Scientific Progress and Democratic Society through the Lens of Scientific Pluralism

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ABSTRACT

Background and Objectives:
In this research article, the researcher addresses the issue of creating public understanding in a democratic society about the progress of science, with an emphasis on pluralism from philosophers of science. The idea that there is only one truth and that there are just natural laws awaiting discovery by scientists has historically made it difficult to explain scientific progress. This belief motivates science to develop theories that explain the unity of science, and it is thought that diversity in the way different ideas presented by scientists is a problem that results in time being wasted in search of the most accurate theory. Some scientists perceive a benefit in having a range of scientific hypotheses, though. One benefit that is frequently cited is that scientific diversity as a whole contributes to the development of a democratic society that permits the expression of a range of viewpoints. The road to accountable scientific pluralism is fraught with difficulties, though. Therefore, it is crucial to take into account both pluralism's advantages and disadvantages. This research aims at:
1. analyzing in an epistemological way the interpretation of scientific theories and the progress of science from the perspectives of scientific pluralists;
2. analyzing the relationship between science and democracy in explaining scientific significance and progress; and
3. synthesizing new knowledge on epistemic dependentism and to argue that it plays a significant role in evaluating research issues related to scientific pluralism.

Methodology: The research methodology involves the application of documentary investigation along with philosophical discourse. The method of philosophical argumentation involves analyzing the lines of arguments found in relevant academic publications in order to assess their validity and soundness.

Main Results: One key argument of the pluralists is the use of the concept of theoretical pluralism, which suggests that scientific knowledge is created from a variety of perspectives according to the social and cultural context of knowledge creation. It is found that part of Longino's argument is based on the negation of rational/social dichotomy. Moreover, her theory is a departure from philosopher of science Philip Kitcher, who advocates the creation of scientific knowledge and the evaluation of scientific progress through the means of democratic society. He explains that these procedures will lead to "well-ordered science" in democratic society.

Discussions: The researcher examines the underlying ideas accepted by these two philosophers of science and finds that although their opinions differ, they have common ground in the acceptance of consensus. However, the views of both philosophers still lack weight in explaining the knowledge itself. The researcher argues that the acceptance of pluralism as a way of understanding scientific progress necessarily lends itself to dependentism, which points to interdependence in comparisons of superiority/inferiority between scientific theories. It is undeniable that the situation has emerged all the time, even though the success of the scientific theories being compared to each other comes from different social and cultural grounds of thought.

Conclusions: Some popular models of scientific pluralism in the philosophy of science still lack a compelling justification, particularly on the epistemic grounds. By elucidating the epistemic significance of the interdependence of these things, scientific pluralism can be strengthened by incorporating the notion of epistemic dependentism into the analysis of scientific progress.

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Introduction

An important question to the philosophy of science is the question of the advancement of science. The significance of this issue appears to be acknowledged by the majority of humans, not just scientists from various disciplines. Such recognition frequently coincides with international and local social and political issues. This is due to the fact that scientific progress frequently comes at the expense of investment in all areas and international cooperation, particularly in the information and education of society's members. Therefore, it cannot be denied that science and politics should coexist. The urgent instance of climate change and its connection to the global COVID-19 pandemic appears to be the best illustration at present. For instance, there is information that has led to a campaign to increase awareness of such situations to the point of giving them a name that suggests they must be addressed more urgently, such as "global heating," and it calls for international cooperation to draw attention to it (Diesendorf, 2020; Tännsjö, 2021). These factors are inextricably linked to the dissemination of scientific education to the global populace.

One of the greatest obstacles, however, is the widespread belief that today's highly advanced science is populated by scientists who share the same viewpoints; therefore, solving these problems will appear to be successful without any disagreements. But beliefs that take the form of what philosophers refer to as "scientific monism" are not problem-free. People may be astonished to discover, upon examining the work of scientists in each community, that even within the same field there are numerous disagreements, especially at the grass-roots level. Surprisingly, some philosophers of science are aware of this issue, but they do not view it as a significant problem. They have a concept called "scientific pluralism" that acknowledges that this is already the nature of the scientific community's activity. In addition, they tend to assume that it will be even easier for scientific endeavors to produce more advanced knowledge in the future. Progress will also serve to reinforce democratic society.

Regarding the aforementioned concerns, the importance of conducting studies and research in this field becomes evident, as it is crucial to gain a comprehensive understanding of the rationale behind scientific pluralism. This perspective emphasizes the significance of integrating diverse viewpoints within a democratic society, in order to foster comprehension and constructive critique of scientific advancements. This study will focus on the philosophical system of thought referred to as scientific pluralism. My research query is how Philip Kitcher and Helen E. Longino, two prominent philosophers of science in these related issues, reason about the progress of science based on the pluralism of scientific conception and the political and cultural context of the people. Nevertheless, I will present my own philosophical arguments that can be synthesized from these concepts to create a new theory and new body of knowledge based on the research.

Review of literature

Is it conceivable for theories in all fields of study that constitute part of modern science to be reduced to a final unified theory? Many scientists believe in the discovery of such a theory and concentrate on its position in physics, leading to the notion that all branches of science can eventually be explained by laws in physics. However, many philosophers of science have contested the notion that physics is the last chance for discovering the origin of a unified theory. For instance, Nancy Cartwright believed that the laws of physics could not adequately explain the physical world. To have a single set of laws or theories to explain reality would be to presume that the universe and the world have a unified order, which is a dubious assumption (Cartwright, 1983). It is unlikely that the pursuit of correct scientific knowledge and theories that will play a role will result in a single body of knowledge or theory. In such processes, the natural laws known as scientific laws are more likely to be arranged in a patchwork fashion (Cartwright, 1999).

In general, scientific progress is regarded as the pursuit of accurate knowledge and its application for the benefit of humanity. However, it has been argued that the issue itself is founded on false premises, or that the widespread belief that scientific progress is possible has been misled. Thomas Kuhn's *The Structure of Scientific Revolutions* is a well-known work in the philosophy of science that clearly conveys this argument by demonstrating that his critical study of the history of science indicates that each shift in scientific perspective is merely a paradigm shift (Kuhn, 1962).

Since after World War II, or roughly the second half of the 20th century, science has begun to doubt the positivist epistemology that dominated the first half of the century. Since Kuhn's vision of a paradigm shift in science, post-Kuhnian, post-colonial, and feminist perspectives have bolstered the challenges to positivist perspectives. As exemplified by the work of Sandra Harding and Evelyn Fox Keller, these perspectives are based on the social and cultural study of science. These philosophers sought to legitimize the use of women's and non-Western experiences as the premise for the study and evaluation of science and technology (Harding, 1991; Harding, 1998; Keller, 1985). Moreover, sociological studies of science are said to have had a significant impact on the belief that science's claim to hold the only key to reality must be questioned. These scientists (particularly physicists) cannot assert that their pursuit of knowledge must be socially neutral. It is impossible not to allow the social context to influence one's approach to knowledge, since scientists are also members of society (Fuller, 2002). Paul Feyerabend was among those who provided a revolutionary perspective on the status of science in society. He emphasized that there is no singular scientific method that is more accurate than others. This paved the way for his view of "epistemological anarchism" (Feyerabend, 1975: p. 189). Once it is acknowledged that any scientific theory can produce knowledge in the way it should, an open society with a great deal of freedom will result to enable the search for scientific knowledge without being hampered by having to conduct research according to the power or influence of the scientific method believed to be the most accurate (Feyerabend, 1978).

Nevertheless, the belief that science is a fixed body of knowledge is considered that it should still serve as a foundation for such a notion of a definitive theory. Also contributing to the replacement of old theories with new ones was the realization that the new theory was more accurate. This sort of scientific conception is understood as scientific realism (Psillos, 1999). Advocating for the perspective of "scientific realism" serves to preserve the integrity of the scientific enterprise, as it acknowledges that scientific inquiry and experimentation often lead to insights about phenomena that transcend human observation and experience. The cause-and-effect process is contingent upon the inherent nature of the experimental entity, rather than being contingent upon the human ability to see and comprehend it as such, solely based on human knowledge. The concepts referred to as "realism about entities" and "realism about theories" have been identified by Ian Hacking (1983, pp. 27-28).

Some scientists consider it unnecessary to place too much emphasis on the conflict between "scientific realism" and "anti-realism." This is a result of the lack of reality in both sides' comprehension of the advancement of science and their apparent fixation on metaphysical matters. These discussions have not fully taken into consideration the fact that experts' opinions can differ, even within the same scientific discipline. As a result, discussion should shift to taking into account a different issue. The issue at hand is whether or not the diversity of scientific theoretical viewpoints and scientific development are related. This is one of the reasons some scientists turn to pluralistic scientific ideas. The term “scientific pluralism” refers to the group of philosophers of science who do not believe there is a singular explanation for the actual world. Contrastively, the other term, “scientific monism” refers to the other group of scientific philosophers who believe in the existence of a concluding theory and the reduction of all branches of science to a single unified theory (Bueno, 2017, p. 229; Pavlinov, 2021, pp.

92-93). However, many philosophers of science do not believe that a single scientific theory adequately describes reality. Some philosophers of science dislike the term pluralism because it could delude others into believing they embrace epistemic relativism (Veigl, 2020). It can be considered that the name of pluralism requires a more specific definition, to the extent that philosophers of science who have such a concept may be called pluralists in their own manner.

However, it is still possible to locate an explanation indicating that such conclusions can be supported by scientific advancement. The plausibility of these explanations is both endorsed and contested in the realm of philosophical academics. Here, I would like to present the results of my investigation on this topic, focusing on the debate between Philip Kitcher and Helen E. Longino. Despite their agreement that the argument for the advancement of science is possible in social epistemology of science (Kitcher, 1990; Kitcher, 1993; Longino, 1990) and that decisions regarding the advancement of science should involve the consensus of people in a democratic society (Kitcher, 2001) to encourage "democratic inclusiveness in science" (Longino, 2002c, p. 573), the two philosophers disagree significantly on the basis for explaining the relationship between consensus in such a democratic society and the advancement of science. Even though the two philosophers argued vehemently in the late 20th century, and early days of the 21st century, their arguments continue to be the subject of analysis and critique to this day. It is therefore essential to study the origins of the arguments of the two philosophers and the interpretations of other scholars who participated in the debate on these issues. This is necessary to have a clear analysis of the approaches and the pros and cons of the corresponding arguments, which will aid in determining how to investigate the relationship between democratic society and scientific endeavours for the future benefit of humanity.

Research objectives

1. To analyze in an epistemological way the interpretation of scientific theories and the progress of science from the perspectives of scientific pluralists.
2. To analyze the relationship between science and democracy in explaining scientific significance and progress.
3. To synthesize new knowledge on epistemic dependentism and to argue that it plays a significant role in evaluating research issues related to scientific pluralism.

Method

The research method in this research is documentary research. The methodology is founded on philosophical inquiry, which entails reading and analyzing documents along the line of arguments using a logical method of reasoning. Research findings are presented in the form of an analysis of the academics' lines of reasoning, followed by a discussion from the researcher indicating whether the lines of reasoning are logically appropriate or not.

Findings and analysis

1. Philip Kitcher's science and democratic society

In his early philosophical writings about science, Philip Kitcher proposed three key attributes that are indicative of scientific endeavors that have achieved success. The concept of "independent testability" refers to the ability to test auxiliary hypotheses apart from the specific instances in which they are proposed. The concept of "unification" emerges as a consequence of the application of a limited set of problem-solving procedures to a wide range of scenarios. The concept of "fecundity" arises from the state of incompleteness, whereby a theory presents opportunities for novel and advantageous avenues of research (Kitcher, 1982, p. 48).

In *Science, Truth, and Democracy*, Kitcher discusses two significant aspects relevant to this investigation. That is, the question of "scientific significance" or what is also known as "epistemic significance," and the question of "well-ordered science" (Kitcher, 2001, p. 63, p. 117).

Kitcher's position is compatible with scientific pluralism in many respects, which has led many pluralist thinkers to interpret him as a pluralist philosopher of science. However, Kitcher's true position is what he calls "modest realism," which involves how science is portrayed as a representation of the real world in the form of a constructivism theory (Kitcher, 2001, p. 16, n. 1). In this context, the term realism refers to the use of language in scientific theories that are universally comprehended by humans, such as reading a map of the same world. It is unacceptable for one language to dominate the reading of world maps as though it were the only legitimate language. It is easier to read maps in multiple languages when each community understands various aspects of the same concept. Ultimately, in this form of constructivism, human understanding is possible if one is willing to listen to all perspectives, which is analogous to translating and attempting to comprehend different languages. This situation is similar to the creation of human knowledge in the domain of science (Kitcher, 2001, p. 43-53).

In Kitcher's conception of scientific epistemology, "epistemic significance" is an important concept. In chapter six of the above-mentioned book, he conveys his arguments about the significance in scientific inquiry. Kitcher explains that this notion of significance was of interest to previous scientific philosophers. If there is scientific significance, it should consist of facts, discoveries, explanations, or theories that are crucial in providing answers to long-sought questions. This is due to the fact that along the path of the scientist's investigation there may be numerous truths, but they are merely trivial truths. Yet, the discovery of such an important truth may be a long-awaited hope, but when it is realized, it resolves a large number of essential scientific concerns. In this manner, Kitcher views the significance and attributes "epistemic significance" to either the knowledge itself or the creation process. Kitcher's response to the point is that determining when a scientist makes a discovery based on what knowledge is significant to the scientific community is not a particularly objective criterion for forming judgments regarding the existing body of knowledge. According to Kitcher, the fact that each piece of knowledge discovered by science leads to additional knowledge is indicative of its level of significance. In other words, a level of knowledge that science already possesses can generate future discoveries. This level of understanding determines which scientific knowledge derived from a discovery appears to be more or less valuable. Any scientific knowledge that is so exceptional that it is recognized as a remarkable achievement appears to be more significant than any previous knowledge. But when contemplating the creation of knowledge, outstanding scientific knowledge does not emerge without any context (Kitcher, 2001, pp. 63-82).

Is the scientific progress that generates knowledge that is ultimately recognized as being of significance independent of knowledge and discovery? Kitcher’s answer is negative. Rather, these evaluations are always influenced by the expectations of scientific societies and other social factors. From this concept of "epistemic significance," Kitcher concludes that the degree of importance of scientific knowledge must arise from relevant assessments of its value by all parties involved. In this circumstance, it is necessary to assume the role of the people in evaluating the value of scientific discoveries in order to determine their applicability. This ordering leads him to the conclusion that a democratic society and science should go hand in hand; he termed this "well-ordered science." Kitcher concludes that this was the social aspect of the production of scientific knowledge (Kitcher, 2001, pp. 117-135). In addition, it can be considered that many scientists have frequently idealized cognitive descriptions that scientific endeavor to be independent of social factors because they assume they have nothing to do with society. This sort of reductionism in scientific inquiry is used to anticipate the discovery of an ultimate, unified scientific theory. However, Kitcher denies this separation of science and society. He argues that this theory of reductionism was perilous because it created a dictatorship in scientific theory that prevented others from hearing the opinions of others. This is because the approach of reductionism misleadingly expects to see the unity of science in one correct manner (Kitcher, 2001, p. 175).

Kitcher once again articulated the connection between democracy and scientific advancement, emphasizing their interdependence for societal growth and achievement. A significant issue that the author experienced in his work *Science, Truth, and Democracy* pertained to the need of addressing the prevalence of specialized terminology within expert scientific discourse. In his later book, *Science in a Democratic Society*, Kitcher mentions about the comprehension of scientific concepts and the level of skill possessed by professional scientists that it may provide challenges for those who lack specialized knowledge in the field. The lack of effective communication and proper manner of professional scientists towards others knowledgeable in their field, as well as the general public, hinders the desired integration of science within a democratic society. Nevertheless, Kitcher attempts to substantiate this assertion by offering a rebuttal to the prevailing notion that science is replete with specialized jargon and using this error as a basis for critiquing the interplay between science and democracy. A scientist who has both expertise and a disposition conducive to effectively disseminating scientific information to the public might be regarded as an exemplary scientist. This particular interpretation of science is often seen as suitable and in alignment with the principles of a democratic society (Kitcher, 2011).

2. Helen E. Longino's conception of science and theoretical pluralism

This section centers on the work of Helen E. Longino, a feminist philosopher of science whose *The Fate of Knowledge* (2002a) prominently features this concept. I will explain and assess Longino's theoretical pluralism, which is evident in chapter eight, "*Pluralism and local epistemologies"* of the text. Longino attempts to demonstrate the inconsistency of biological theories to prove that no single scientific theory can adequately explain the actual world. However, before getting to the meat of this chapter, Longino describes how her study of science is social and how it exposes the possibilities of knowledge. Longino argues that the "rational-social dichotomy" approach to separating the rational knowledge system and the social knowledge system is flawed (Longino, 2002a, pp. 1-3). The approach of non-dichotomizers, which I will discuss next, is a more accurate method for sustaining theoretical pluralism.

Rejecting dichotomies

The purpose of *The Fate of Knowledge* is to construct an explanation of scientific knowledge that responds to normative uses of the terms "knowledge" and "explanation" by examining the social character of the scientific process. Social conditions that facilitate the development of scientific knowledge. Longino's first contribution to the sociology of knowledge was to highlight the possibility of social knowledge that is both rational and a social product (Longino, 2002, pp. 1–10).

This is a crucial aspect of the starting point for her to get it understood in the beginning. This is due to the fact that if social knowledge is not feasible from the start, there is a problem from the start. Similar to Steve Fuller, philosophers of science have expressed concern that the influence of the philosophy of science on positivist approaches has rendered the term "social epistemology" incompatible, or an "oxymoron" (Fuller, 2002: p. xiv).

Longino, however, employed the terms "cognitive rationality" and "cognitive sociality" to denote the dichotomies that these traditional philosophers of science believed to be distinct (Longino, 2002, p. 1). She seeks a hypothesis that permits these dichotomies to be described as they are. In general, evidence-based justifications for scientific judgments are distinct from the non-evidential considerations that the scientific community frequently idealizes. Consequently, they are regarded to be separate poles. She attempts to comprehend and refute these assumptions so that scientific epistemology can completely incorporate learning processes (Longino, 2002a, pp. 1-2). What is the significance of rejecting dichotomies in fostering adoption of Longino's scientific pluralism? The author highlights how the scientific

community's conventional approach to rationality, which pertains to an idealized understanding of truth, has caused the notions of knowledge and rationality to impede on this idealized perspective. This perspective precludes the notion that the rationality and knowledge produced by scientific theories invariably emerge within a particular context of knowledge acquisition (Longino, 2002a, p. 24).

Longino discovered through her study of numerous academicians that social science education programs, such as the Edinburgh School and the Strong Programme, sought to make science education pertinent to economic, social, and political contexts. This connection is related to the acquisition of scientific knowledge. Studies from scientific laboratories, where scientific research is linked to the mobilization of budgets for industry, are an additional trend. Therefore, scientific knowledge consists of these rather than logically derived truths. These studies challenge the notion that cognitive rationality and cognitive sociality are two distinct entities. However, Longino realized that they, too, were trapped in this dichotomy. These studies do not question the possibility of such creation or the nature of such scientific knowledge, including the principles of the scientific process in producing knowledge (Longino, 2002a: pp. 7–10).

Then, what types of scientific investigations would circumvent this dichotomy between rationality and society? Longino first points out the difference in meaning of the word 'knowledge,' which has three definitions. The three meanings are as follows: (1) knowledge as knowledge production, which indicates that a piece of knowledge should specify how knowledge can be produced or created; (2) knowledge as knowing, which is about the process which is a person's state of being in relation to things, such that a person S knows that p is true if and only if he believes that p is true, which is to say that S has a valid reason for believing p; and (3) knowledge as content, which is that various fields of science are not dependent on the knowledge of any one person or tied to a specific period in the history of knowledge production (Longino, 2002, pp. 77-85). The diagnostic tree of knowledge is comprised of the empirical and normative contexts of these three meanings of knowledge. Each meaning can be explained in detail below.

(1) Knowledge as knowledge production. The empirical context identifies a process or practice that is effective in forming beliefs or gaining acceptance for a corpus of knowledge in a particular community. The normative context is concerned with the acquisition of beliefs or the acceptance of reasons to support them.

(2) Knowledge as knowing. S admits that p and p are acceptable in community C, and S's approval of p is also acceptable in community C. Normative context relates to an additional epistemic process: S accepts that p, and p is true, and S's acceptance of p results from or is consistent with the process's system or normative practice.

(3) Knowledge as content. The empirical context pertains to the epistemic content e that is accepted by the community C or the outcomes of empirical processes or practices in the community C. The normative context highlights the knowledge content in the subset of known truths, whether known by the individual or the community (Longino, 2002a, p. 84).

This suggests that philosophy and social studies have distinct starting positions and are insufficient for examining all dimensions. Explorers guided by sociological studies begin with the production of knowledge, whereas philosophers begin with knowledge as a content and move on to reasoning about the veracity of that content. For example, if a philosophical definition of knowing is regarded to be the correct definition of knowledge, then we would be concerned with discovering the conditions that define a knower's knowing. Doing so would result in the establishment of knowledge conditions, such as belief, propositional form, truth, and justification based on sound logic. These factors are insufficient because there is no examination of the knowledgeable individual as a member of a specific community (Longino, 2002a, pp. 85-86). Therefore, it can be concluded that this dichotomous way of thinking

accentuates viewing by focusing only on the perspective that one is interested in investigating. In other words, whereas the social polarity emphasizes empirical knowledge, the rational polarity emphasizes normative knowledge.

How can we overcome this polarized viewpoint? Longino notes that there are three perspectives to consider, and that each perspective has two distinct dichotomies:

- Individualism vs. Nonindividualism: This refers to knowledgeable individuals.
- Monism / Nonmonism: These are metaphysical philosophies concerning the essence of known objects or reality.
- Relativism / Nonrelativism: This relates to the nature of knowledge acceptance.

Individuals with a rational scientific education will choose individualism, monism, and nonrelativism, according to dichotomous thinkers. Those who study science with an emphasis on social studies will choose nonindividualism, nonmonism, and relativism as their philosophical stances. Longino reinterpreted each pole positively and singled out the path of such thinkers, namely nonindividualism, nonmonism, and nonrelativism, on the path of non-divisional thought to which she considered herself to belong. Additionally, Longino selects an interpretation for each characteristic. Nonindividualism means that there is a connection between those who know, not that there can only be one person or a singular group of people who can know without this connection. Nonmonism in this context refers to realist nonmonism, i.e., the view that reality actually exists, but that there is not a single explanation or theory that can explain all physical-biological processes into a singular system of reality, so explanations of different aspects are not only possible but necessary. Nonrelativism entails denying the necessity of a singular set of justifications. There is no explanation for this absolutism. Within the context of the pedagogical method, justification must also be founded on rules and procedures. Therefore, it possesses contextualist characteristics. All of this is interpreted in a manner consistent with non-dichotomy thinkers (Longino, 2002a, pp. 91-93).

When choosing to look directly at Longino's pluralism, it can be seen that it is compatible with the interpretation of realist nonmonism which is rather near to Philip Kitcher's conception. However, it is not that we can have multiple self-performing theories, but rather that the assumption that there are multiple worlds would inevitably render it impossible to evaluate each theory using the same criteria. This is because each application corresponds to a distinct environment. Theoretical pluralism, as defined by Longino, refers to the existence of multiple theories that explain the one true world. In other words, each theory can explain some aspect of the world, but none can explain everything. Theoretical pluralism does not contest the possibility of a theoretical unity resulting from these various theories. Longino describes the fundamental understanding that pluralism has about the acquisition of knowledge, namely: (1) it is the plurality of how the world is presented, and it demonstrates how human wisdom organizes our understanding of the world; (2) a satisfactory epistemology must be open to theoretical plurality or theoretical unity as the end result of the knowledge acquisition method; (3) the purpose of theoretical pluralism is not to evaluate only with one epistemological option; and (4) epistemology must be modest; that is, it is not necessarily a comprehensive guide to knowledge, but it can explain the nuances and normative judgments inherent in knowledge discourse (Longino, 2002a, pp. 94-95, pp. 140-141).

Longino argues that the epistemological stance she employs is neutral regarding the origin of plurality. Her purpose in this section is to support her scholarly position regarding the rationale behind rejecting those dichotomies. However, is this the cause of the diversity of human abilities and interests, or does the world we seek to comprehend contain inherent diversity? The response is that theoretical pluralism is applicable to any origin. Longino is an example of a field that clarifies how this can be accomplished. An example of this is biology, which will be elucidated and discussed in the following section.

Pluralism and local epistemology

Longino notes that biology provides a clear illustration of how scientific knowledge can be explained by a multitude of diverse theories. This circumstance in biology should serve as a strong argument in favor of theoretical pluralism. Since the beginning of Darwinian biology, there has been debate over theories and methods, and at the turn of the century, there was disagreement over mechanism and vitalism in biology. Currently, there are debates in a variety of specialized disciplines. For instance, the theory of evolution debates selection's units and levels. In addition to debating whether behavior is natural or learned, behavioral biology employs various methods of investigating biology, such as those derived from the study of genes, biochemistry, physiology, and neurology. The extent to which DNA plays a function in cellular biology is the subject of debate. In the realm of practice, however, there is no need to await the conclusion of the debate and the discovery of the sole most accurate theory. This may result from the interest of practitioners in those sub-fields and whether there are any factors that draw their interest to enter the debate (Longino, 2002a, pp. 175-176), or it may result from accepting a particular method of explanation because it is already associated with certain values (Longino, 1990, pp. 83-102). It can be considered a hypothesis that incorporates social and intellectual context analysis, which is essential for comprehending a theory's scope and limits.

Longino gives us an example of a subfield in biology that has encountered debate over the suitability of its theories; she cites almost every branch of biology that studies living objects and the environments suitable for life. Such inconsistencies were discovered both at the theoretical level and in the research methods. In ecology, for instance, there is a debate about experimentation and measurement. There is evidence that the number of amphibians is progressively declining, which is a global phenomenon. A research group in Oregon reportedly conducted an experiment with the embryos of two species of frogs. One group was protected against ultraviolet (UV) radiation, while the other group was not. The experiment revealed that frog eggs that were shielded from UV rays developed substantially faster. Therefore, it was determined that UV radiation was a significant factor in the decline of reptile populations. However, many ecologists disagree because they believe that the data from this experiment lacks sufficient weight because it necessitates monitoring over a longer period of time and examining the entire ecosystem's population. This method, however, makes it more challenging to design an experiment because the experiment cannot encompass the entire system. If a system is simulated in order to restrict certain study parameters, it could be argued that the simulated system is not real. However, this type of experiment is still being conducted, and it can be seen that there is another value context hidden in it. For instance, one simulation system is chosen because of a certain factor, or there is an interest in limiting the scope of the study only. Consequently, it can be concluded that the study's outcomes are diverse. These studies have demonstrated that the explanations of various biological theories may have some overlap and are not necessarily incompatible (Longino, 2002a, pp. 177-178).

Longino concludes, based on the scenario of the cited research work, that the various characteristics of these cases refer to various aspects of the pluralism issue. Considered sufficient and acceptable in terms of knowledge, the plurality of a theory, whether in the explanation or the theory itself, can be derived from a variety of factors that fluctuate depending on the study method. There are two kinds of assumptions. The substantive assumption is a view of what the world is like, i.e., a world composed of subatomic particles or a world in a permanent state of change. The other perspective is that of methodological assumptions, which is the acceptance of how to acquire or create knowledge. There are many methods of arguing, not limited only to the field of philosophy. As exemplified by the issue of the acceptance or rejection of a particular experimental method in ecology, various viewpoints are possible within each academic field. From this, monism should be viewed as merely one of several

theories that hold substantive assumptions since the monists believe that there is only one correct way to describe the world (Longino, 2002a, pp. 184-185).

When one realizes that each scientific community or explorer is based on either substantive assumptions or methodological assumptions, as stated by Longino, it is possible to distinguish between the two. It is evident that each assumption serves both the research objectives and the research tradition upon which it is based. This decision was not deliberate, but rather the result of community deliberation. These are both substantive and methodological, goals and purposes. Justifications for linking hypotheses to goals and objectives are subject to critical analysis and discussion. These items are inextricably intertwined with the social values of a specific community's culture. This situation may be referred to as community's epistemology, in which there are methodological rules and procedures that are compatible with the community's interest in knowledge. There is a hypothesis and a research tradition or objective that corresponds with the hypothesis. According to Longino's terminology, knowledge-seeking activities with distinct characteristics are referred to as "local epistemology." The dynamic complexity of beliefs, norms, objectives, and practices, which can vary from community to community and even within the same community at various times, and the possibility of coordination between communities likewise (Longino, 2002a, pp. 186-187).

It is this point of local epistemology that Longino employs to consider the presentation of scientific theories consistent with pluralism. In a democratic society, the path of local epistemology is compatible and requires consensus. Scientific pluralism encourages the consideration of multiple points of view, recognizing that each side's arguments may be founded on different assumptions. In a democratic society, the decision to conduct science can be made without presuming that one scientific theory is necessarily more influential than another. However, these circumstances do not necessitate that scientific work is relative to external influences. This is because theoretical pluralism discourages the influence of authoritarian parties that can determine the nature of scientific knowledge. This, according to Longino, is beneficial for nurturing democracy in the scientific community (Longino, 2002a, p. 213).

Philosophical discussion

1. Criticisms of Kitcher and Longino on the account of democracy and pluralism

The examples of these two philosophers illustrate their view of the relationship between scientific advancement and democratic society, which may be utilized to create one's own interpretation of pluralism. They relate scientific pluralism to democratic society to explain scientific progress.

In the current trend of scientific pluralism research, scholars are familiar with and employ the methodologies of these pluralist philosophers of science. Jeroen Van Bouwel, an eminent scholar, admired Longino's pluralism and recognized its applicability to social science as a branch of science. According to Van Bouwel (2008), Longino's pluralism serves as a foundation for economics. Moreover, according to Van Bouwel (2009), general forms of pluralism can establish consensus when contemplating public policy regarding the application of science. Consequently, he recognized the necessity of science and democracy cooperating. Although there is some debate and it has not yet been determined whether scientific pluralism is compatible with the consideration of problems in a democratic society, in practice it appears to be a more consensus-generating alternative than other types of theories (Van Bouwel, 2014). Another prominent scholar, Stéphanie Ruphy, has noted that scientific pluralism has the advantage of eventually creating the possibility of unifying science in terms of knowledge, methods, and knowledge, or even of a previously considered metaphysical problem (Ruphy, 2016).

However, numerous papers by the two philosophers themselves reflect their viewpoints and their conversations with one another, particularly their 2002 correspondences. In his critique of Longino, Kitcher claims that the main idea of *The Fate of Knowledge* shows how

he misunderstood the rationality/society dichotomies. She makes the mistake of equating plurality with this misinterpretation, making Longino's pluralism unappealing (Kitcher, 2002a). Later, according to Longino who assesses Kitcher's book, *Science, Truth, and Democracy*, she explains that Kitcher has made an effort to involve democratic methods in assessing the intellectual relevance of research, which is the main point of the argument. His prior work lacked a clear hierarchy of significance; therefore, this looks to be a change from that. However, she bemoans the fact that it is not at all clear that there is a real distinction. Another key aspect is that Kitcher portrays valuing scientific knowledge as a successful technique. His own stance on conversation in democracies is at odds with this (Longino, 2002b). Kitcher suggests that when expenditures for scientific research are taken into account, Longino sees issues with the governance of science. Being a well-ordered science seems to give birth to a business's power to set the standards for assessing these things. Nevertheless, Kitcher sees that even if this is the case in practice, democratic cultures could still allow individuals to participate in the selection of the standards used to assess such research projects (Kitcher, 2002b). Longino argues that Kitcher's assessment of her as choosing not to be entrenched in the third way is the cause of his critique of her work. According to Kitcher's understanding of her suggested pluralism, it sounds like her pluralism is a main theory in and of itself. Because she does not think that one-sided pluralism should be her own position or that it is the sole valid theory, she rejects this form of misleading reasoning. In other words, her pluralism is not that excessive (Longino, 2002c).

In this section, I have a question asking about Longino’s version of theoretical pluralism. Has Longino achieved success? Based on what I have learned and discussed about her theoretical pluralism, I have determined that there are issues that require additional analysis and critique. It is crucial to observe that theoretical pluralism itself has some points that Longino has not adequately explained. These are the points that Philip Kitcher has made and that I agree with him. Even though Kitcher has critiqued nearly every aspect of Longino's *The Fate of Knowledge*, the issues in this article are limited to pluralism and facilitating scientific consensus, so I will only focus on Kitcher's concerns.

Kitcher observes that Longino attempts a flexible form in her pluralism. She believes that humans can have knowledge of various aspects of nature, and that it is our responsibility to visualize the world based on our abilities and interests. However, Longino leaps to the conclusion that our depiction of the world cannot be comprehensive and that there is no room for compromise. If human knowledge is compared to a representation of the world as we map it, it is not surprising that some aspects of the world will be represented on the maps we create, and there will be some aspects of what are not the same as the way the world is. Even though this map does not depict every aspect of the world, we still accept it as a good map. In such a case, however, we would say that the map can only depict a portion of the scene, not that it is impossible for the map to depict the entire scene. Therefore, Kitcher considers this interpretation of pluralism to be inadequate (Kitcher, 2002a, p. 555). I concur with this position from Kitcher. Longino asserts that her pluralism allows for the possibility that the results of knowledge with plurality in the theory may be a single theory that incorporates multiple theories. It demonstrates that she desires this pluralistic position to be tolerant. Therefore, since monism and individualism assert from the outset that there is only one real world and that only a limited number of people have access to it, a lenient denial of the veracity of such an approach would be to assert that a group or an individual can only show a partial picture of the world. To say that a group or an individual cannot represent the universe as a whole would be too strong and could be interpreted as contradicting what she herself had stated.

2. A proposal of new theory: Epistemic dependentism

In this section, I address another important claim about Longino's definition of knowledge and the non-dichotomous method of acquiring knowledge. Despite being an

essential claim, it is not analyzed as thoroughly as it should be to address the issue. For this point I see this same sort of problems occurring with Kitcher's position, either. Moreover, it has been argued previously that Kitcher was not cautious enough in how he understood the contextual notion of the pursuit of scientific knowledge. According to some academics, Kitcher was unaware that knowledge itself may be influenced by factors outside of it. Kitcher's error prevented him from realizing that his theory is sided more with monism, and that he could not support a pluralism more powerful than Longino's (Harron, 2008).

The strength of their contribution to the analysis rests in her notion of knowledge. With the knowledge that they had analyzed, which was the primary claim, were Longino and Kitcher able to conduct a thorough analysis? I observed that they also held the view that knowledge requires a knower, and that this knower can have an interest in and interact with the knowledge. This is evident, for example, from the passage in local epistemology that Longino discusses, which indicates that humans or their communities play a significant role in this function. Nevertheless, if another point is more accurate, such an analysis must promptly encounter issues. This is the purpose of recognizing that knowledge and those who possess it are genuinely interconnected and mutually influential. This influence of knowledge on those who know Longino and Kitcher did not analyze in depth. "The Question Concerning Technology" by Martin Heidegger demonstrates this point.

According to Heidegger's analysis of empirical knowledge, humans consider the natural world to have only a single discernible order. Such reasoning reflects mankind's efforts to acquire knowledge about nature. To manage and alter the natural world to function as a "standing-reserve" for human needs. This perspective on the natural world is evident in technological advancements. Heidegger also perceived the influence in reverse. In other words, the way humans perceive the natural world reflects on them, causing them to view themselves as standing-reserves that must be organized. By employing mathematics and physics to study the natural world, humans attempt to acquire knowledge from the perspective of this definite order. If this analysis is accurate, it will demonstrate that knowledge plays a greater role than previously understood by humans. Because one of its functions is to determine the method of knowledge acquisition. For instance, if knowledge of things must be in a particular order, then methods of knowledge acquisition that cannot provide such characteristics must be eliminated (Heidegger, 1997, pp. 3-23).

As a result, all those theories in scientific pluralism will face greater difficulty. This is because a theory that lacks these characteristics or is inferior to other theories cannot be supported, and a theory that has a definite order but does not entail the continuation of technology will also not be supported. Longino and Kitcher acknowledge that the justification of a community's knowledge may have intrinsic value. However, if they learned from Heidegger's analysis, they may have to deny the inherent value of technology in maximizing efficiency. This value not only determines how the world is represented, but it also precludes other methods or justifications for knowledge if they do not support the value concealed within it. If this Heideggerian approach to knowledge analysis is accurate, then their proposed scientific pluralism will encounter difficulties. This is possible because they disregard the fact that knowledge can also influence the knower.

According to Heidegger, it seems to me that from the issue of considering levels of scientific knowledge as Kitcher points out, as well as the method of acquiring knowledge in the manner of pluralism as proposed by Longino, we should pay more attention to the consideration of ground when evaluating knowledge. William F. Vallicella has proposed an intriguing theory regarding the consideration of facts in metaphysics, which he calls dependentism. His approach to the issue begins with the premise that the existence of objects is contingent. However, such truths must be supported by something to demonstrate why they are facts. It makes no sense to explain facts in terms of their constituent parts. These truths

ultimately depend on what unites them and their constituents into a singular unity. This is the sheer existence of the facts (Vallicella, 2002, pp. 195-199). Such a concept appears applicable to the field of epistemology and can be termed epistemic dependentism. Kitcher himself stated that it is possible to contemplate the epistemic significance of a successful scientific theory without abandoning the context in which it exists. Longino herself argued that local epistemology must be evaluated within the context of a community. This context can be regarded as the basis for scientific knowledge consideration. According to Kitcher, the function of ground is to integrate scientific theories into evaluations. Therefore, the purpose of the ordering of the significance of knowledge is to generate unity among scientific theories; they are in no way separate or independent foundations of existence. However, the consideration of scientific knowledge cannot be devoid of this basis. I refer to this as epistemic dependentism.

Similar considerations to my proposed theory have been made in the past, with some epistemologists referring to it as epistemic dependence. However, some philosophers associated it with a dependence between beliefs and evidence that led to the formation of beliefs (Hardwig, 1985), whereas the other associated it with learning potential that was dependent on external factors that were independent of the individual (Pritchard, 2015). However, I am rephrasing it here to refer to epistemological ground to explain how back-and-forth effects between knowledge and knower can occur through the phenomenon of knowledge. From my perspective, in order to ensure compatibility with epistemic contextualism, dependentism in this context must not only be explicated but also consider the necessity of a worldview in the study of science to elucidate the rationale behind the world's existence as it is described by contextualists. Furthermore, with regard to the terminology employed in scientific discourse, the concept of dependentism makes it clear that scientific concepts must be represented through language when presenting a scientific theory; the terms in that particular language are inextricably linked to the context of each scientific theory. This is because the meanings of words designating objects exist and coexist within the context in which they are used in scientific theories, and not because words possess true meanings independent of that context.

How can my new proposal address Heidegger's problem? The answer is that epistemic dependentism does not differentiate between knowledge and its possessor. It is not surprising that these two components constantly interact and influence one another. If this theoretical paradigm is employed, the explanation for pluralism will be strengthened. Because we can explain that being a knower in a particular context or locality is closely related to the knowledge that a person chooses to evaluate as knowing in the manner in which she knows. In a different context, the same interpretation can be made. Finally, it might be said that epistemic contextualism and epistemic pluralism are consistent with one another.

Conclusion

Although scientific progress can be explained through the lens of scientific pluralism or, in Longino's view, theoretical pluralism, and even if philosophers of science believe that the success and progress of science must be tied to the views that come from many sectors that create it under the consensus in a democratic society, creating a common conclusion that something coming out as a resolution must still be based on some ideas of contextualism. At this point both Kitcher and Longino were correct. The existence of such a specific criterion for evaluating progress demonstrates the epistemic dependence of binding successful knowledge to the ground that permits its explanation. This indicates that the ground of scientific knowledge plays a significant role in the creation of knowledge without being separated from it, but it must also be considered that it exists to establish the conclusion that advanced scientific knowledge has greater epistemic significance than scientific knowledge without such significance. This is what I refer to as epistemic dependentism, and I have demonstrated that neither Kitcher nor Longino have given it sufficient consideration.

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