort of causally efficacious entity,"
2. "treat apparently different entities as versions of a standard or paradigmatic member of the domain," and

[68] Ibid.
[69] A similar argument develops Susan Sperling, "Baboons with Briefcases: Feminism, Functionalism and Sociobiology in the Evolution of Primate Gender," *Signs* 17, no. 1 (1991): 1–27.
[70] She, however, also adds that "I'm not sure about this, partly because I'm not sure that feminism has any status apart from an oppositional one." Longino, "In Search of Feminist Epistemology," 477.
[71] Longino, "Cognitive and Non-Cognitive Values in Science," 46.
[72] Longino, "In Search of Feminist Epistemology," 477.
[73] Longino, "Cognitive and Non-Cognitive Values in Science," 46.

3. "treat differences as eliminable through decomposition of entities into a single basic kind."

Longino considers ontological heterogeneity as a value of a scientific theory and, on the contrary, ontological homogeneity and its characterizing properties (see the list above) as undesirable features of a scientific theory.

The requirement for ontological heterogeneity is associated with the demand for respect for diversity and individuality. Longino references research projects across a number of scientific disciplines (from botany to primatology) in which the emphasis on individual differences has contributed to significant achievements. Methodologically, the requirement for ontological heterogeneity is associated with methodological particularism or individualism, that is, the requirement to prioritize individuals over collectives or abstractions. However, it might be also seen as a version of the Menger's law against miserliness.[74]

This principle of prioritizing individuals – methodological individualism – is not entirely new. For example, in his most important book on human behavior, published 1949, von Mises refers to "The Principle of Methodological Individualism," and, indeed, makes it the focus of this book's second chapter.[75] Here, he emphasizes that because all actions are carried out by individuals, any correct analysis must begin with an analysis of individuals and only then relate these actions to higher social units.

Although Longino's requirement for respect for diversity and individuality is something that can, in our view, be generally regarded as desirable, it cannot be said unequivocally that the characteristics she links to ontological homogeneity can in all cases be described as undesirable. Looking at the first characteristic recalls that relatively few scientific theories postulate only one type of entity as a causal actor (Longino gives no example).

Furthermore, preferring theories that use more than one sort of causally efficacious entities is a methodical principle, that we may call anti-ockhamism: while Okham's razor principle suggests that theories with lesser number of types of entities should be preferred, this requirement may be interpreted as suggesting exactly the opposite.

[74] Karl Menger, "A Counterpart of Occam's Razor in Pure and Applied Mathematics; Ontological Uses," in *Logic and Language: Studies Dedicated to Professor Rudolf Carnap on the Occasion of His Seventieth Birthday*, eds. B. H. Kazemier and D. Vuysje (Dordrecht: Springer, 1962), 104–17.

[75] Ludwig von Mises, *Human Action, The Scholar's Edition* (Auburn, AL: Ludwig von Mises Institute, 2008).

Moreover, we are not convinced that it can be stated a priori that such a theory is less valid than a theory postulating multiple kinds of causally effective entities. Many theories are abstractions of reality, reducing its complexity by focusing only on some of its aspects; as such, they may be perfectly sufficient even when using only one kind of entity. For example, in the case of orbital mechanics, scientists often limit themselves to discussing only one type of entity (material body) and one type of causal effect (gravitational pull), but it is not clear why these restrictions should be methodologically flawed. However, it should be also noted, that simplicity of explanation can be seen as red flag of pseudo-science.

Similarly, regarding the second characteristic, it is not clear why it should be a methodological shortcoming in all cases. To be sure, the problem emerges with discerning exactly what qualifies as "apparently different." In some cases, disregarding the differences between various entities may be a methodological error; in other areas, it may be an adequate simplification. For example, different variations of common oak, which are often visually very different, may be considered from a scientific research point of view to be various versions of a standard or paradigmatic member of the domain *Quercus robur* without this being a methodological error. For other research purposes, it may be useful to focus on the individuals and their individual features. Some theories may treat different common oaks as versions of a standard or paradigmatic member of the domain, other theories may thematize their individual differences. It is not obvious why the first approach makes primary a priori undesirable characteristics of a theory and why theories of the second kind should be (*ceteris paribus*) preferred.

Similarly, for the third characteristic, it is not possible to say in general that treating differences as eliminable through the decomposition of entities into a single basic kind is a methodological error. The decomposition of complex entities into more basic entities is one of the basic procedures of the scientific method. For example, a complex data-mining task can be decomposed into several smaller, less complex, and more manageable sub-tasks that can be solved by using existing tools.[76] Longino provides no convincing argument for why a theory formalizing such data-mining procedures is methodologically undesirable.

[76] Oded Maimon and Lior Rokach, "Decomposition Methodology for Knowledge Discovery and Data Mining," in *Data Mining and Knowledge Discovery Handbook*, eds. Oded Maimon and Lior Rokach (Boston, MA: Springer, 2005).

In general, we believe that there are no convincing arguments available that can demonstrate why we should include ontological heterogeneity among the values of scientific theories and use it as an evaluation criterion for the selection of theories. Similarly, there are no obvious reasons why we should consider ontological homogeneity a methodological defect.

Ontological heterogeneity may play a positive role in scientific methodology not as a value but rather as part of methodological guidelines recommended to scientists but only optionally applicable. Undoubtedly, in *some* cases, an ontologically heterogenous approach is better that a homogenous one and can contribute to important scientific results; therefore, it may be very useful for scientists to consider this aspect of the research and theories they construct. In this sense, we may do well to follow Longino and emphasize ontological heterogeneity as methodologically beneficial. Also, from above mentioned view of Menger, it could be understood as a methodological guidance to avoid oversimplified theories.[77]

3.7 Mutuality of Interaction

Mutuality of interaction proposes as more valuable those scientific theories that treat relationships between entities and processes:[78]

1. "as mutual, rather than unidirectional" and
2. "as involving multiple rather than single factors."

Both of these characteristics are in some sense problematic. It is not possible to generally say that in all cases it would be methodologically more adequate to understand the relationship between two entities as mutual, rather than unidirectional. For example, while it can be said that solar radiation, solar activity, and other changes of the Sun affect living organisms on Earth; on the contrary, it cannot be said that living organisms on Earth fundamentally cause changes in solar activity and that it would thus be methodologically appropriate to examine this relationship as mutual rather than unidirectional. To be sure, the extent to which a particular relation is unidirectional or mutual may differ from case to case, and it is appropriate to approach each relation with the assumption that the interaction *may* be mutual (as a methodological recommendation). However, it is not obvious why we should consider a theory that treats interactions as mutual a priori as

[77] Menger, "Counterpart of Occam's Razor."
[78] Longino, "Cognitive and Non-Cognitive Values in Science," 47.

methodologically more acceptable than one that treats interactions as unidirectional. Ultimately, this would mean that we should prefer a theory that postulates that living organisms influence solar activity over a theory that does not include this postulate (*ceteris paribus*), but only for methodological reasons.

To eschew single-factor, unidirectional causal models in favor of models that incorporate dynamic interaction may be correct in many cases, and Longino refers to several examples of this approach.[79] She does not, however, provide any convincing arguments that this approach is a universally valid principle for assessing competing theories. Listing examples of the successful application of this principle in different scientific areas shows only that this principle may be something to keep in mind when theorizing about an unknown phenomenon or even discussing its competing explanations. A collection of examples, however, cannot serve as a convincing argument that this principle should be considered a value that is, *ceteris paribus*, decisive in all cases when choosing among competing explanations.

The second characteristic of this value is to prefer theories that treat relationships between entities and processes as involving multiple factors, rather than single factors. Even regarding this characteristic it can be said again that its validity depends on the nature of the theory in question. For example, as mentioned above, the study of general relationships between large material bodies can be – given some preceding background theoretical assumptions – limited to gravity. We may eventually analyze these assumptions, even reject them and replace them with different assumptions (e.g., if the older assumptions were discovered to be somehow biased). However, there is no obvious reason why a theory based on such assumptions should, in all cases, be evaluated less favorably than other theories involving a greater number of relationships (while having, at the same time, less empirical accuracy). On the other hand, if an alternative theory that explains relationships between large material bodies using gravity as well as some other factor produces more accurate calculations, then it would, perhaps, be appropriate to prefer that theory. However, this approach, in which empirical accuracy is the decisive value, is a standard Kuhnian one.

The mutuality of interaction, thus understood as a value used to assess scientific theories, again seems to emerge as invalid due to weak arguments. However, the observation behind this characteristic, namely that in some cases researchers neglect the mutuality of interactions between entities

[79] Ibid.

or limit their focus to one factor despite the presence of other important factors, can be considered correct. Similarly, as in the case of previous characteristics, we would consider it a suitable form of expressing of this idea to include it among a set of methodological guidelines in the form of a recommendation motivating researchers to always carefully consider whether the interaction is mutual when examining relationships between entities and processes that seem, at first glance, unidirectional.

3.8 Consistency of Theory

The list of values proposed by Kuhn also includes internal and external consistency. Longino has no reservations about the requirement for internal consistency – she writes that it is only a matter of satisfying some elementary logical principles such as the principle of non-contradiction; accordingly, this requirement is generally accepted in her conception.[80] Along these lines, Longino did not even include it on her list of values.

The situation is different in the case of external consistency. Kuhn, as well as Quine and Ullian, consider external consistency an important characteristic of scientific theory, a value that should be taken into account when deciding between alternative theories that fit empirical data with similar accuracy. Kuhn argues that, in such a case, we should prefer a theory that is consistent with other theories in other areas.[81] Similarly, Quine and Ullian state that we should choose the theory that disrupts the web of belief as little as possible.[82]

Meanwhile, Longino wagers the opposite: she maintains that we should always prefer a novel theory to one characterized by external consistency. Here, it is helpful to note that external consistency presupposes a certain conservatism, that is, some level of confidence in the validity of theories in other areas. However, Longino believes that such confidence is misplaced: "The novelty criterion recommends theories and models that depart from accepted theories. It recommends disregarding consistency with other theories, and not being hamstrung by conservatism."[83] This is due to Longino's deep skepticism about existing theories, which emerges on socio-political grounds: "The socio-political basis for the criterion of novelty is the need for theoretical frameworks other than those that have functioned in gender

[80] Ibid., 42.
[81] Kuhn, *Essential Tension*, 322.
[82] Quine and Ullian, *Web of Belief*.
[83] Longino, "Cognitive and Non-Cognitive Values in Science," 51.

oppression by making gender invisible."[84] If we accept that the entireties of science and theory are stigmatized by their participation in various forms of oppression, Longino says, then the criterion of external consistency loses its justification. New theories, even if they are not consistent with existing theories in other disciplines, should therefore take precedence over old theories.

Longino gives several examples of scientific theories burdened by racist or sexist biases and that thus contributed to certain forms of oppression. However, these individual observations do not justify her general condemnation of current science and all scientific theories as participating in some form of oppression. Any oppression is undoubtedly reprehensible, and theories burdened with biases and participating in oppression should be identified and appropriately corrected and biases removed. However, blanket generalizations do not fundamentally contribute to this process.

Another problem with this approach is the fact that if we agreed to this proposal, the result could be science as a collection of unrelated, inconsistent theories that somehow make sense within their limited domain, but which have no connections linking them and that, taken together, are riddled by unsolvable inconsistencies. The question is whether we could still call such a bundle of theories a "science."[85]

3.9 Pragmatic Criteria

In her discussions of the values of scientific theories, Longino mentions two additional items: *applicability to current human needs* and *diffusion of power*.[86] Admitting that they are not values in Kuhn's sense, she calls them *pragmatic criteria*. For our purposes, what is important to note here is that these characteristics do not primarily serve as criteria for effectively choosing between alternative scientific theories, but rather as criteria for deciding on the direction of research programs – they should be primarily used to select the area or problem on which scientific research should focus.

More specifically, the applicability to current human needs principle "favors research programs that can ultimately generate applicable knowledge," that is, programs "improving the material conditions of human life,

[84] Ibid.

[85] It may be argued that even in contemporary science, there are cases of external inconsistency. In most of these cases, however, we do not have alternative theories that would offer full external consistency without sacrificing empirical accuracy and other values.

[86] Longino, "Cognitive and Non-Cognitive Values in Science," 48.

or alleviating some of its misery."[87] In particular, research should focus on neglected areas related to "the human and social needs traditionally ministered to by women."[88] On the contrary, research focused on "defense" or research to create knowledge without direct applicability, should be less preferred. Applicability to human needs is thus a pragmatic equivalent of the value of mutuality of interaction.

Thus, it seems that, according to Longino and the authors she endorses,[89] disciplines such as archeology, large parts of history, astronomy, some parts of mathematics, and a number of others that are not applicable to human needs should be left behind. Longino herself does not provide any arguments for the desirability of this principle; she only refers to those authors who formulated it before her. She says that her approach is an enhancement of the common requirement to prioritize applied science, but that it has been extended to increase the emphasis on neglected areas; therefore, she does not seem to assume that this requirement should be justified in detail.

A similar requirement, however, also mentions Kuhn, who writes about "social utility" and draws attention to the difficulties connected to this value: "Change the list, for example by adding social utility as a criterion, and some particular choices will be different, more like those one expects from an engineer."[90] The problem with the emphasis on this value is that the result of its application is the transformation of science into some kind of "engineering." However, Longino does not respond to this objection in any way.

The characteristic of *diffusion of power* "gives preference to research programs that do not require arcane expertise, expensive equipment, or that otherwise limit access to utilization and participation."[91] Longino, as an example, points to certain critics of research in the field of engineering or economics that have argued against the requirements for mathematical knowledge in these fields because, according to these critics, they far exceeded what was really necessary to practice these fields. Other authors mentioned by Longino demand including some areas that are widespread but neglected by science (e.g., midwifery) among scientific disciplines.[92]

[87] Ibid.
[88] Ibid.
[89] Mary Tiles, "A Science of Mars or a Science of Venus?," *Philosophy* 62, no. 241 (1987): 293–306.
[90] Kuhn, *Essential Tension*, 331.
[91] Longino, "Cognitive and Non-Cognitive Values in Science," 48.
[92] Ruth Ginzberg, "Uncovering Gynecentric Science," *Hypatia* 2, no. 3 (1987): 89–106.

Notably, the ecologically oriented authors she cites recommend placing more emphasis on the development of locally applicable technologies.[93] Ultimately, all these demands can be summed up under the principle of diffusion of power.

On the other hand, it can be argued that research programs that make a major contribution to improving the material conditions of life often require expensive research equipment. For example, research into new medical treatments or the automatization and robotization of production require expensive well-equipped laboratories. In addition, these life-improving fields are extremely demanding on expert knowledge. Along these lines, is the demand that scientific practice should reduce the requirements for the knowledge of researchers a bit contradictory? Specifically, in the case of mathematics, it has already been demonstrated in many cases that some areas of mathematics, which were considered to be purely of theoretical interest and without practical application, have found new, very useful applications over time (e.g., cryptography and computer security). Therefore, in many areas, it is considered appropriate that researcher knowledge of mathematics should somehow exceed the minimum necessary to solve current research tasks.[94] Of course, this means restricting access to scientific careers for those who, for some reason, are unwilling or unable to meet these demands; however, to be sure, this applies to every area of human activity.

4. Conclusion and Critical Evaluation

Why should we accept this newly proposed list of values as a proper tool for assessing scientific theories? Longino rejects some feminist theories that argue that women, because of their biology or social experience, are better able to understand the world via theories characterized by these features. Likewise, Longino denies that these values should be preferred because they are beneficial to outsiders to mainstream science, such as women or marginalized groups.[95]

The reason we should accept these values as, according to Longino, that they are beneficial primarily for revealing the gendered biases within sci-

[93] Gita Sen and Caren Grown, *Development, Crisis, and Alternative Visions* (New York: Monthly Review Press, 1987).

[94] However, we may agree that, e.g., in economics, past financial crises sparked a vital discussion among the economists in relation to the exaggerated mathematization of their discipline and its neglect of philosophical, ethical and other values.

[95] Longino, "Cognitive and Non-Cognitive Values in Science," 49–50.

ence: "In the account given above of each of the virtues, I suggested how inquiry guided by them would be thought to reveal gender, either in the form of bias about the phenomena or as a phenomenon in the domain itself, or to reveal the activities of women or females in the domain."[96]

Revealing bias, that is, the prejudice or non-neutrality of science, whether in research of any phenomenon or caused by any factors, is certainly a worthwhile goal that has its place in scientific methodologies. At the same time, this is not a new goal: as we mentioned above, a similar motif can be found in Bacon's famous concept of idols. In her conception, Longino responds to a number of specific cases where it turned out that scientific research was in some way biased (e.g., sexist or racist). The research, for example, did not pay enough attention to females (in the case of biology, especially primatology) or the social conditions of women (in the case of sociology). In this context, its proposals can be understood as meaningful ways to make research more objective and thus as contribution to the development of unbiased science. However, this also shows the limits of this concept. It would not be appropriate to accept it as a universal method of assessing scientific theories, because some of its feature points, as we have shown, should be rejected – for example, the consideration of the accuracy of empirical data as the least important feature of a scientific theory.

Nevertheless, as we said, many other features of Longino's conception may be beneficial to scientific methodology. These features are, in many aspects, results of developing older motifs which have been formulated before, but still they are fruitful and beneficial in their application to neglected areas of scientific bias. After some critical reflection, Longino's work can be a useful contribution to the development of a scientific method. As we have noted above, instead of talking about the values used to assess scientific theories, the principles that Longino formulated should be presented as, for example, guidelines for scientists that can help them shape a scientific practice that does not exhibit problematic elements (e.g., sexist or racist biases). These guidelines can be illustrated with the several examples Longino mentions in her work.

Before closing, one more important feature of Longino's conception must be clarified. Some parts of her text suggest that ideology always takes precedence. Consider, for example, a hypothetical sexist or racist theory that, after closer examination, proves either defective in terms of Kuhn's

[96] Longino, 50.

traditional cognitive values (e.g., it contradicts empirical data) or without problems in terms of cognitive values.

In the first case: if a biased theory (sexist or racist) is flawed with respect to cognitive values (e.g., poorly fits empirical observation) and the underlying methodology, then using a better methodology that identifies these biases can achieve better results and yield another theory that will not be as biased as the original theory: "if sexist and racist science is bad science that ignores the facts or fails to treat them properly, this implies that there is a good or better methodology that will steer us away from biased conclusions."[97] This situation is not problematic and, as we have already mentioned, Ruphy states that all real examples of biased theories, including those provided by Longino, fall into this class.[98]

A problem would arise in the second case with a hypothetical biased theory, such as, for example a sexist theory, validated by traditional cognitive values and the methodology based on them. In such a case, the only solution, according to Longino, is a paradigm shift that delegitimizes such a theory: "if sexist science is science as usual, then the best methodology in the world will not prevent us from attaining those conclusions unless we change paradigms."[99] Here, Longino refers to Kuhn's theory of a paradigm shift.[100] However, there is one significant difference: Kuhn's paradigm shift is due to the accumulation of anomalous results of observations and experiments that are difficult to reconcile with the current paradigm. For Longino, however, a paradigm shift is required because the theory, although in line with the current scientific paradigm, is not in line with selected non-cognitive ideological principles.

Longino also believes that we should "reexamine [...] the assumption that value-laden or ideologically informed science is always bad science."[101] Longino seeks to integrate values, principles, and methods that would make it impossible to accept any racist, sexist, or similar theories into the methodological basis of science. This requirement has such a priority that it is more important than the consistency of science as a whole, and to meet it may require the acceptance of completely new scientific paradigms based on mutually inconsistent theories that do not reflect empirical data as well as the original theories. Such an approach is necessary to solve the purely

[97] Longino, *Science as Social Knowledge*, 11.
[98] Ruphy, "'Empiricism All the Way Down,'" 199.
[99] Longino, *Science as Social Knowledge*, 11.
[100] Kuhn, *Structure of Scientific Revolutions*.
[101] Longino, *Science as Social Knowledge*, 7.

virtual problem – as we have repeatedly stated, all biased theories, racist, sexist or other, have been refuted on a purely traditional basis, usually because they were not consistent with empirical observations – and this tool, which has been the most successful in disproving biased theories, Longino wants to demote to the factor of lowest importance when assessing scientific theories.

We argue, however, that the realization of Longino's intentions would yield exactly the opposite results she wills. For example, if someone today holds racist views, then it is possible to oppose them with reference to the results of accepted scientific theories contrary to such racist views and thus to prove them wrong. However, this is only possible if science itself is neutral with regard to racism, that is, if the methodological principles and values that govern the choice of theories are purely cognitive and not subject to any socio-political overriding principles. Only then is it possible to effectively argue that neutral science comes to conclusions that deny racist views.

If we accept Longino's proposal and integrate principles that would rule out any racist theories (even at the expense of lower consistency with empirical data or inconsistencies in science as a whole), into the scientific methodology and values that govern the choice of theories, then such an anti-racist argument would become impossible – it would be a circular argument. If science would a priori reject theories consistent with racism, then surely all accepted theories would be contrary to racism. However, such a statement would be completely banal and would have minimal argumentative or persuasive value, and the same goes for sexism or any other bias.

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