Science and Engineering Ethics (2021) 27:6
https://doi.org/10.1007/s11948-021-00279-9

ORIGINAL RESEARCH/SCHOLARSHIP

The Value of 'Traditionality': The Epistemological and Ethical Significance of Non-western Alternatives in Science

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Received: 26 May 2020 / Accepted: 21 December 2020 / Published online: 2 February 2021

Abstract

After a brief review of the relationship between science and value, this paper introduces the value of 'traditionality' as a value in the pure and applied sciences. Along with other recognized values, this value can also contribute to formulating hypotheses and determining theories. There are three reasons for legitimizing the internal role of this value in science: first, this value can contribute to scientific progress by presenting more diverse hypotheses; second, the value of external consistency in science entails this value; and third, this value helps to eliminate some of the adverse social and cultural effects of Western science in non-Western societies. 'Traditionality' is an extrinsic epistemic value, according to the first two reasons, and at the same time, is an ethical value, according to the last reason. Also, the ethics of belief is adopted to further confirm the ethical role of this value. Finally, this paper discusses three potential criticisms that can be levelled against this idea and responds to each of them.

Keywords Tradition · Science and value · Underdetermination

Introduction

Although the definitions of tradition vary, there are commonalities among the various definitions. Tradition is a theoretical and normative framework as a prerequisite for utterance, thought, action, critique, and for going further. Tradition has a

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historical and social nature, without which knowledge and science cannot be realized. Tradition itself can be criticized, and since experience (along with the scientific community) is capable of invalidating given theories, traditional positions can thus be said not to be entirely subjective (MacIntyre 1988, pp. 176, 371; MacIntyre 1994, p. 65; MacIntyre 2006, p. 19; Popper 2014, pp. 36, 173–176; Polanyi 1946). Concepts such as worldview, belief system, and paradigm are concepts that are similar to the idea of tradition (see, e.g., MacIntyre 2006, p. 15).

Every tradition generally has scientific implications which might differ from those of other traditions. If a tradition makes a major contribution to a science or to a theory, then the science or theory can be attributed to that tradition. The role of the philosophical or metaphysical aspect of traditions in supporting the presuppositions of theories or the frameworks of the sciences is something that is well recognized (Burtt 1925; Plantinga 1996; Golshani 2000; Kawagley and Norris-Tull 1995). In this sense, for example, traditional Chinese medicine is Chinese due to the fact that the Chinese worldview plays a role in the construction of this science, and therefore differs from traditional Iranian medicine, for example.[1] Western science is similarly attributed to the Western tradition. In this sense, this science can be different from non-Western sciences.[2]

In this article, 'non-Western alternatives' refers to the beliefs or values of non-Western traditions which can, directly or indirectly, play a role in science. Also, non-Western alternatives include non-Western scientific theories, i.e. theories wherein the beliefs and values of non-Western traditions have been involved in their constitutions.[3] A non-Western theory might already exist in a scientific tradition, or it might be developed now. Although sciences might be different in this sense, this does not necessarily amount to the incommensurability or impossibility of comparative

[1] Chinese or Iranian natural philosophy holds that every body (physical being) is comprised of five (fire, air, water, metal, and wood) or four (fire, air, water, and earth) basic elements, respectively. It should be noted that these concepts have terminological meanings. Since both Chinese and Iranian medicine have origins in Chinese and Iranian philosophy, therefore Chinese medicine is based on 'five element theory' and Iranian medicine is based on 'four element theory' (Behmanesh et al. 2015). It should be noted that a tradition may have clusters or branches. In general, the branches of a tradition might differ in some problems, but they have common roots. A proposition or belief might not be recognized in all branches of a tradition. On the other hand, a statement in one tradition might also be acceptable in some other traditions.

[2] For example, Western medical science has a materialist worldview (Loudon 2001, p. 250), while Iranian medicine, for example, has a monotheistic worldview (Behmanesh et al. 2015). On the other hand, it has been demonstrated that worldviews can affect diagnosis and case formulation, and can have therapeutic implications (Josephson and Peteet 2008). As a case in point, there is a theoretical reciprocal interaction between Avicenna's medicine and Islamic philosophy (Zahabi 2019). Therefore, there are some differences between these two medicines. For example, Iranian medicine has a holistic approach to both diagnosis and treatment. In the monotheistic medicine, the esoteric intent of the therapist and his relation to God have an influence on treatment (Zeinalian et al. 2015). Also, prayer plays a role in this medicine whereas modern Western medicine does not have a clear understanding of the health benefits of prayer (see, e.g., Rezaei et. al. 2008; Jantos and Kiat 2007).

[3] Although the concepts of traditional knowledge and indigenous science have similarities with the idea of scientific tradition or to the scientific component of tradition in this article, they mostly refer to a kind of tacit knowledge or folklore, not to an exclusive framework that includes theoretical and explicit knowledge (ICSU 2002; Snively and Corsiglia 2001).

studies (Douglas 2014; Bala and Gheverghese Joseph 2007; see, e.g., Rezadoost et al. 2016; Heyadri et al. 2015).

Today, mainstream science mostly falls within the ambit of the modern Western tradition, i.e. the modern Western worldview makes the main contribution to the construction or modification of the sciences and to the formulation of most theories. This article attempts to answer the following questions: Should non-Western scientists pay attention to their traditions in their scientific inquiries? What is the significance of non-Western alternatives in the pure or applied sciences? As this issue is completely related to the discussion of science and value, we can therefore proceed to ask: What is the role of the value of 'traditionality' in science? Can this value be seen as a threat to science? Or, conversely, can it lead to scientific development?

Rejecting the ideal of value-free science, the main issues include which values are legitimate in science? And, when and how are values legitimate? (Douglas 2016) This article first gives a literature review of science and value. Next, the value of 'traditionality' is discussed with respect to this issue. Since the external role of this value (e.g., selecting the research problem) is not so challenging, its internal role (the epistemological validation of scientific theories) is evaluated. Three arguments are provided to legitimize the internal role of the value 'traditionality' in both the pure and applied sciences. The first argument demonstrates that it can contribute to scientific progress. The second argument states that external consistency, as a recognized value in science, implies the value of 'traditionality'. One of the common justifications of values in science is based on underdetermination. Most of the literature is descriptive. One of the less-discussed issues is the analysis of underdetermination from an ethical point of view. For example, when a scientist or a scientific community encounters an underdetermination during research, the question arises as to what should be done 'ethically'? In addition to the epistemological aspect of this value (the first two arguments), its ethical aspect (the correlation of this value with the social responsibility of scientists) will also be mentioned in the third argument. Finally, three possible criticisms will be discussed and responded to.

Science and Value: A Literature Review

Contrary to the notion of science as being value-free, there is a well recognized body of philosophical literature on the value-ladenness of science, which shows that the presence of value in science is rationally possible, desirable, or even necessary (Douglas 2016). Values and their roles are explained in the pure and applied sciences (Hansson 2007; Diekmann and Peterson 2013). The role of value in science is divided into two types: external and internal. The first includes the role of value in selecting the research problem, identifying the research method, and its role in the practical application of scientific theories; and the second consists of the role of value in the epistemological validation of scientific theories (Douglas 2009).

Values in science are also considered to be epistemic or non-epistemic. The first includes the following: predictive accuracy, consistency (internal and external), scope, simplicity, fertility, refutability, unifying power, and explanatory power (Kuhn 1977; McMullin 1983; Longino 1990; Lacey 1999). Sometimes metaphysical

commitments are also considered to be epistemological values. The latter includes social values (freedom, justice, democracy, property rights, technological advancement, economic development, profit, empowerment of participants); and moral, personal, religious, aesthetic, political, and cultural values (Rooney 2017; Lacey 2017). Epistemic values are criteria for truth attainment, and non-epistemic values are qualities that do not reliably promote the attainment of knowledge (Elliott and Steel 2017, p. 3). They are generally deemed to be applied values. The internal role of epistemic values is considered to be legitimate. It has also been argued that epistemic values take precedence over non-epistemic ones, and that the entry of non-epistemic values through epistemic values is legitimate. However, this distinction and its related discussions are controversial (Douglas 2013; Laudan 2004; Elliott and McKaughan 2014; Hicks2014).

The most challenging argument is the internal role of non-epistemic values.[4] Reasons have been given for legitimizing this role, including underdetermination. Other reasons also refer to underdetermination since they are one of its particular cases (Biddle 2013; cf. Brown 2013). According to underdetermination, empirical data or evidence is not sufficient to determine a theory, because several theories can explain these data at the same time. Under these conditions, scientists fill the gap between experimental data and selected scientific theory with values. In other words, scientists consciously or unconsciously choose between equivalent theories by employing values. And although epistemic values are necessary for the determination of theory, they are not sufficient for eliminating the underdetermination problem. Ultimately, a theory is chosen from among the alternatives by employing non-epistemic values (Douglas 2000, 2017; Biddle and Kukla 2017). Some scholars have argued that scientists should be appropriately transparent about their value commitments (Douglas 2009; Elliott 2020).

There are three interpretations of the underdetermination thesis: First, Transient Underdetermination states that *some* scientific theories are underdetermined by logic and the *available* empirical evidence. Second, Permanent Underdetermination states that *some* scientific theories are underdetermined by logic and *all* of the empirical evidence. Third, Global Underdetermination states that *all* scientific theories are underdetermined by logic and *all* of the empirical evidence (Kitcher 2001).

Underdetermination has also been explained for the applied sciences. In technology, for example, in many stages of design, designers are faced with the choice between equivalent alternatives, where engineering sciences alone cannot determine the superiority of a given design. In other words, there can be several different designs for one functional purpose (see, e.g., Bijker et al. 1987; Van de Poel and Royakkers 2011, p. 178). However, in practice, non-technical values such as social, cultural and political factors lead to the determination of a design and to the termination of the underdetermination (Feenberg 1995, p. 4; Feenberg 2008; Feenberg 2010, pp. 109, 135). The underdetermination of technology design is like the

[4] For example, some scholars maintain that "sound social values as well as sound epistemic values must control every aspect of the scientific research process, from the choice of research questions to the communication and application of results" (Kourany 2013).

underdetermination of scientific theories and requires selection from equivalent alternatives. Medicine, likewise, faces an underdetermination in the perception of diseases and in their therapy (Chin-Yee 2014; Feragen 2017). In other words, in many cases, there are equivalent theories or therapies concerning a single disease.

Arguments in Defense of the Value of 'Traditionality' in Science

Scientific inquiry has stages. Although the details are open to discussion, yet three main phases can be generally propounded: "(1) A pre-epistemic phase, during which research programs are chosen, hypotheses are formulated, and experiments are designed and conducted. (2) An epistemic phase, during which hypotheses are evaluated in terms of their relationship to empirical evidence, among other things, and accepted or rejected. (3) A post-epistemic phase, during which accepted hypotheses are utilized in other research (whether to produce more knowledge or new technology or both); this phase also includes the impacts of the accepted hypotheses on the broader society" (Hicks 2014). In the following arguments that defend the value of 'traditionality' in science, the roles of this value will be mentioned in the different stages of scientific inquiry.

To Sustain Scientific Progress by Proposing More Hypotheses

The formulation of hypotheses is generally rooted in scientists' psychology or sociology (Kuhn 1970). Scientists typically borrow presuppositions from their societies. In addition to common presuppositions, Western and non-Western societies also have presuppositions that are not held in common. Therefore, the hypotheses offered by Western scientists (Western hypotheses) might differ from the hypotheses offered by non-Western scientists (non-Western hypotheses). But non-Western scientists formulate relatively fewer non-Western hypotheses, as the vast majority of the official sources in universities today and the common theoretical frameworks in universities are generally Western. The value of 'traditionality' simply as another value beside other recognized values in science invites non-Western scientists to pay attention to non-Western alternatives in the pre-epistemic stage; that is, either to propose available traditional scientific theories as new hypotheses or to formulate new hypotheses using some presuppositions from their non-Western worldviews or traditions. If the hypotheses can be empirically evaluated, irrespective of whether or not we distinguish between discovery and justification, this recommendation would not be illegitimate within the framework of current mainstream scientific thinking.

This approach allows for a variety of hypotheses to be globally formulated for a given scientific problem in the pre-epistemic stage and then to be evaluated in the epistemic phase. Finally, comparative studies of the results of these experiments increase the likelihood of finding a better theory. Falsificationism about the nature of the growth of science (conjectures and refutations) yields the insight that the increase in proposed hypotheses increases scientific progress (Popper 2014; cf. Gilles 1993; MacIntyre 2006, p. 187). For example, the value of 'traditionality'

invites Chinese, Indian, or Iranian scientists, to explain or treat a specific disease if possible, through available Chinese, Indian, or Iranian medical theories respectively, or to formulate hypotheses within their respective theoretical frameworks.

According to the definition of the World Health Organization, traditional medicine "is the sum total of the knowledge, skill, and practices based on the theories, beliefs, and experiences indigenous to different cultures, whether explicable or not, used in the maintenance of health as well as in the prevention, diagnosis, improvement or treatment of physical and mental illness" (WHO 2013). Prior to the recognition of traditional medicine in the contemporary era, reports indicated that many people around the world used traditional medicine without the support of insurance or of the government. The WHO has attributed the development of traditional medicine to its strengths: compatibility with the nation's culture, holism, and applicability (acceptability, safety, and being economically justified). Therefore, the WHO, referring to the lack of medical access for many people in some countries and to dissatisfaction with modern medicine (especially in the treatment of chronic diseases and considering the side effects of chemical drugs), advises countries to pay attention to traditional medicine. Initially, traditional medicine was considered to be complementary or alternative; but due to its remarkable successes, today the approach of integrative medicine has entered the dialogue of the mainstream (Jameson et al. 2018, p. 3462). Furthermore, pharmaceutical researchers can increase the efficiency of detecting active ingredients by basing their hypotheses on traditional medical sciences. It seems that if theorizing in medicine were limited to the confines of modern Western science and did not pay attention to the theories of traditional medicines, then it would be impossible, difficult, or more time-consuming to achieve these benefits.

The value of 'traditionality', in addition to the pre-epistemic stage, can also function in the epistemic stage. If an underdetermination occurs, as mentioned earlier, values can lead to the determination of theory. Here, too, adding the value of 'traditionality' to other determinant values can make it easier for the local scientific community to choose a theory from competing theories, just as increasing the constraints for an underdetermined mathematical problem can pave the way for obtaining an answer. If permanent or global underdetermination is considered, the importance of values, including 'traditionality', in arriving at a determination will increase.

This value is not just a value to limit the selection options but has its specific function. The presence of this value in the set of determinant values works in favor of the multiplicity of presenting hypotheses at the global level and leads to the testing of more hypotheses around the world, and consequently leads to an increase in scientific progress.

For example, if underdetermination occurs in a specific problem that arises in Chinese, Indian, or Iranian society, the inclusion of 'traditionality' as a value will give more weight to Chinese, Indian, or Iranian theories respectively. Ultimately, compromise between all values including that of 'traditionality' might lead to the choice of traditional theories, but in any case, reaching a final decision is facilitated by the addition of one more determinant value at the local level. At the same time, this value increases the probability of introducing a variety of theories concerning an issue globally, and consequently increases the likelihood of finding the better

theory with comparative studies. The role of this value at the pre-epistemic stage is in prompting alternatives at the global level; and in the epistemic stage, lies in helping to overcome underdetermination and reducing equivalent theories at the local level so that equivalent theories can be increased globally. The function of this value at both stages fosters scientific progress.

This approach is like increasing the number of participants (theories) from different countries (traditions) in a global competition. As another example, this approach is similar to plant breeding in that it first increases the genetic diversity of a crop (theories concerning a problem) and finally, after inspection of the genotypes (theories) takes place, the optimal genotype is found. Just as genetic diversity and richness in plant breeding is a value, the presence of diverse scientific theories is also a value in bringing about scientific progress.

Some points should be noted here. First, global agreement on a theory will not necessarily lead to the extinction of local (traditional) theories. For example, a medical theory and practice or some ecological knowledge might be optimal only locally due to cultural factors. Similarly, a genotype has several phenotypes (observable characteristics). This means that the optimality of a genotype depends on its location, because a phenotype is influenced by its environment as well as by its genotype. Second, experiment, observation, and theory choice might be controversial (Chalmers 1990). So, a better theory which is globally selected cannot be considered definitive. For these two reasons, the problem of the 'progress of science' can turn into the problem of the 'progress of the sciences'. Third, it cannot be concluded that the selected theory, if found, necessarily is independent of any tradition. Global acceptance of a theory does not eliminate its dependence on its foundations.

The Entailment of the Value of External Consistency

Consistency is a value that plays a role in evaluating the content of scientific theories. It includes two subtypes: internal and external. Internal consistency means that there is no self-contradiction in the theory. This epistemic value is a necessary condition for truth. External consistency means that the hypothesis in question is concordant with, or at least is not contradicted by, its surrounding scientific theories and hypotheses, or beliefs that are widely accepted. External consistency makes the application or extension of a new theory or background theories easier. The epistemological value of external consistency is context-dependent (Steel 2010; Biddle 2013; Douglas 2009).

Some background beliefs of Western and non-Western scientists might be different. This means that during the process of hypothesis formulation or theory choice, if all the values are the same for Western and non-Western scientists (even given their different weightings), then the epistemic value of external consistency might point each scientist to a different hypothesis or theory. Therefore, if the epistemic value of external consistency is recognized as legitimate, then the value of 'traditionality' will be accepted.

As an example, when a Chinese or Iranian scientist formulates a medical hypothesis in the pre-epistemic stage, or evaluates a proposed hypothesis in the epistemic

stage (including the choice among equivalent alternatives), he or she consciously or unconsciously takes other background beliefs, values and theories into his or her consideration, even those in the architecture of his or her culture, because there are connections between medicine and architecture in a tradition such as the Chinese or Iranian tradition (Pollio 1914, p. 10; Jiang 2014; Hamzehnejad and Servati 2018). Medicine has been effective in shaping the architecture of buildings and in urban design. At the same time, architecture has raised issues against medicine and provided a framework for it. As such, these mutual implications might lead the Chinese or Iranian scientist to formulate a hypothesis or to choose a theory within the context of traditional Chinese or Iranian medicine. Similarly, from this perspective, the non-Western architect or urban planner also takes traditional medicine into account in his or her designs. Of course, one should not overlook the fact that ultimately, a theory or technological design is chosen by taking all values into account and by giving specific weights to each value. Theory (or design) choice might be controversial. That is why the demarcation between mainstream medicine and complementary health care varies from one culture to another over time (Jameson et al. 2018, p. 3462). Of course, these changes over the past decade have led to a better understanding of the capabilities of traditional medicines, to their gradual integration with modern Western science, and ultimately, to providing improved health care around the world.

Reducing the Adverse Cultural Effects of Western Science in Non-Western Societies

In the post-epistemic stage, sciences might involve risks. It is necessary to be informed of such risks in order to be able to manage these risks. It is more likely that the risks of a theory found in the history of a given society's scientific tradition, or which are in some way related to the beliefs and values of a society, will be better known because they are generally experienced by that society over long periods of time. In other words, non-traditional theories are more likely to have more unknown risks.[5]

Also, scientific theories might have unintended and undesired cultural effects—cultural or social risks. For example, the applied sciences might change lifestyles by producing technologies, and the theories within the pure sciences might strengthen the biased stereotypes of certain social groups or challenge commonly held religious beliefs (Hicks 2014; Longino 1990; Plantinga 2011). Here, we focus on the adverse cultural effects and social risks of theories, which are usually paid less attention to.

The direct and indirect implications of a Western science or theory might be incompatible with the beliefs and values of a non-Western society as a consequence of its presuppositions and context. These discrepancies might, in principle, have adverse cultural effects on the society which assents to the science (see, e.g., Nasr 1993, Ch. 6; Nasr and Iqbal 2007; Shayegan 1997). Socially, the persistent

[5] In all of these cases, society can be thought of as a laboratory (Van de Poel 2013, 2016). This issue has ethical implications.

incompatibility of the beliefs and values of a society and the sciences weakens the bond between science and society, and ultimately either the scientific progress of that society is stifled or the integrity of society's identity is undermined. From the perspective of social psychology, this incompatibility leads to cognitive dissonance: a type of stress or mental disorder that is caused by conditions such as the induction of two or more contradictory beliefs or values in the same person (Festinger 1957; Fischer et al. 2008).

The challenge between science and religion is one of the best examples of this matter (Reich 1989). Different approaches have been proposed to explain and resolve the conflict between scientific theories and religious beliefs and values (Ferngren 2017; Plantinga 2011; Harrison 2015). At one end of the spectrum is the rejection of science, and at the other end of the spectrum is the rejection of religion. With respect to this matter, the value of 'traditionality' helps to eliminate this conflict in some cases.

To take an example from the pure sciences, standard quantum mechanics holds that the material world has an indeterministic and accidental essence whereas the worldview of a society or culture might not agree with such a view (see, e.g., Born 1971; Smith 2005; Nasr and Iqbal 2007). What should the role of a scientist be in such a situation? The epistemological task of a scientist is to provide a theory to explain the empirical evidence. Initially, the scientist is not going to challenge the worldview of his or her society, unless his or her epistemological task logically requires the rejection of that worldview. In this situation, the value of 'traditionality' requires that while the scientist is fully committed to epistemic values, he or she has to provide a theory that is consistent with or at least not inconsistent with society's worldview. Therefore, the value of 'traditionality' in the example of quantum mechanics in such a society or culture would favor alternative theories based on causal models such as Bohmian mechanics (Albert 1994; Cushing 2019). Of course, the final choice is made by taking all values into account and by giving specific weights to each value. Also, as seen in this example, the value of 'traditionality' does not necessarily imply a white or black evaluation of a theory. The existence of a presupposition consistent with the tradition in the set of presuppositions of a theory predisposes the value of 'traditionality' toward that theory to a certain extent.

The cultural and social impacts of the medical sciences can be considered as an example of the applied sciences. Unlike the past, modern Western medicine accepts a plurality of modalities to some extent, and has peripherally included spirituality and religion with its physical and mental health care in the last two or three decades (Seybold and Hill 2001; Ellison and Levin 1998; Powell et al. 2003). But the Western medical tradition is predominantly based on the Western assumptions of naturalism and reductionism and is materialist in its approach (Gordon 1988; Kingma 2017; Loudon 2001, p. 250). On the other hand, some cultures, in the context of their spiritual or religious worldviews, have direct and indirect implications for medical theory and practice (Helman 2007; Koenig et al. 2001; Josephson and Peteet 2008; Zeinalian et al. 2015). Suppose a researcher can formulate a hypothesis or select a theory within a modern Western or traditional framework to solve a medical problem. Suppose further that each of these two theories meets all epistemic and non-epistemic values equally. *Ceteris paribus*, including the value of 'traditionality'

in the scientific inquiry ensures that the formulated hypothesis or chosen theory will be one that falls within the worldview of the society of the scientist, thereby mitigating the unintended and undesirable cultural and social consequences of the Western alternative.[6]

The Value of 'Traditionality': Epistemic or Non-Epistemic

Epistemic value is a truth-referring value and is divided into two types: intrinsic and extrinsic. Intrinsic epistemic value is the value which manifests the constitution of truth attainment or the necessity for truth, such as empirical adequacy or internal consistency. Extrinsic epistemic value is a value that is not the intrinsic value but one that indirectly promotes the attainment of truth. For example, the testability criterion is an extrinsic epistemic value because it is not necessary for truth (a testable theory might have a wrong prediction, and a non-testable theory might be truthful), while it can help to achieve the truth by enhancing the efficiency of scientific inquiry (Steel 2010). Whether values such as simplicity, external consistency, and testability actually promote truth attainment will depend on the context (Douglas 2016).

The first argument in this paper shows that the value of traditionality helps to enhance the efficiency of scientific inquiry by providing a wider variety of hypotheses or theories, leading to scientific progress. Besides, this value is not necessary for truth. Therefore, the value of 'traditionality' can be considered to be an extrinsic epistemic value. The second argument also shows that the epistemic value of external consistency entails the value of 'traditionality'. External consistency is not a necessity for truth, because a true statement might be inconsistent with some background wrong beliefs (Steel 2010). On the other hand, external consistency plays an epistemic role because it provides the basis for scientific inquiry (Douglas 2009). In addition, according to the Duhem-Quine thesis, it is impossible to test a hypothesis in isolation, i.e., with no background assumptions or auxiliary hypotheses (Gilles 1993). In another way, this thesis also shows that the existence of surrounding beliefs is necessary to scientific inquiry. External consistency, then, is an extrinsic epistemic value. Because this value entails the value of 'traditionality', it also confirms that the value of 'traditionality' is an extrinsic epistemic value.

It should be noted that 'traditionality' or external consistency often plays a role in science, consciously or unconsciously, provided that there is a sound connection between the science and the society. Western scientists are more committed to the 'traditionality' or the value of external consistency than non-Western scientists who mostly study Western science and who are educated in a Western context, many of whom are unfamiliar with their traditions. In some cases, it has even been shown

[6] This paper mainly focuses on the theoretical or philosophical presuppositions of theories or sciences but practical or normative presuppositions can also be considered. For example, Iran's demographic predicament, between the 1910's and 1940's, differed from that of most Western countries. Nonetheless, Iranian modernists' perceptions of the problem were influenced by contemporary Western debates about demography, hygiene, genetics, and eugenics (Schayegh 2004).

that non-western scientists' perceptions of themselves are within the Western perspective (Smith 2012; Iqbal 2009). The advantage of 'traditionality' over external consistency is that 'traditionality' draws the attention of non-Western scientists to their dual context situation.

Today, science has become one of the most influential institutions in society (Ziman 1984). There is a point of view which believes that science is entirely good and should be expanded limitlessly, regardless of its social consequences. This view has been met with a significant amount of criticism, especially in view of the problems of the modern age such as the threat of nuclear war and the environmental crisis. The social responsibility of scientists has been raised as an objection against this view (Mitcham 1985; Douglas 2003; Resnik and Elliott 2016). This viewpoint maintains that science is a profession, and that scientists, as professionals, have a social responsibility and must be accountable to the general public for the work that they do (Davis 1995). For example, physicians are not only responsible for their patients but are also responsible to society[7] (Shamoo and Resnik 2015, p. 5). This responsibility includes not only professionals working in the applied sciences, but also those in the natural sciences as well (Douglas 2003; Popper 1971). Numerous scholars have argued that scientists have a responsibility to disclose the social implications of their research (Kitcher 2001; Douglas 2009; Børsen et al. 2013). Not only are there ethical guidelines for scientists' social responsibilities, but sometimes there are regulations as well. In some cases, the study of the social impacts of scientific research is one of the criteria for governmental selections of proposals (Shamoo and Resnik 2015, p. 143).

The third reason indicates that a non-Western scientist might be in a situation where the result of his or her work produces either a Western theory or a non-Western theory, where almost all values were met in both cases. Even so, the former might have unintended social and cultural consequences due to the incompatibility of the theory with his or her society's worldview, while the latter does not. In this situation, the value of 'traditionality' increases the likelihood of proffering non-Western theories to non-Western societies, thus helping the scientists to fulfil their aforementioned social responsibilities and moral duties. To come at it from the other side, it can thus be stated that under such situations, the non-Western scientists' preference for Western alternatives can be unethical. Therefore, the value of 'traditionality' is not only an epistemic value but also an ethical value. This dual function is also seen in some other values. For example, the epistemic value of simplicity in the choice of a given theory is also an aesthetic criterion.

Apart from the social and cultural issues, the political aspects of western science can also be examined. There is evidence that shows there might be links between western science and imperialism or colonialism (Vlahakis et al. 2006; Harding 2011; Krige 2008). "Academic knowledges are organized around the idea of disciplines and fields of knowledge. These are deeplyimplicated in each other and share genealogical foundations in various classical and Enlightenment philosophies. Most

[7] As a case in point, over-prescribing antibiotics might be beneficial to the patients of a doctor but can create drug resistance in the community as a whole (Porco et al. 2012).

of the 'traditional' disciplines are grounded in cultural world views which are either antagonistic to other belief systems or have no methodology for dealing with other knowledge systems. Underpinning all of what is taught at universities is the belief in the concept of science as the all-embracing method for gaining an understanding of the world. Some of these disciplines, however, are more directly implicated in colonialism in that either they have derived their methods and understandings from the colonized world or they have tested their ideas in the colonies" (Smith 2012, p. 68). In such cases, imperialist or colonialist approaches are reflected in specific forms of some western science or theories. This science can act as a gatekeeper to the traditional ways of being, knowing, and doing of postcolonial populations. Postcolonial studies has provided detailed criticisms to Western science as the unique source of knowledge and in some cases tries to integrate marginalized knowledge with mainstream science (see, e.g., Racine 2003; Boisselle 2016). Since attempts to indigenization or decolonization of science is often challenging (Smith 2012), the value of 'traditionality' provides an epistemological and ethical basis for postcolonial approaches and helps to lead sciences away from possible imperialist tendencies.

The ethics of belief is another framework in which the ethical role of 'traditionality' can be evaluated. It can be shown that when an empirical equivalence of Western and non-Western theories occurs, or when the formation of both Western and non-Western hypotheses is equally possible, non-Western scientists' belief in non-Western alternatives is ethically acceptable and sometimes even necessary. Beside the epistemological aspect, this means that 'traditionality' can be seen as an ethical value.

Belief in a proposition means belief in the truth of a proposition. Evidentialism holds that individuals are required to form beliefs based on sufficient evidence (Clifford 1879). Leaving aside the criticisms that have been levelled against evidentialism (Dougherty 2011), since there is not any determinant evidence in favor of any equivalent alternatives (this being the definition of equivalence), the criterion of evidentialism does not apply. Non-evidentialism argues that in the 'genuine option' (selection), we are required to form a belief based on insufficient evidence. The genuine option is a condition in which the choice about a momentous issue between the available options is inevitable, despite the fact that there is no convincing evidence to swing the decision in a particular direction (James 1979). Common types of non-evidentialism include practical non-evidentialism, conservatism, and fideism.

Practical non-evidentialism, which can be used to justify the value of 'traditionality', involves two approaches. First, the pragmatic or prudential approach which emphasizes the primacy of the practical and believes that in the absence of evidence, we must form a prudentially beneficial belief (James 1979). The first argument in this paper shows that the non-Western scientist does not have enough evidence to choose a theory in cases of underdetermination, but that at the same time, belief in a non-Western alternative has the benefit of increasing the probability of scientific progress. Therefore, pragmatic non-evidentialism recommends that the 'traditionality' should not be overlooked as a value in scientific inquiry. Of course, pragmatic non-evidentialism often sees a kind of exigency or passionate interest necessary for a subject in forming a belief. As such, the scientists who are able to take advantage

of the value of 'traditionality' will be the ones who feel a need or interest in maintaining and fostering their own tradition and culture.

The second approach is ethical in which it is recommended that a belief can be formed from an ethical standpoint. Kant believed that if there is not enough evidence for the proposition *p*, and if someone has adopted an ethical end that required the truth of *p*, and if all the available evidence refers to the truth of *p*, then it is permissible and sometimes even necessary to take *p* as true (Chignell 2007).

The third argument of this paper shows that where there is equivalence, all three abovementioned conditions will have been met: there is not enough evidence to choose a non-Western alternative because of the equivalence; the scientist's ethical obligation (social responsibility) demands that the scientist believes in the non-Western alternative which is compatible with the worldview of his or her community; and all available evidence points to the truth of the non-Western alternative. Therefore, the non-Western scientist's belief in the non-Western alternative is permissible and sometimes even necessary. This means that the scientist must ethically be committed to the value of 'traditionality'.

Criticisms and Responses

There might be criticisms against the value of 'traditionality' in science. Here are three possible objections and the responses to them.

Firstly, it could be objected that this value might lead to prejudice, leading scientists of any culture irrationally to insist on the traditional theories of their own respective cultures. In response, it should be said that this is a practical objection, not an inherent objection, and that similar objections obtain for other values. Epistemic and non-epistemic values such as simplicity and economic value can contribute to the progress of science, but in some cases, can also lead to the deviation of scientific research (Stephan 2012; Resnik 2007; Stecher and Fürnkranz 2016; Webb 1996). Improper use of a value does not essentially invalidate that value. The point to note here is that a single value is not the only criterion and other legitimate values should be considered in scientific inquiry.

Secondly, it can be said that the value of 'traditionality' might cause a country's scientific progress to lag behind as it is possible for the investment in some non-Western alternatives to remain ineffective and not provide a good return on investment. In response it can be said that a similar objection can be levelled against Western alternatives. Also, there are various institutions and scientists in each country, many of which will remain occupied in the practice of conventional science by virtue of the effects of regulations or government investment. In addition, the rest will not necessarily have the same theoretical choice. For example, simplicity and external consistency can be interpreted in different ways (Kuhn 1977). Besides, research with null results and publication at the present period are not only recognized (Ferguson and Heene 2012) but also, from a falsificationist point of view, such research is required for scientific progress (Van Witteloostuijn 2016). Therefore, the value of 'traditionality' as a deciding factor can help to enhance overall scientific growth.

Another version of this critique states that traditions (Western and non-Western alike) have the potential of suppressing certain hypotheses. Therefore, it cannot be concluded that this value does not play a positive role in scientific progress. In response, it should be stated that there are historical cases in which some traditions suppress certain hypotheses,[8] just as they engendered and fostered other ones. But the construction of the traditional sciences, and furthermore, the global competition between them, can help to illustrate the strengths and weaknesses of every tradition in every field. This requires recognizing the value of 'traditionality'. Additionally, the results of these comparative studies might be used to spur the growth of traditional sciences or theories. Thus, the competition might continue unabated (MacIntyre 2006, p. 20).

Thirdly, it can be objected that the traditional alternatives that have already been proposed are rejected in the epistemic stage, or are verified and then sustained in the post-epistemic stage and that in either case, such alternatives have no other theoretical or practical capacity to flourish. Therefore, it would be unreasonable to refer to non-Western alternatives in new research. In response, it must be said that the history of science has repeatedly shown this claim to be indefensible. Chaos theory was born out of Newtonian mechanics at a time when it was thought that there are no unknown capacities remaining for this mechanics (see Scheck 2010). Another example is that the evidence for the efficacy of traditional medicines (at least in the last two or three decades) indicates that there might be theories that are effective in explaining and treating certain diseases, while the western scientific communities either declare them to be illegitimate or exclude them from their research altogether. The resurgence of traditional medicine in China due to social and political factors was initially opposed by modern Western medicine but is now recognized throughout the world in academia (Jameson et al. 2018). Traditional Iranian medicine, which was not recognized by the government and faced some legal restrictions in Iran (WHO 2001; Zakersalehi 2017), is now allowed to operate after the recommendations of the WHO, and is now gradually becoming a normal science again (Ayati et al. 2019).

'Traditionality' as a value has been considered as legitimate in the past. For example, in a letter to Pope Paul III, Copernicus described the process of the formation of his theory. After dealing with his theoretical dissatisfactions with Ptolemy's astronomy, Copernicus stated his doubts about geocentrism, which was a common belief in the scientific centers of his era. Copernicus then turned to the doctrines that

[8] For example, ancient Greek astronomy was limited to the circle in modeling the motion of celestial bodies due not only to observations but also to certain metaphysical assumptions (Aristotle 1939); Lysenkoism as a Marxist view rejects mendelian genetics (Lewontin 1976; Stanchevici 2017; Huxley 1949); modern Western medicine ignored or rejected traditional medicines for a long period of time, and continues to do so in some cases (WHO 2001; Zakersalehi 2017); some Western approaches were initially skeptical or hostile to fuzzy logic as a many-valued logic due to their cultural backgrounds while Japan as an eastern country accepted it earlier and made significant strides in control engineering as a result (Kosko and Toms 1993). Also, the ethical constraints imposed by tradition can affect scientific development. For example, Islamic and Christian traditions have decided restrictions on human cloning and believe that scientific progress should be moral (Larijani and Zahedi 2004; Cole-Turner 1999).

predate Aristotle, such as the Pythagorean doctrine, and carefully read all the existing books written by the ancient philosophers. Copernicus realized that there were philosophers who had other postulations and believed that the earth is in motion. He explicitly begins his reform by citing these sources alone, and takes the rotation of the earth as the starting point of his research, knowing that the idea would seem absurd at first glance (Copernicus 1543). By demonstrating the function of 'traditionality' in the exact mathematical sciences, Copernicus shows his interest in past scientific traditions (Granada and Tessicini 2005).

Conclusion

Tradition is a theoretical and normative framework which acts as a prerequisite for utterance, thought, action, critique, and for going further. Tradition has a historical and social nature, without which knowledge and science cannot be realized. In this article, non-Western alternatives refers to the beliefs or values of non-Western traditions which can, directly or indirectly, play a role in science. Also, non-Western alternatives include non-Western scientific theories, i.e. theories wherein the beliefs and values of non-Western traditions have been involved in their constitutions. Also, the value of 'traditionality' is introduced as a value which gives more weight to traditional alternatives in hypothesis formulation or theory choice.

The main question of this article is whether non-Western alternatives should be preferred by non-Western scientists, *ceteris paribus*. In other words, when an equivalence of Western and non-Western theories occurs, or when the formulation of both Western and non-Western hypotheses is equally possible, whether non-Western scientists should prefer the non-Western alternatives. Three arguments are provided to show that the value of 'traditionality' is a legitimate value along with other recognized values in science. First, this value can contribute to scientific progress by presenting more diverse hypotheses. Second, the legitimate value of external consistency entails this value. Third, this value helps to eliminate some of the adverse social and cultural effects of Western science in non-Western societies.

The value of 'traditionality' is an extrinsic epistemic value, because this value can lead to scientific progress while it is not a necessary condition for truth, and also because external consistency as an extrinsic epistemic value entails the value of 'traditionality'. Based on both the social responsibility of scientists and practical non-evidentialism, 'traditionality' is an ethical value as well.

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