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Toward a Social Phliosophy of Science: Integrating Virtue Epistemology and STS

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Abstract

This article looks at the sources of micro-tensions between the science and technology studies (STS) approach and a human perspective in virtue epistemology (VE), opening it to societal influence. It calls for a holistic approach that respects both the societal pull and the individual's moral compass in scientific activities. It ends up by pointing out the necessity of such a cross-cutting approach for a more ethically motivated and socially aware science, but it suggests an option of research to be carried out in the future about the incorporation of virtues in scientific practices and adapting science to society's needs. The review section of the literature is designed to develop concepts within the STS and VE, grounding them on seminal works from scholars like Bruno Latour, Thomas Kuhn and Donna Haraway. It sticks to things like paradigm shifts, Actor-Network Theory and "Cyborg Manifesto," among others, to stress the points of how science is linked to sociocultural systems. The paper provides the grounds for the link between ethics and scientific inquiry, arguing for a reflection of the intellectual virtues in scientific practice and suggesting a more diverse and inclusive scientific practice that is respectful of different values and standpoints.

Keywords: *STS, Virtue Epistemology, Social Philosophy of Science, Ethics of Knowledge, Intellectual Virtues*

INTRODUCTION

The multidimensional field of science and technology studies (STS) investigates and evaluates the interactions between science, technology, and social institutions. It is based on the widespread belief that science is influenced by a variety of political, economic and cultural factors rather than progressing in a vacuum. As a result, mainstream STS researchers have investigated the dynamics of scientific practices, scientific knowledge dissemination, and technological innovations in relation to social impact. STS's central ideas include the role of expertise, the influence of values on scientific decisions, the social construction of scientific facts, and the coherent evolution of societal frameworks alongside science and technology (Borup et al., 2006: 290).

In turn, virtue epistemology, built on virtue ethics, emphasizes intellectual virtues necessary for the development of beliefs and knowledge. Rather than focusing on the methods of acquiring knowledge, virtue epistemology emphasizes the subject's attitudes and characteristics. Open-mindedness, intellectual humility, intellectual strength, and epistemic accountability are the foundations of this approach. According to J. Baehr, «the success or failure of an inquiry has a more personal source. This is due to the fact that inquiry has a robustly active dimension...it requires an exercise of certain intellectual character traits. It can require, for instance, that one engage in attentive observation, thoughtful or open-minded imagination, patient reflection, careful and thorough analysis, or fair-minded interpretation and assessment. As this suggests, inquiry makes substantial personal demands on inquirers. It demands an exercise of a range of intellectual character virtues» (Baehr, 2011: 1).

The anticipated importance of combining STS and Virtue Epistemology is significant in the philosophical sciences (Valladares, 2022: 1322). First of all, the combination of the two disciplines provides an opportunity to bridge the gap between the social-cultural perspective of STS peacefully and the virtue-based ethical reckonings of Virtue Epistemology (Han and Jeong, 2014).

By combining the external influence of sociocultural paradigms with the intrinsic values that drive scientific advancements, such approach provided a more comprehensive framework for assessing and analyzing the spread of scientific knowledge and practices. A deeper understanding of scientific objectivity necessitates the integration of STS and virtue epistemology. Science is frequently viewed as an independent field that is unrelated

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to ethics. As a result, we should make an effort to identify the ethical stance of scientific research and investigate the role of virtues in the field's progress. As a result, we can understand and value the ethical and contextual aspects that contribute to the advancement of knowledge at a deeper level.

This approach provides a more solid foundation for discussing issues such as scientific accountability, the broader social implications of scientific progress, and trust in scientific institutions (Fuller and Collier, 2003). This paper aims to provide a more in-depth understanding of STS and virtue epistemology by investigating and analyzing their integration. Even though each of these fields contributes valuable insights into the structure of scientific dispositions, a collaborative approach may be required. We will determine whether it is possible to integrate STS and Virtue Epistemology and, if so, how much this integration improves our philosophical representation of the scientific world by assessing the congruence of ethical virtues and social-cultural factors within scientific practices.

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

This section delves into the existing material on the basic concepts and continuing debates within the Science and Technology Studies (STS) and Virtue Epistemology. We can only fully appreciate the potential integration of STS and Virtue Epistemology after a nuanced exploration of the foundational concepts.

Genesis of Science and Technology Studies (STS)

STS was developed in the second half of the 20th century as a response to the discovery of how deeply intertwined science and technology were with societal frameworks. Some of the pioneering scholars, including Bruno Latour, Thomas Kuhn, and Donna Haraway, advanced the understanding of Science and Technology Studies with the aim of providing more insights into the embeddedness of society in the scientific field. Thomas Khun introduced "The Structure of Scientific Revolutions" as an explanation of the paradigm shifts that characterized the social features of scientific change. On the other hand, Bruno Latour proposed the Actor-Network Theory (ANT) that was aimed at advancing the scientific sociological perspective by evaluating the relationships between actors, both non-human and human, in scientific practices. In Donna Haraway's "Cyborg Manifesto" a more fluid understanding of technological augmentation is adopted with the intention of challenging the traditional beliefs of identity.

The theories postulated by the three mentioned scholars are rooted in aspects of the role of expertise, scientific knowledge, as well as the influence of scientific and technological advancements on society. It is important to note that STS has not always been met with open arms since the "Science Wars" of the 90s that involved various scholars present continuous tensions between social, cultural constructivism and scientific realism within the discipline. Indeed, Science and Technology Studies (STS) has been established as a distinguishable field in demystifying the relationship between science, technology, and society. This interdisciplinary field reveals the interconnectedness between science and society through paradigm shifts and social dynamics, Actor-Network Theory, Fluid Identities and Cyborg Manifesto, the Debates and Science Wars, and the Nature of scientific knowledge and expertise.

Paradigm Shifts and Social Dynamics

Paradigm shifts, a term popularized by Thomas Kuhn in his seminal work, "The Structure of Scientific Revolutions," refer to the fundamental changes in the basic concepts and experimental practices of a scientific discipline (Kuhn, 2012). Kuhn argued that scientific progress is not a linear accumulation of knowledge but occurs through revolutions that replace one paradigm with another radically different one. The social features of scientific change characterize these shifts as communities of scientists move from one consensus to another. Imre Lakatos introduced the methodology of scientific research programs. Lakatos proposed the MSRP as a response to the challenges posed by the demarcation problem, distinguishing scientific theories from pseudoscience. He argued against the simplistic dichotomy of falsifiability presented by Karl Popper, suggesting that science should be assessed as research programs rather than individual theories. Within Lakatos' framework, a scientific research program consists of a hardcore, which comprises the fundamental principles and assumptions that are considered non-negotiable (Collin, 2013: 84).

The evolution of a scientific discipline, according to Lakatos, is marked by the competition between research programs. A program that exhibits progressive problem-solving, successfully predicts novel phenomena and withstands empirical challenges is considered superior. On the contrary, Paul Feyerabend was the proponent of epistemological anarchism. His latter stance was that no particular methodological scheme that universally applies to science exists. Besides, his outlook also brings along the idea of diverse ways of doing science, hence opening a conversation on the sufficiency of one method for science and the role of methodological pluralism in the understanding of the complex nature of the scientific institution.

All these post-positivist theories became the foundation for the formation of STS. Moreover, they first drew attention to the importance of normative regulation in science. Therefore, it signifies a departure from traditional positivist approaches, emphasizing not only the empirical aspects but also the ethical dimensions of the scientific inquiry.

Actor-Network Theory

Actor-Network-Theory (ANT), a name given to the framework by Bruno Latour and developed by Michel Callon and John Law, is a framework that explains how relationship dynamics and material semiotics are interconnected in scientific and technological activities. Bruno Latour, in his words, the agency of the human and the non-human actors is central (Latour, 2007). He opposed the traditional view of nature and society that put nature in the lower rank, suggesting instead a tendency where objects and ideas share equal power. The idea of ANT is that everything in the social and natural realms is a part of the process in which everything is associated and interrelated. It accents the agency of non-human elements, including technologies, objects, and ideas in these networks, which help diminish the traditional divisions between humans and non-humans. Michel Callon further built on ANT by introducing the idea of translation. It promotes symmetry rather than hierarchy. Through processes of translation within networks, scientists, along with actors such as technologies and ideas, gain acceptance and significance (Crawford, 2020).

Callon's account of science brought out the 'doing' aspects of science and pointed to the performativity of knowledge production, which centers on interactions that produce technological developments. Finally, Law's John ANT development was brought in to focus the action around the sociology of translation. He came up with a new concept of "heterogeneous engineering," which divides reality into different actors, thus forming a new model of reality. Law emphasizes the ANT theory, so the idea that reality is constantly new because of the associations and links of innumerable elements is reinforced (Fountain, 1999: 345). ANT shows how scientific knowledge and technology developments are grown within the networks. It focused on the essentials of collaborative investigation and the characteristics of distributed knowledge.

Fluid Identities and Cyborg Manifesto

In Donna Haraway's "Cyborg Manifesto," a cyborg is advocated as a symbol to represent the reality of the present society and self (Haraway, 2013: 110). It lays down the foundation for STS to contest the existing fixed identities and adopt a flexible notion of self with the advent of technology. The postmodernist point of view looks for a reconsideration of the classical categories that have structured thought throughout history and recognizes a multifaceted world where technology, society, and identity are constantly intertwined. Haraway's work also challenges fixed identities and advances a less rigid self-constitution question, more so in technological augmentation.

Haraway's concept of the cyborg, which is one of her most significant ideas, breaks down these fixed boundaries that separate man and machine, proposing a more symbiotic and hybrid model (Cox, 2018: 320). In an unexpected way, this concept can be applied in conjunction with virtue epistemology, since by discussing a more refined picture of self in the background of technological augmentations, Haraway recommends phronesis, a kind of epistemic humility and open-mindedness as the basis of epistemic identity

The Debates in the Science Wars

Social constructivism understands that scientific knowledge not only represents an objective reality but it formed by social, cultural, and historical contexts as well. Such a perception of truth grounded in science stresses

that measures, standards, and values of the scientific community, as well as overall social influences, largely determine the emergence and adoption of scientific theories and facts. According to some views framed by STS (e.g., Sandra Harding), acknowledging those influences does not devalue scientific knowledge; rather, it provides a more holistic view of the way in which scientific knowledge is produced and validated. Harding and others recommend a refined strategy that appreciates the fact that science is quite objective and empirical, though it also takes account of social and cultural factors that determine the outcome.

Within the ranks of the two sides of the debate and the scientific realism perspective, which argues that science is a pursuit of objective knowledge about the natural world that is mostly uncoupled from social or cultural influences, one finds scholars like Paul Gross and Norman Levitt. Gross and Levitt addressed the STS program for what to them seemed like the subjectivizing the authority of science by the social construction of scientific knowledge is oversold (Sjøberg, 2002). They claimed that those views put scientific disciplines into question because they encourage people to perceive scientific achievements as biased and subject to manipulation. The "Science Wars" underscore an ongoing challenge within STS and the broader scientific community: distinguishing the line between objective and value-based scientific knowledge (Söderberg, 2021). This debate concerns the much deeper questions that are connected with the issues of the nature of knowledge and science, the proper role of science in society, and the right way to understand the complex relationship between scientific inquiry and the social world.

The nature of scientific knowledge and expertise, therefore, is to know how scientific knowledge is generated, improved, and disseminated both within scientists and to the general public. Harry Collins and Trevor Pinch have specifically examined experiential and interactional expertise, arguing that scientific knowledge is both an outcome of evidence and interaction in the experiment within the scientific community (Collins and Evans, 2002: 235-296). This view of scientific expertise highlights the need for both technical competence and social skills in the development and spread of both scientific knowledge and practice, calling into question the traditional notion of expertise as being purely technological or objective. It is in this aspect that STS must be complemented by virtue epistemology, which provides the value perspective of the cognitive agent, i.e. the scientist. For virtue epistemology, the primary focus is on personal states and dispositions of intellectual behavior. Within virtue epistemology, knowledge is not reduced to its propositional expression as a true and justified belief, but is seen as an active practice realized by cognitive agents in a particular context, which may be the space of ordinary communication, scientific research, or interdisciplinary dispute.

DISCUSSION

The Way of Integration and some Challenges

The STS-Virtue Epistemology approach constitutes a fresh standpoint that seeks to rethink the very basics of scientific inquiry. This attempt at convergence is to close the epistemic gap (knowledge) and the ethical gap (morality) differences in science by suggesting an ethical research framework. STS, in the study of the interactions between scientific knowledge and social-cultural context, underscores the fact that scientific practices and understandings are immersed in and shaped by the context and are influenced by societal, political, and cultural settings. This view raises a question about scientific knowledge being considered a product of impersonal observation and pure "objective and neutral" truth, revealing another reality: the process of its being created is being influenced by many social factors and forces.

On the other hand, Virtue Epistemology focuses on the intellectual, moral, and personal characteristics of individuals in the process of the quest for knowledge. It is where it argues that virtues like intellectual sincerity, courage, humility and fairness are not just supplemental but obligatory for the realization of true knowledge. STS and Virtue Epistemology fusion suggest an approach to revitalize the discussion on how scientific knowledge is produced, verified, and applied (Battaly, 2008). It leads to, therefore, the conclusion that the value of scientific inquiry is also determined by the moral and social environment wherein the investigation is done, not only by the characters and virtues of the people involved.

According to this standpoint, the scientists' attitude should promote qualities such as openness, a critical mindset, and a readiness to contact the issues and see things from different perspectives. Hence, such an approach reinforces the quality and credibility of scientific knowledge and, at the same time, results in an

accountable and inclusive science that respects the values of all participants, including both experts and the public (Reed, 2001). This integration is, therefore, the promise of conversion of scientific inquiry into a respond to complex and interconnected issues of the modern day.

The dynamic offers an unprecedented opportunity to transform the field of scientific inquiry, heralding a new vision for the ethics embedded in the scientific paradigm. Virtue epistemology approach not only questions what is normatively acceptable at this time and in this research discipline, but also tries to transform objectivity. Objectivity itself is now seen as a normative and value category that has a prescriptive force, which is different from the standard view. Impersonal reason has been regarded as an objective form of detachment, but often, science is closer to personal values than is generally recognized.

The interaction between STS and Virtue Epistemology indicates that we may get a more sophisticated picture of objectivity, which means that in scientific work, values and epistemology cannot be separated (Crisp, 2010). This updated concept of objectivity refers to conscious participation in ethical virtues, such as transparency, accountability, and inclusiveness, and argues that it does not disvalue scientific rigor but rather adds value by increasing the reliability, integrity, and societal relevance of scientific outcomes. This point of view is, therefore, a valuable asset to the concept of scientific objectivity since it offers an approach to scientific inquiry that is both ethically involved and epistemologically solid and where ethical dimensions are not some external affairs that add to the scientific endeavor but components that are core part of scientific excellence as cognitive practice.

The synthesis of ethical dimensions into scientific processes makes a reflective approach to scientific work possible. Scientists are those who are prone to critically comprehend their methods, assumptions, and the possibility of biases and implications of their research. It provided the reflective practices inspired by Virtue Epistemology and the STS insights that, in turn, created a science that is more ethics-conscious and socially responsive. The stance of humility and openness that the scientific community should take helps them to manage better the complicated interplay between scientific knowledge and societal values by considering and analyzing ethical aspects and the final influence of their work.

The inscription of Virtue Epistemology along with STS into the actual framework of scientific investigation, which is a novel avenue that can offer a science that is more ethically based and socially responsive, is not without difficulties and objections. The primary issue of contention is the potential friction that may arise between the shared, context-based stance of STS and the narrow focus on the individual inherent in Virtue Epistemology. STS reveals socio-political and cultural factors in producing scientific knowledge, pointing out the fact that the sociocultural environment places its fingerprint on scientific practices and results. This particular approach renders scientific knowledge as the outcome of collaborations and social negotiations, emphasizing how external social factors shape thoughts in/of the scientific community.

The Virtue Epistemology, on the other hand, emphasizes virtues, which are character traits of an individual scientist, such as honesty, humility, and integrity, suggesting that the acquisition of knowledge is intimately related to the character of the epistemic agent. This divergence presents a conceptual challenge: how to effectively frame social philosophy of science in line with the individual morality of Virtue Epistemology so that the focus on social aspects and collective processes of STS. In other words, there is important connection between social context of science and individual components advocated by Virtue Epistemology. This problem can be solved only by an integrated strategy that identifies the social aspect of scientific practices as well as places the individual actors at the center of the picture. Another promising way to cross this gap is the creation of a more common value of virtue inside the realm of scientific research. In this case, Virtue Epistemology can be further extended beyond individual virtues to virtues of the scientific communities and scientific institutions. By such an approach, the great role of social institutions, norms, and cultures in the development and maintenance of virtues in scientific activity would be recognized.

Thus, the reconciliation of the individualistic/collective elements in STS and VE necessitates critical questions about the objectivity of science and the extent to which values affect the process of scientific inquiry. Objectivity and neutrality of scientific processes may be called into doubt by having a focus on virtues. Thus, subjectivity may be introduced into the scientific realm, which could undermine the objectivity and neutrality that were

traditionally associated with scientific knowledge. Nevertheless, the above criticism overshadows the fact that intellectual virtues help science to be reinforced, and it becomes apparent. Through the action of dealing with values that cultivate honesty, equity, and inclusiveness, scientific methods can become more reflexive and responsive to the challenges of society without losing epistemic rigor.

The shortcoming of Virtue Ethics (which is a theoretical premise for VE) in its operationalization within scientific practices highlights the crucial difficulty in the construction of Virtue Epistemology in conjunction with STS (Reijers, 2019). Detractors say that the notion of intellectual virtues, which underlies Virtue Epistemology, could be perceived as too vague or too subjective to fit into scientific research, which is empirical and supposed to be objective by definition. This criticism epitomizes the main conflict between the scientific claim of objectivity and the values-based nature of virtues. Besides, the problem of determining which ethics of knowledge should be valued in scientific research is another layer that brings about the issue of complexity. Various disciplines of science can be distinguished on the basis of diverse epistemic and ethical challenges (Briggle and Mitcham, 2012). An illustration is that intellectual humility is expected for a discipline where a high level of uncertainty exists (as in macmathematics), while a discipline with serious societal impact is given responsibility as the prime virtue (as in biomedicine). Thus, it becomes clear that it is not an easy task to trace and cultivate these virtues in the scientific community, and it requires some sort of insight into the dynamics of the interrelationship between ethical values and scientific practices.

Enriching Philosophy of Science

It is the combination of STS and Virtue Epistemology in the philosophy of science that triggers a new way of thinking about scientific objectivity, moral responsibility, and the societal implications of science. Conventionally, scientific objectivity has been viewed as value-free neutrality in form, a concept that is based on the principle of insulation of scientific data from the effects of personal (subjective) bias, predominant values and cultural perspectives (Bijker et al., 2009: 325). According to the traditional view, the credibility and universality of scientific knowledge depend upon its ability to surpass not only the individual scientist's subjective perception in which they act but also the cultural factor in which this knowledge is created.

Nonetheless, STS and Virtue Epistemology now pose a problem with this by claiming that objectivity is not void of values but should be embedded in ethical virtues (Morrison, 2020). This perspective explains that this should not be seen as if objectivity in science is an absence of values but rather as an acceptance or adherence to principles such as fairness, transparency and inclusivity. This perspective states that embedding these ethical commitments in the core of scientific studies is the best option to be objective rather than compromising the objectivity of sciences. This is a radical redefinition that recognizes that all scientific research is driven by and dependent on core sets of values and that being fully aware of and open in introspection about these values can result in both more ethically accountable and stronger scientific outcomes.

Beyond the ambiguity of objectivity, the combinative approach of VE and STS theory has significant impacts on the ethical responsibilities of scientists and the whole scientific community (Iizuka, 2020). Although it identifies ethical virtues as integral to the scientific pursuit, it does not consider them as attributes that would make scientific knowledge noble. This view requires that a more reflexive approach be taken in scientific practice; thereby, scientists are expected to analyze their own biases and ethical dimensions of their work and the potential adverse impacts of their research. It exchanges the function of an ethical habit with the intellectual humility, courage, and empathy virtues, stating that these virtues could be core in dealing with the complex ethical problems found in modern scientific research (Zagzebski, 2020).

This approach is the move from the dominance of technical issues that purely concern scientific work to a more practical approach that considers the moral and societal prospects of scientific activity. Unlike many other intellectual professions, in science, the researchers work most of the time in isolation, which reduces the possibility of cultivating these virtues (Code, 2020; Van Slyke et al., 2012). Therefore, scientists and their institutions should do more to actively cultivate these virtues in both researchers themselves and the policies of institutions. Through this transition, a more ethically-minded and socially responsible scientific enterprise is likely to be formed, one that is more effective at grappling with multifaceted issues of the present-day world.

The broader outcomes of interlinking STS and Virtue Epistemology in the philosophy of science are felt not only within scientific research but also while the whole society is affected by scientific studies (Bezuidenhout et al., 2019). Such integrative character of this approach stresses the social aspect as well as underlines the dispersed nature of scientific knowledge being produced and implemented, which is ultimately influenced by the broader social, economic, and political contexts. In this view, the aim is to encourage an objective and scientific approach while also incorporating ethical values, thus ensuring that the science that is developed is not just accurate, dependable and reliable but also socially just and responsive to the needs and values of the diverse communities.

CONCLUSION

STS and Virtue Epistemology at their crossroads enlighten the possibility of a more ethically involved and socially responsible approach to science. The moral virtues of ethical conduct are integrated into scientific activities, providing a way by which this interdisciplinary approach will create an enriched epistemological culture coupled with science. It questions the validity of the old idea of scientific objectivity and impartiality. Overcoming these challenges is going to be possible only through a firm labor of ethical reflection, inclusiveness, and teaching future scientists to be virtuous. Although these challenges are subject to discussion, the combination of STS and Virtue Epistemology presents a great opportunity to fuse morality with the philosophy of science. Among the philosophical implications of science studies are the revisiting of scientific objectivity, the change in the social role and ethical responsibilities of scientists, and the readiness to evaluate the social acceptability of scientific research. This adoption promotes an enlightened science that is not just epistemically solid but also morally right and advantageous to society.

In conclusion, STS and VE are useful frameworks to have when thinking about the meaning of ethics in science. It creates a new direction in research that interprets the gap between the epistemology, ethics and science. This direction creates a new aspect both methodologicaly and ethically at the same time. Future research should take a deeper dive to investigate the ways intellectual virtues can be successfully incorporated into scientific practices; special attention should be given to addressing inclusivity, variety, and adaptability in relation to the needs of society. The deep interdisciplinarity of this undertaking could raise the level of our understanding of the role of science in society and contribute to a more ethically informed and socially responsible science.

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