KUHN, THE POSTSTRUCTURALIST

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ABSTRACT

This paper attempts to establish the philosopher of science, Thomas Kuhn, as a pioneering thinker in the poststructuralist tradition. Close theoretical linkages between Kuhnian philosophy and those of Foucault and Heidegger are explored. Using such a triangulation approach, The Structure of Scientific Revolutions is shown to echo some of the core concepts of poststructuralist thought ranging from Heidegger's instrumentalism to Foucault's relativism. It is argued that if postmodernism is to be substantially critiqued, one first needs to find a condensed work containing a coherent articulation of the core tenets of poststructuralism. A successful critique of that would clear the way for a systematic challenge to postmodern tendencies in Science Studies.

1. INTRODUCTION

This paper is to be read as the first part of a larger project aimed at critiquing poststructuralism and its influence on Science and Technology Studies in general, and Science Education in particular. The author is concerned about the attack on students' and the public's trust in science by the predominance of poststructuralist discourse in scholarly and public understanding of science. What this paper does is establish the philosophy of Thomas Kuhn as a junction or confluence of multiple strands of classic poststructuralist philosophies, as well as the fountainhead of poststructuralist thought in studies of science. Once that thesis is conclusively established, it would be possible, in subsequent papers, to critique poststructuralism as a whole by highlighting loopholes in Kuhn's philosophy of science.

2. THE CHALLENGE OF THE POSTMODERN

The Swedish epidemiologist Martin Lindström (2020) held postmodernism—and its influence on public policy—directly responsible for the relatively high—and avoidable—COVID-19 casualties in Sweden during the early stages of the pandemic. To give an empirical basis to this assertion, Lindström cited Ronald Inglehart's (Inglehart, 1997; 2018) World Values Survey (WVS) which identified Sweden as the most postmodern country in the world. This association of non-/anti-scientific thinking with postmodernism, though not unprecedented, reached a climactic moment in the era of the pandemic. The science journalist, John Horgan (2020), writing for *The Scientific American* during the pandemic, argued that although postmodernism was originally popular with the left-wing, of late extreme postmodernism ("the idea that all claims reflect the interests of the claimer") has come to be appropriated by the right-wing (especially those on the Republican side of the political spectrum) towards causes ranging from AIDS-denial to vaccine-skepticism (and subsequently, coronavirus-skepticism). The focus of Horgan's article, however, was the philosopher of science Thomas Kuhn, whose philosophy articulated in *The Structure of Scientific Revolutions* (Kuhn, 2012), he claims, forms the genesis of postmodern skepticism towards science. Horgan is also one of the rare journalists to have ever interviewed the late philosopher (back in 1991, at MIT).

Not only in epidemiology and science journalism, but also in science education, has Kuhnian philosophy come to be traced as the root of postmodernism and constructivism, which

Mackenzie, Good and Brown (2014) call "a manifestation of the educational reach of postmodernism". In an unequivocal critique of postmodernist trends in science education, they term postmodernism anti-science, and after critical examination of various strands in postmodernist scholarship, conclude that it "offers little that can be used to improve the scientific literacy of our citizens". They opine,

"When ideology trumps science, as in climate science debates where oil and coal companies resist scientific findings and related implications for action, we are left with no reasonable way to solve problems. The same pattern is repeated in campaigns against child and adult vaccination. When scientific knowledge is seen as a 'regime of truth' that endangers our freedom and democracy, as suggested by PM proponents, then political and religious ideologies can replace knowledge gained through scientific methods; it becomes much more difficult for people to recognise and reject pseudoscience" (Mackenzie et al., 2014).

Tracing the import of postmodernism into discussions of knowledge to the work of Jean-Francois Lyotard (1979), Mackenzie and colleagues identify three core ideas of postmodernism: opposition to the critical rationality of the Enlightenment, rejection of objective truth, and localism (as an alternative to universals and grand-narratives). Incidentally, one of the pioneers of the constructivist approach in Science Studies, Bruno Latour, also published his landmark work *Laboratory Life* in 1979 (Latour, 1979). This work contained some of the early concepts of Actor-network theory. Mackenzie and colleagues delineate various disciplines which started adopting constructivist methodologies around this time; most notably sociology, where David Bloor and colleagues of the Edinburgh School came to target Robert Merton's sociology of science with their 'strong programme'. A social constructivist methodology was also adopted by historian of science Paul Forman in his 1971 study of the development of quantum theory in interwar Germany (Forman, 1971).

The authors identify Kuhn as an origin of the social constructivism characteristic of the above scholarship, and argue that what separates Kuhn from most traditional philosophers of science is his thesis that the foundation of science "lay in the historically situated social practices of interpretation and understanding of a professional community". From this analysis, it appears that the adaptation of social constructivism in Science Studies was a case of parallel, convergent evolution with constructivist

trends simultaneously emerging in different fields and collectively resulting in the postmodern climate at their point of intersection, which is the discipline of Science Studies. Borrowing Gerard Holton's characterization of postmodern scholarship in science as a "loose consortium", the authors write that in science education, this "postmodernist *loose consortium* consists of radical constructivism, queerism, variants of multiculturalism, some versions of feminism and more recently 'cultural studies of science education' (CSSE)" (Mackenzie et al., 2014).

3. A NOVEL APPROACH TO THE PROBLEM

What is missing in the above critical analysis, though, is an examination and exploration of the possibility of existence of deeper conceptual or theoretical linkages between Kuhnian social constructivism and the postmodernism in subsequent studies, besides their common interest in social practices and historical situatedness. More importantly, the authors' critical review of the literature gives the impression that postmodernism and constructivism are nothing more than a set of truisms and their emergence is an unexpected aberration in the scholarship:

"Science is a social construction. It is an account of the world that has been, and is still being, put together by people. Many would regard this as so obvious as to be hardly worth saying. Nevertheless, over the past thirty or forty years, it has become the slogan of some science educators. They clearly think that it is somehow an important thing to say, one which is contrary to accepted ideas" (Mackenzie et al., 2014).

By such an extrinsic framing of the problem, the authors fail to address the question: what was it about the general mood in the social sciences in the years between the early 1960s and the early 1980s that led to such a warm welcome of Kuhn's theories across diverse disciplines? In the absence of any convincing answer, the only possible or suggested solution to counter postmodernism might be for scholars to see the damage postmodernism causes to scientific literacy and discourse, and hence voluntarily abandon it. In my opinion, an internalist critic of postmodernism, one that exposes theoretical loopholes in constuctivist methodology itself, would be more effective in intrinsically motivating scholars and theorists to view postmodernism critically.

Not only Mackenzie and colleagues, but also two of the fiercest critics of postmodernism, Alan Sokal and Jean Bricmont (Sokal & Bricmont, 2010), identify Kuhn's philosophy as just a response to that of Karl Popper, and frame it as a part of "historical analyses that have apparently provided grist for the mill of contemporary relativism". They fail to locate any direct theoretical linkages between *Structure* and continental European (post)structuralist philosophy. Two consequences of this failure to see deeper linkages are: firstly, following Tim Maudlin, they read Kuhn's philosophy as vacillating between a moderate — more acceptable — avatar and a radical — surprising but false — one; secondly, they see relativism as little more than an imprecisely formulated potpourri of ideas that are influential in some sectors of academic and public discourse. Due to such a disintegrated understanding/framing of the subject, critics like Sokal (1998) have had to separately critique each of the individual thinkers belonging to the so-called postmodernist "loose consortium" or "potpourri of ideas". Successfully problematizing, for example, Kuhn alone, does not pose any significant challenge to the ontological stability of the entire family of postmodernist thought.

If postmodernism is to be critiqued, one first needs to find a condensed work containing a coherent articulation of the core tenets of poststructuralism, the theoretical foundation of postmodernism. A successful critique of that would clear the way for a systematic challenge to postmodern tendencies in Science Studies.

Hence, instead of the thesis of convergent evolution, I contend that works in the postmodernist "loose consortium" have a deeper structural basis: they are emblematic of the poststructuralist paradigm ushered into Science Studies by Kuhn in 1962. No wonder why the publication of Kuhn's *Structure* is itself, ironically, seen as having affected a paradigm-shift in the field. An implication of this insight is that empirical falsification of the core thesis of the *Structure*, which is an early exemplar of poststructuralist analysis, would amount to a kind of anomaly in the Kuhnian paradigm, and thus, in the long run, open analytic possibilities beyond the debilitating postmodern impasse that Science Studies is stuck in today. But as mentioned earlier, this essay shall confine itself to establishing Kuhn as a poststructuralist. The theoretical critique is left to a subsequent paper.

4. THE RISE OF (POST) STRUCTURALISM

The germs of constructivism and postmodernism were sown in the field of Science Studies with the publication of *Structure* in 1962. Although not explicitly a postmodern text, one could see clear indications of poststructuralism in Kuhn's narrative.

It should be noted that the French (post)structuralist Michel Foucault's influential book *The Order of Things* (Foucault, 1966), whose central concept 'episteme' has been viewed as similar to Kuhn's concept of 'paradigm' (Piaget, 1968; Solo, 1975), was published in 1966, just four years after *Structure*. Although both Kuhn and Foucault are often characterized as structuralists, I contend that their respective concepts of 'paradigm' and 'épistémè' lean towards poststructuralism.

Structuralism may be broadly understood as

"The belief that phenomena of human life are not intelligible except through their interrelations. These relations constitute a structure, and behind local variations in the surface phenomena there are constant laws of abstract structure. Thus, superficially diverse sets of myth, or works of art, or practices of marriage, might be revealed as sharing the same pattern" (Blackburn, 1996).

This methodology was first exemplified in the structural linguistics or semiology of the Swiss linguist Ferdinand de Saussure, who in his lectures delivered at Geneva (Saussure, 1959), formulated a two-dimensional view of language: first, as a semiotic system, and second, as a social phenomenon. On the semiotic side, Saussure reduced language to a dyad comprising of the signifier and the signified, both of which together form the sign. The signifier is the visual or auditory perceived form which a sign takes and the signified is the mental construct or psychological concept represented by the sign. In this system, then, a linguistic sign is not a link between a thing and a name, but between a concept and a sound pattern. By giving a psychological/cognitive basis to language and concomitantly a linguistic basis to thought/cognition, Saussure showed that language is inseparable from thought, thus dissolving the classical binary of thought versus language.

An important feature of the Saussurean sign is its arbitrariness. In the words of Saussure, "Because the sign is arbitrary, it follows no law other than that of tradition, and because it is based on tradition, it is arbitrary". It is this arbitrariness that is responsible for the existence of different words in different languages to refer to the same concepts.

Another crucial characteristic of the sign is the preeminence of difference. Saussure writes,

"In language there are only differences… without positive terms. Whether we take the signified or the signifier, language has neither ideas nor sounds that existed before the linguistic system, but only conceptual and phonic differences that have issued from the system. The idea or phonic substance that a sign contains is of less importance than the other signs that surround it. Proof of this is that the value of a term may be modified without either its meaning or its sound being affected, solely because a neighbouring term has been modified" (Saussure, 1959).

The characteristics of arbitrariness and difference in language, in turn, endow on language a social or communal quality, which, as mentioned earlier, is the second dimension of Saussure's theory of language:

"Language is a well-defined object in the heterogeneous mass of speech facts. It can be localized in the limited segment of the speaking-circuit where an auditory image becomes associated with a concept. It is the social side of speech, outside the individual who can never create nor modify it by himself; it exists only by virtue of a sort of contract signed by the members of a community. Moreover, the individual must always serve an apprenticeship in order to learn the functioning of language; a child assimilates it only gradually" (Saussure, 1959).

This social dimension of language implies that it is possible for a structuralist to interpret or find meaning in a language through its contextualization within its society of speakers. Also, structuralism was founded on the premise of universalizability of the semiotic structure of language to reveal general laws. At the beginning of the *Course*, Saussure makes it one of the aims of linguistics "to determine the forces operating permanently and universally in all languages, and to formulate general laws which account for all particular linguistic phenomena" (Saussure, 1959).

Taking the above premises together, since there are general laws of language, the structure of any society could be understood or rationalized by unearthing the underlying universal features common to all language, rendered unapparent by the superficial diversity of languages. Saussure writes:

"Each language in practice forms a unit of study, and we are induced by force of circumstances to consider it alternately from the historical and static viewpoints. Above all else, we must never forget that this unit is superficial in theory, whereas the diversity of idioms hides a profound unity" (Saussure, 1959).

Inspired by this Sausurrean insight, the French anthropologist Claude Lévi-Strauss developed a novel discipline, Structuralist Anthropology, whereby he attempted to derive general laws not only in the area of kinship relations, but relating, as well, to all other social phenomena—including legal systems, costumes, myths, and cuisine, each of which, he thought, is structured like a language and

can be analyzed accordingly. His goal was to find patterns, a structure that helps understand behaviour. "Ethnographic analysis tries to arrive at invariants beyond the empirical diversity of human societies," he wrote (Lévi-Strauss, 1966).

Some of the core structuralist tenets were later adopted by poststructuralists like Jacques Derrida and Julia Kristeva in their works. For example, Saussure's concept of difference, explained earlier, posited that terms acquire their meaning in reciprocal determination vis-à-vis other terms within language. This insight was used by Derrida and Kristeva to develop their respective concepts of differance and intertextuality. A concept similar to Lévi-Strauss' floating signifiers was used by Derrida while writing about the "freeplay" of signifiers: arguing that they are not pegged to their signifieds but refer to other signifiers in an "indefinite referral of signifier to signified" (Derrida, 1978).

5. READING KUHN THROUGH A FOUCAULDIAN LENS

Despite these overlaps, structuralism was rejected by the poststructuralists. This was primarily in opposition to the tendency among structuralists, like Lévi-Strauss, to explore universally existing general laws in human behaviour and cognition. According to poststructuralists, meaning-making or sense-making or interpretation does not and cannot happen in vacuum. A structuralist trying to study a language or a social phenomenon is herself located within the structure. So, instead of trying to understand phenomena from a presumed external position of privilege, poststructuralists, most notably Foucault, examine and try to expose the historical conditions that, in the first place, enable understanding and acquisition of knowledge.

In Foucault's words, the fundamental question is:

"How is it that the human subject took itself as the object of possible knowledge? Through what forms of rationality and historical conditions? And finally at what price? At what price can subjects speak the truth about themselves?" (Raulet, 1983).

This Foucauldian project, then, imparts to human sciences, including linguistics, an epistemological orientation. Such an approach is exemplified in Foucaults's classic work *The Order of Things: An Archaeology of the Human Sciences*, mentioned earlier. In this work, Foucault periodizes the history of the human sciences—since the Renaissance—into three épistémè or paradigms of thought: (a) the Renaissance épistémè, characterized by similitude and resemblance; (b) the Classical épistémè, characterized by ordering, taxonomy, representation

and difference; and (c) the Modern épistémè, defined by the emergence of "man" as a transcendental subject. He writes,

"In any given culture and at any given moment, there is always only one épistémè that defines the conditions of possibility of all knowledge, whether expressed in a theory or silently invested in a practice" (Foucault, 1966).

In other words, Foucault examines the researchers' ways of seeing employed while studying or knowing an artefact. Although unearthing deeper cognitive structures defining an historical epoch could be seen as a structuralist project, *The Order of Things* could be called a pioneering work in French poststructuralism because it reverses our gaze from the object of study to the subject of knowledge itself. A key takeaway is that since all researchers are *a priori* embedded in or encapsulated by an overarching historical and cognitive context, it is impossible to presume the existence of universal or general laws governing all of human society or cognition or language. This is why the grand ontological claims of structuralists are premised on impossible grounds.

Another implication of this Foucauldian thesis is the rupture of the historical field of human epistemology into discontinuous phases. Foucault did clarify that several épistémè may co-exist and interact at the same time, but they would still remain parts of different power-knowledge systems. This thesis of multiple historical epistemes points at the possibility of existence of multiple and parallel contexts/structures/ "regimes"/worlds which encapsulate the knower(s) or interpreter(s), precluding the possibility of mutual intelligibility or translation of language. In other words, inhabitants of different épistémè talk past one another.

As an example of the disjuncture between épistémè, Foucault cites the epistemological break between the disciplines of biology and natural history:

"Historians want to write histories of biology in the eighteenth century; but they do not realize that biology did not exist then, and that the pattern of knowledge that has been familiar to us for a hundred and fifty years is not valid for a previous period. And that, if biology was unknown, there was a very simple reason for it: that life itself did not exist. All that existed was living beings, which were viewed through a grid of knowledge constituted by natural history." (Foucault, 1966)

What is implied by the above argument is that biologists and natural historians saw the world differently. Where a biologist sees 'life', a natural

historian saw 'living beings.

This thesis almost perfectly echoes the philosophy of Thomas Kuhn, who predating Foucault's *Structure* by four years, wrote in *Structure*:

"Paradigm changes do cause scientists to see the world of their research-engagement differently. In so far as their only recourse to that world is through what they see and do, we may want to say that after a revolution scientists are responding to a different world" (Kuhn, 2012).
And

"When Aristotle and Galileo looked at swinging stones, the first saw constrained fall, the second a pendulum" (Kuhn, 2012).
And

"A pendulum is not a falling stone, nor is oxygen dephlogisticated air. Consequently, the data that scientists collect from these diverse objects are, as we shall shortly see, themselves different" (Kuhn, 2012).

To understand this striking similarity, one needs to first grasp the essence of Kuhn's argument. His *Structure* is mainly an analysis of the development of science from a historical perspective. He looks, for example, at the shift from the Ptolemaic model of the solar system to the Copernican, and shows that besides scientific considerations such as consistency, accuracy and simplicity, ideological (political and religious) and social factors, too, played a decisive role in leading scientists to adopt one model over the other. Put simply, Kuhn defines science as social practice. An implication of this stated influence of social and ideological factors on science is the departure from a linear, cumulative model of scientific knowledge. There is no progress in science. Instead, the story of science is one of breaks or disjuncture between paradigms, with successive paradigms wholly replacing the preceding ones. Kuhn defines a paradigm as the set of assumptions agreed upon, often implicitly, by members of a scientific community. These assumptions may include practice and knowledge of exemplary experiments, methods, scientific theories, and laws. Consensually accepting the validity of the core elements of a paradigm, scientists work within a paradigm using its basic assumptions to solve problems and discover answers to questions posed by the paradigm. Kuhn calls this process 'puzzle-solving', and this phase, 'normal science'. Scientists generally assume that the results of puzzle-solving would be consistent with the core assumptions of the paradigm. However, over time, certain 'anomalies' accumulate in the discipline. Kuhn defines an anomaly as a violation of the "paradigm-induced expectations that govern normal science". In case an anomaly is a single, isolated occurrence, it is either ignored or explained away. However, if anomalies begin to accumulate, scientists begin losing confidence in the paradigm itself.

This leads a few scientists to abandon normal science and look for a new paradigm. At this juncture, the scientific discipline is said to be in a state of 'crises. If and when a broader consensus develops and the scientific community's opinion leans in favour of a newly proposed paradigm, the old is entirely replaced by the new, and a scientific revolution is said to have occurred. Two significant facts to be noted are: (a) There is a strict discontinuity or 'incommensurability' between two paradigms, as if the practitioners of both paradigms see and live in two different worlds; (b) While deciding between competing paradigms, factors that play a crucial role are external to what is considered standard scientific practice.

Regarding incommensurability between paradigms, Kuhn equates it with the problem of translation between languages and the corresponding challenge of communication between separate language communities. This is because the independent worldview or epistemology of a paradigm is necessarily accompanied by a linguistic code shared by members of that scientific community. Kuhn writes,

"The proponents of different theories are like the members of different language-culture communities. Recognizing the parallelism suggests that in some sense both groups may be right. Applied to culture and its development that position is relativistic" (Kuhn, 2012).

And "Men who hold incommensurable viewpoints be thought of as members of different language communities and that their communication problems be analyzed as problems of translation" (Kuhn, 2012).

Here one can see influence of the Saussurean view of language on Kuhn. The former, as described earlier, advocated the inseparability of thought and language. In a similar vein, what Kuhn is telling his readers is that scientists inhabiting a paradigm not only see and think about the world in a particular epistemic frame, but also speak in a particular language, perhaps because thought implies language. However, this apparent influence of Saussure's structural linguistics should not deceive one into viewing Kuhn as a structuralist. By now it is abundantly clear that although Kuhn's work is titled "The Structure of Scientific Revolutions", its central thesis, actually, is that there is no rational or internally meaningful structure in science. Instead,

the history of science and adoption of scientific frameworks is an arational process, determined by extra-scientific factors. The only semblance of "structure" that exists is the near-paradoxical fact that the structure of science is discontinuous. The mechanism of unfolding of this discontinuity, however, is neither rational nor progressive. There is no universal scientific principle or paradigm that can serve as a common yardstick for all the competing paradigms. Hence, there is no objective or neutral scientific truth that science can progress towards. Instead, the shift between paradigms is alogical:

"Just because it is a transition between incommensurables, the transition between competing paradigms cannot be made a step at a time, forced by logic and neutral experience. Like the gestalt switch, it must occur all at once (though not necessarily in an instant) or not at all" (Kuhn, 2012).

Worse still, paradigm-shift is likened to the process of religious conversion:

"The transfer of allegiance from paradigm to paradigm is a conversion experience that cannot be forced… Furthermore, these conversions occur not despite the fact that scientists are human but because they are. Though some scientists, particularly the older and more experienced ones, may resist indefinitely, most of them can be reached in one way or another. Conversions will occur a few at a time until, after the last holdouts have died, the whole profession will again be practicing under a single, but now a different, paradigm" (Kuhn, 2012).

These characteristics of the Kuhnian "structure" of science align well with poststructuralist conceptions of knowledge. As discussed earlier, the basic feature of poststructuralism is the denial of the existence or knowability of general laws or universal structures. This, in other words, implies a denial of grand-narratives such as universal reason, objective or scientific truth, historical progress or rationality in history. Kuhn's thesis encompasses all of these. Hence, we could safely call his philosophy a poststructuralist philosophy of science.

The genesis of poststructuralism is usually traced to France of the late 1960s, which saw the publication of Foucault's *The Order of Things* in 1966 and Derrida's *of Grammatology* in 1967 (Derrida, 1967). But considering that Kuhn's *Structure* was published in 1962 in the United States (Kuhn, in fact, traces the genesis of his philosophy to 1947), we now have indications of the very origins of poststructuralism in Science Studies itself.

Mackenzie and colleagues termed Kuhn a constructivist, and saw constructivism as the educational avatar of postmodernism. But now, on

re-evaluating Kuhn's position in the light of the overlaps expounded above, one sees the possibility that Kuhn was essentially a poststructuralist and thus, poststructuralism (whose contextualization in the postmodern climate is called postmodernism), might have been born in Science Studies and later spilled over to other disciplines. If that is established, the striking resemblance between Kuhn's concept of paradigm and Foucault's concept of épistémè, as also the common feature of the epistemological discontinuity or incommensurability between two paradigms, should not take us by surprise. The next section will highlight the fact that certain core elements of Kuhn's *Structure* are near-identical with the philosophy of not only Foucault, but also Heidegger, who has been described as a non-Kantian "great father-figure" of pioneering poststructuralist Derrida (Rorty, 1978). When such deeper theoretical linkages between Kuhn and intellectual fathers of poststructuralism are observed, it becomes nigh impossible to overlook the poststructuralism in Kuhn.

6. READING KUHN IN THE SHADOW OF HEIDEGGER

One may now briefly return to the issue of Kuhn's association with the scientific skepticism and relativism characterizing the post-truth world of today. In his lifetime, Thomas Kuhn disavowed of political consequences of his text. Yet, allegations, such as those raised by Horgan (2020) and Mackenzie et al. (2014), are not purely unwarranted given that Kuhn's poststructuralist thesis presents scientific development as a function of ideology and social practices bereft of any objective legitimacy. And since ideologies themselves are embedded in and sustain inequitable social structures, scientific discoveries, decisions and policies, too, are subject to power-dynamics between competing groups of vested interests.

In response to critics who characterize his philosophy as relativist, Kuhn submits that it is relativist only when applied to culture and its development. When applied to science, it may be called relativist only at the extra-paradigm level. That is only because in his philosophical framework, successive paradigms do not move progressively closer to representing the hypothetical 'truth' of nature ("what is really there"). From Aristotle to Newton, Kuhn says, "I can see in their succession no coherent direction of ontological development". This is what Sankey has termed Kuhn's "ontological relativism" (Sankey, 2000). At the intra-paradigm level, however, Kuhn says his theory is not relativist.

This is because "later scientific theories are better than earlier ones for solving puzzles in the often quite different environments to which they are applied" (Kuhn, 2012). And the criteria for deciding whether a theory is better or not include "accuracy of prediction, particularly of quantitative prediction; the balance between esoteric and everyday subject matter; and the number of different problems solved". This view is grounded on the thesis that in normal science, puzzle-solving is the only possible criteria of demarcation of science from non-science; or to put it simply, science is nothing but puzzle-solving. This may lead some to conclude that Kuhn, despite viewing the ontology of science as fragmented, does believe in a form of epistemological coherence in scientific thinking. After all, doesn't better puzzle-solving imply better scientific thinking? And if one way of thinking is better than another, must there not be a general standard of scientific thinking? A closer reading reveals that Kuhn's answer would be a "No".

Kuhn writes that one of the reasons why a scientific theory is felt to be better than its predecessors is that "it is a better instrument for discovering and solving puzzles". He adds, "Newton's mechanics improves on Aristotle's and that Einstein's improves on Newton's as instruments for puzzle-solving".

And not only a theory, the entire scientific community adhering to a theory or paradigm is nothing but an instrument for solving puzzles that the paradigm defines:

"In its normal state, then, a scientific community is an immensely efficient instrument for solving the problems or puzzles that its paradigms define". (Kuhn, 2012)

He adds,

"The scientific community is a supremely efficient instrument for maximizing the number and precision of the problem solved through paradigm change" (Kuhn, 2012).

These statements show that for Kuhn, a scientific theory is just an instrument for puzzle-solving in much the same way as a toddler trying to solve jigsaw puzzles is an instrument to solve the puzzle. Here, it is not the mind of the child alone that is useful in solving a puzzle. Rather, a puzzle is solved by the co-working of the child's hands (the shape and size of the blocks should be suitable for those hands), eyes, mood, knowledge (of puzzles, solutions, techniques) and multiple other factors. In other words, the solvability or solution of a puzzle is a function of its technological affordance, context, and thinking (cognition) of the puzzle-solver.

The dimension of thinking is just one among multiple factors playing out in the arena of puzzle-solving. This, in my opinion, highlights the post-cognitivist turn of Kuhn's philosophy of science. And this becomes highly likely given the striking resemblance this view bears with the philosophy of technology of Martin Heidegger, whose ideas formed the origin of the postcognitivist movement led by Hubert Dreyfus (1972).

In *The Question Concerning Technology*, Heidegger writes,

"If man is challenged, ordered, to do this, then does not man himself belong even more originally than nature within the standing-reserve? The current talk about human resources, about the supply of patients for a clinic, gives evidence of this. The forester who, in the wood, measures the felled timber and to all appearances walks the same forest path in the same way as did his grandfather is today commanded by profit-making in the lumber industry, whether he knows it or not. He is made subordinate to the orderability of cellulose, which for its part is challenged forth by the need for paper, which is then delivered to newspapers and illustrated magazines. The latter, in their turn, set public opinion to swallowing what is printed, so that a set configuration of opinion becomes available on demand" (Heidegger, 1977).

'Standing reserve' corresponds to that which may be identified as a distinct form of 'instrumentalism'. Heidegger argues that technology's instrumental orientation to the world transforms the world or humanity itself into a 'standing reserve'. In the paragraph quoted above, Heidegger sees the forester as being at the mercy of the paper industry, which in turn is at the mercy of the print industry, which in turn transforms the reading public into a source of its own profits. Heidegger writes, "The current talk about human resources, about the supply of patients for a clinic, gives evidence of this" (Heidegger, 1977).

In *The Nature of Language*, Heidegger attributes to Nietzsche the understanding that "method" is more crucial than "result":

"The sciences know the way to knowledge by the term "method." Method, especially in today's modern scientific thought, is not a mere instrument serving the sciences; rather, *it has pressed the sciences into its own service* [italicized by author]. Nietzsche was the first to recognize this situation, with all its vast implications, and to give it expression in the notes that follow" (Heidegger, 1982).

He adds,

"In the sciences, not only is the theme drafted, ailed up by the method, it is also set up within the

method and remains within the framework of the method, subordinated to it… Method holds all the coercive power of knowledge. The theme is a part of the method" (Heidegger, 1982).

In the very next paragraph, Heidegger writes that scientific representation can be contrasted with "thinking," where there is "neither method nor theme". This separation between scientific representation (governed by method) and thinking (without method) is also Kuhn's understanding of (normal) science or puzzle-solving. As the exemplary scientific method(ology) governs practice within a paradigm and generates themes of research, the science comes to be a mere instrument or tool at the service of method. In this puzzle-solving exercise, there is no scientific thinking, and therefore, at a general (cross-paradigmatic) level, there is no intellectual benchmark to suggest any form of epistemological coherence.

It is now evident that when Kuhn talks about a scientific theory or a scientific community being an instrument of puzzle-solving, he perfectly echoes the Heideggerian sentiment of instrumentalism (a term coined by me to represent this sentiment) or primacy of method over science. Paul Forman (2007) situates somewhere between the dying years of the 1970s and the early years of the 1980s, a great reversal of the ideological climate: from modernity, when science denoted technology too, to postmodernity, when technology denotes science too. In the last decade of modernity, historians of technology established their field in opposition to the primacy of end-in-itself science and its emphasis on methodism. But in their zealously programmatic endeavour to liberate and elevate technology, Forman writes, they ignored and excluded science from their analysis which has caused their failure to historicize the great reversal. In his extensive critique, Forman rightly identifies Martin Heidegger as a key intellectual in giving unprecedented primacy to technology over science, since for Heidegger, technology evokes "science into its own service". Now that the striking similarity/overlap between Kuhn's and Heidegger's thinking is clear, we may safely claim that the above great reversal predates the period identified by Forman, by at least a decade, given that *Structure* was published in 1962. And interestingly, the historian of science Thomas Kuhn seems to have preceded historians of technology in ushering instrumentalism into the historical discipline.

Only one is left wondering what might have been the Kuhnian equivalent of Heidegger's science-preceding technology.

Limiting oneself to science at the moment, it may still be tempting to ask: Given that Kuhnian science is an instrument, what kind of an instrument is it? What is the characteristic feature of this instrument? Here, again, Kuhn's categorical definition of normal science versus revolutionary science indicates a Heideggerian influence. In *Being and Time* (Heidegger, 2001), Heidegger dissolves the Cartesian subject-object binary, which formed the basis of the Enlightenment. Challenging the Cartesian presumption of extricability of the subject from the object, Heidegger emphasizes the lived nature of cognition. As an alternative, he introduces a novel concept of Being-in-the-world, which implies that the world itself is part of the fundamental makeup of the human. For Heidegger, in contrast with Descartes, the understanding of Being is interwoven with the intricate network of social practices that constitute the world. He categorizes the entities we encounter in our immediate interactions into Things and Equipments. These, respectively, reflect a separation between two ways in which we approach the world: the present-at-hand (*Vorhandenheit*) and the ready-to-hand (*Zuhandenheit*). Present-at-hand refers to our theoretical understanding of a world made up of objects or mere Things. This conception of the world is what gives rise to science. The ready-to-hand, instead, describes our practical relation to Equipments or useful things. Heidegger's fundamental assertion is that practice precedes theory, and that the ready-to-hand is prior to the present-at-hand.

Although Heidegger writes that science views objects as Things, Kuhn seems to extend the concept of Being-in-the-world to something roughly analogous to science-in-the-world. Just as Heidegger's Being has two attitudes, Kuhn's science also has two attitudes, and like Heidegger, the ready-to-hand (practical) orientation precedes—and offers a more incisive understanding—than the present-at-hand (theoretical) orientation. For Kuhn, normal science, defined by practical, unquestioning engagement in the scientific enterprise, is an equipment or instrument, as discussed earlier. In this phase, the primacy of established method(ology)—and an overarching theme or view of the world—predominates over individual scientific findings. This is why discovery of an anomaly by an individual scientist is often explained away as an outlier without bringing the paradigm itself into question. Thus, during normal science, science comes to be used as an instrument to solve puzzles defined by the established paradigmatic method (technology?), which in turn was adopted as the result of a gestalt switch. This, in a way, suggests a possible answer to

the question raised earlier about the Kuhnian equivalent of Heidegger's technology. In this normal phase, science is known through practice based on a general social consensus. In his critique (Kuhn, 1965) of Karl Popper, Kuhn writes, "Though testing of basic commitments occurs only in extraordinary science, it is normal science that discloses both the points to test and the manner of testing".

The gradual appearance and accumulation of anomalies in this normal practice leads to a breakdown of this puzzle-solving equipment (when phenomena inexplicable or "unknowable" within the bounds of that paradigm emerge and accumulate). Then it comes to be seen as a Thing at a level more phenomenological and surface-based than usage. Heidegger writes,

"But when an assignment has been disturbed—when something is unusable for some purpose—then the assignment becomes explicit. Even now, of course, it has not become explicit as an ontological structure; but it has become explicit ontically for the circumspection which comes up against the damaging of the tool" (Heidegger, 2001).

Here, Heidegger basically describes how a condition of breakage or damage or disrepair leads to a transformation of the ready-to-hand (Equipment) into the present-at-hand (Thing). In this statement, Heidegger also correspondingly explicates the fine difference between the ontological and ontic, the former being more originary and intimate than the latter.

Heidegger notes that "Readiness-to-hand is the way in which entities as they are 'in themselves' are defined ontologico-categorially". This means that Equipment is more primordial or revealing of the relationship between Being and the world than the Thing. This primacy Heidegger accords to the ready-to-hand over the present-at-hand is an important part of Heidegger's critique of the "metaphysics of presence", which, in his words, has been integral to philosophy since the Enlightenment, if not ancient Greece. Western metaphysics, he claims, has privileged presence or the present-at-hand. Heidegger's philosophical project is to challenge this by introducing a fissure between the ontic and the ontological, and establishing the primacy of the ready-to-hand. Heidegger writes,

"[T]he ancient way of interpreting the Being of entities is oriented towards the 'world' or 'Nature' in the widest sense, and [it] is indeed in terms of 'time' that its understanding of Being is obtained. The outward evidence for this (though of course it is merely outward evidence) is the treatment of the meaning of Being as παρουσία or οὐσία, which

signifies, in ontologico-Temporal terms, 'presence' ["Anwesenheit"]. Entities are grasped in their Being as 'presence'; this means that they are understood with regard to a definite mode of time-the 'Present'" (Heidegger, 2001).

Interestingly, deconstructionists, most notably Derrida, borrow this insight from Heidegger to use this critique of the "metaphysics of presence" to develop concepts such as '*différance*' and 'trace', which have found extensive applicability in fields ranging from literary theory to sociolinguistics. In the words of Derrida,

"The history of metaphysics, like the history of the West, is the history of these metaphors and metonymies. Its matrix is the determination of being as presence in all the senses of this word. It would be possible to show that all the names related to fundamentals, to principles, or to the center have always designated the constant of a presence—eidos, arché, telos, energia, ousia (essence, existence, substance, subject), aletheia, transcendentality, consciousness, or conscience, God, man, and so forth" (Derrida, 1978).

Apart from the above influence of Heidegger on critical theory, it has also been argued that Foucault's analysis of biopower, too, is an application and development of Heidegger's critique of our technological understanding of being (Thomson, 2012). Further elaboration on these aspects is beyond the purview of this paper.

This primacy of the ready-to-hand over the present-at-hand is also visible in the primacy accorded by Kuhn to normal science. In his aforementioned critique of Popper, Kuhn writes,

"It is for the normal, not the extraordinary practice of science that professionals are trained… A careful look at the scientific enterprise suggests that it is normal science rather than extraordinary science which most nearly distinguishes science from other enterprises. If a demarcation criterion exists, it may lie just in [normal] science" (Kuhn, 1965).

Furthermore, Kuhn's notion of crisis in normal science could be equated with Heidegger's notion of breakage or damage of Equipment. According to Kuhn, at the point of crisis in normal science, scientists are pressed to choose between two competing paradigms (Things?) by evaluating them in a more objective manner. So, it is during moments of crisis in a normal scientific paradigm that scientists behave like (Cartesian) philosophers whom Heidegger would have viewed as practitioners of a Science based on the metaphysics of presence. Kuhn writes,

"Once a field has made that transition, critical

discourse recurs only at moments of crisis when the bases of the field are again in jeopardy. Only when they must choose between competing theories do scientists behave like philosophers" (Kuhn, 1965).

7. CONCLUSION

Rather than simply highlighting parallels or a faint resemblance between Kuhn and the classic poststructuralist oeuvre, the current paper adopted a triangulation approach to definitively situate Kuhn's philosophy in the very heart of poststructuralism. Kuhn's thought has been shown to not just echo and be echoed by a peripheral segment of poststructuralists. Rather, in Kuhn, we find the most central and indispensable tenets of poststructuralism articulated coherently: ranging from the challenge of cross-epistemic translation to primacy of the ready-to-hand; from the inseparability of thought and language to the fragmented nature of history. In the face of these findings, Kuhn may rightly be called a confluence of multiple foundational strands of (post)structuralism. Saussure influenced Derrida and—through Lévi-Strauss—Foucault. Heidegger, too, influenced Derrida and Foucault. In turn, Kuhn's work echoes the philosophies of Saussure and Heidegger, and finds resonance in the work of Foucault. Overall, Kuhn's philosophy of science can be called a poststructuralist one, and given that *Structure* was published in 1962, well before any other poststructuralist or constructivist work in Science Studies, it may rightly be called the fountainhead of poststructuralist thought in science. It would be wrong, therefore, to provincialize poststructuralism in France or continental Europe. Cross-pollinating winds had dispersed the seeds of poststructuralism across the Atlantic long before the spring.

REFERENCES

Blackburn, S. (1996). Structuralism. In S. Blackburn, *The Oxford Dictionary of Philosophy* (p. 440). Oxford University Press.

Derrida, J. (1967). *Of Grammatology.* Paris: Les Éditions de Minuit.

Derrida, J. (1978). *Writing and Difference.* (A. Bass, Trans.) London: Routledge & Kegan Paul.

Dreyfus, H. L. (1972). *What Computers Can't Do: A Critique of Artificial Reason.* New York: Harper & Row, Publishers.

Forman, P. (1971). Weimar Culture, Causality, and Quantum Theory, 1918-1927: Adaptation by German Physicists and Mathematicians to a Hostile Intellectual Environment. *Historical Studies in the Physical Sciences*, 1-115.

Forman, P. (2007). The Primacy of Science in Modernity, of Technology in Postmodernity, and of Ideology in the History of Technology. *History & Technology*, 1-152.

Foucault, M. (1966). *Les mots et les choses: Une archéologie des sciences humaines.* Paris: Éditions Gallimard.

Heidegger, M. (1977). *The Question Concerning Technology and Other Essays.* (W. Lovitt, Trans.) New York & London: Garland Publishing, Inc.

Heidegger, M. (1982). The Nature of Language. In M. Heidegger, *On the Way to Language.* New York: Harper & Row, Publishers.

Heidegger, M. (2001). *Being and Time.* (J. Macquarrie, & R. Edward, Trans.) Oxford, UK: Blackwell.

Horgan, J. (2020, March 9). *The Coronavirus and Right-Wing Postmodernism.* Retrieved from Scientific American: https://blogs.scientificamerican.com/cross-check/the-coronavirus-and-right-wing-postmodernism/

Inglehart, R. (1997). *Modernization and postmodernization. Cultural, economic and political.* Princeton, New Jersey: Princeton University Press.

Inglehart, R. (2018). *Cultural Evolution: People's motivations are changing, and reshaping the world.* Cambridge: Cambridge University Press.

Kuhn, T. (1965). Logic of Discovery or Psychology of Research? In I. Lakatos, & A. Musgrave (Ed.), *Criticism and the Growth of Knowledge: Proceedings of the International Colloquium in the Philosophy of Science. 4*, pp. 1-23. London: Cambridge University Press.

Kuhn, T. (2012). *The Structure of Scientific Revolutions* (Fourth ed.). Chicago and London: The University of Chicago Press.

Latour, B. (1979). *Laboratory Life: The Construction of Scientific Facts.* Beverly Hills: Sage Publications.

Lévi-Strauss, C. (1966). *The Savage Mind.* London: Weidenfeld & Nicolson.

Lindström, M. (2020). The COVID-19 pandemic and the Swedish strategy: Epidemiology and Postmodernism. *SSM - Population Health*, 1-5.

Lyotard, J.-F. (1979). *La condition postmoderne: rapport sur le savoir.* Paris: Les Éditions de Minuit.

Mackenzie, J., Good, R., & Brown, J. (2014). Postmodernism and Science Education: An Appraisal. In M. R. Matthews (Ed.), *International Handbook of Research in History, Philosophy and Science Teaching.* Springer.

Piaget, J. (1968). *Le structuralisme.* Paris: Universitaires de France.

Raulet, G. (1983). Structuralism and Post-Structuralism: An Interview with Michel Foucault. *Telos*, 195-211.

Rorty, R. (1978, Autumn). Philosophy as a Kind of Writing: An Essay on Derrida. *New Literary History, 10*(1), 141-160.

Sankey, H. (2000). Kuhn's Ontological Relativism. *Science & Education*, 59-75.

Saussure, F. d. (1959). *Course in General Linguistics* (Third ed.). (C. Balley, A. Sechehaye, Eds., & W. Baskin, Trans.) New York: Philosophical Library.

Sokal, A. (1998). *Fashionable Nonsense: Postmodern Intellectuals' Abuse of Science.* New York, USA: Picador.

Sokal, A., & Bricmont, J. (2010). Cognitive relativism in the philosophy of science. In A. Sokal, *Beyond the Hoax: Science, Philosophy and Culture* (pp. 171-227). New York: Oxford University Press.

Solo, R. A. (1975). What Is Structuralism? Piaget's Genetic Epistemology and the Varieties of Structuralist Thought. *Journal of Economic Issues*, 605-625.

Thomson, I. (2012). Phenomenology and Technology. In J. K. Olsen, S. A. Pedersen, & V. F. Hendricks (Eds.), *A Companion to the Philosophy of Technology* (pp. 195-201). Wiley-Blackwell.