OSWALD SPENGLER AND MARTIN HEIDEGGER ON MODERN SCIENCE, METAPHYSICS, AND MATHEMATICS

Gregory Morgan Swer

Abstract: This paper argues that Oswald Spengler has an innovative philosophical position on the nature and interrelation of mathematics and science. It further argues that his position in many ways parallels that of Martin Heidegger. Both held that an appreciation of the mathematical nature of contemporary science was critical to a proper appreciation of science, technology and modernity. Both also held that the fundamental feature of modern science is its mathematical nature, and that the mathematical operates as a projection that establishes in advance the manner in which an object will present itself. They also assert that modern science, mathematics and metaphysics all have their roots in the 'mathematical,' whose essence is itself nothing numerical.

Introduction

One of the consequences of Spengler being deemed to be solely, or at least primarily, a philosopher of history is that his work has tended to be considered in relation only to thinkers or intellectual movements within that field. However if, as has been argued elsewhere, it is the case that one finds within his philosophy a significant component of something akin to existential phenomenology, then this opens up a number of possibilities for comparison of his work with thinkers whose work is not usually considered in relation to Spengler's.[1] Furthermore, if one shifts one's focus on Spengler from his 'historical' aspects, such as his cyclical model of world-history, to his analysis of the nature and development of modern technology, then we can appreciate the considerable proximity his philosophy has with philosophers who, unlike Spengler, are recognized as being part of the philosophical mainstream and whose phenomenological thought also had a technological agenda.

In this paper, in an attempt to indicate the merits of such a reading of Spengler, I shall consider his philosophy in relation to that of Martin Heidegger. I have chosen Heidegger over other technologically-minded philosophers with phenomenological dimensions (such as Jose Ortega y Gasset, Ernst Jünger or Lewis Mumford) for several reasons. Firstly, Heidegger shares a degree of intellectual proximity to Spengler. Both were inheritors of the *Lebensphilosophie* movement in German philosophy, both belonged to the group of

 Idealistic Studies, Volume 47, Issues 1 & 2. ISSN 0046-8541. pp. 1–21
DOI: 10.5840/idstudies201811278

Weimar thinkers that Jeffrey Herf (1984) termed reactionary modernists, and both sought to reconcile cultural tradition with the realities of technological modernity. Secondly, several Heidegger scholars have suggested a limited Spenglerian influence on (usually early) Heideggerian philosophy, which in and of itself suggests that there might be some substance to my suggestion that Spengler's thought has an existential/phenomenological cast to it. Thirdly, and though this might not appear to be a particularly compelling reason for a comparison, at many points in *The Decline of the West* Spengler articulates thoughts that have a decidedly Heideggerian tone to them.

As points of comparison I have selected themes from Spengler's early philosophy that elaborate key insights from Spengler's existential phenomenology to use as points of comparison with Heidegger. These themes are those of mathematics, science and technology and I have chosen to compare them with Heidegger's views on the same topics. I have no wish here to claim that Spengler's thought had any sort of influence on Heidegger's thought, though I certainly do not exclude the possibility, and it is not my intention here to argue for any particularly novel interpretation of Heidegger's later philosophy. What I aim to provide here is a relatively uncontroversial account of Heidegger's philosophical views on mathematics and science, drawn from acknowledged commentators on his work, and construed at a certain level of generality. The point of this paper is not rewrite the way we interpret Heidegger in light of my new account of Spengler's philosophy, but rather to use Heidegger to alter the way in which we consider the nature of Spengler's philosophy. And thereby to motivate for a more general reappraisal of Spengler's philosophical project.

In this paper I argue that there are striking similarities between the views of Oswald Spengler and Martin Heidegger on the nature, interrelations and interdependence of mathematics, modern science and metaphysics that have not hitherto been noted. These similarities, I suggest, are particularly discernible in their analyses of the mathematical nature of modern science. Both philosophers hold that the fundamental feature of modern science is its mathematical nature, and that the mathematical operates as a projection that establishes in advance the manner in which an object will present itself. They also assert that modern science, mathematics and metaphysics all have their roots in the mathematical, whose essence is itself nothing numerical.

There are several peculiarities to both Heidegger and Spengler's treatment of the nature and function of mathematics and modern science, and the relation of the former to the latter, that merit further consideration.[2] Firstly the topic of mathematics and modern science (and mathematical modern science) is something that until recently has been overlooked in analyses of Heidegger's philosophy, and almost entirely overlooked in analyses of Spengler's.[3] With regards to Heidegger his discussion of mathematics and science mainly occurs in his later (or middle to later) philosophy, and tends

to be viewed as just an extension of his primary thesis about the Enframing, the essence of modern technology.[4] I argue however that Heidegger's account of modern science, like Spengler's, is not simply the application of his technological thesis to the field of science. Rather than being driven solely by philosophical considerations, Heidegger's account of science (like Spengler's) represents an attempt to explore the alterations in the nature of modern science through an analysis of the historical development of scientific thought through the modern age, and to identify the recent transformations in the nature and practice of science that have produced the novel (in the sense of historically unprecedented) form of science that we have today, namely science as research, and to account for all the above with reference to the mathematical dimension of modern science.

A second reason for considering Heidegger and Spengler's analyses of mathematics and modern science to be of some significance is that for both philosophers it is their analysis of science that lays the ground for what some take to be one of the central points of their respective philosophies, namely the critique of technological modernity and the appraisal of humanity's remaining prospects therein.[5]

In the following sections I first consider Spengler and Heidegger's accounts of the mathematical nature of modern science, and attempt to define their singular metaphysical understanding of the mathematical and its role in the construction of the modern scientific object. I then discuss their understanding of the contemporary transformations of scientific practice that resulted from industrialization, and consider the ways in which their account of the mathematical projection was employed to account for such novel developments, namely the increased emphasis on scientific experimentation. I consider the epistemic dimension of their accounts of the mathematical projection, and the ways in which it connects to the peculiar experiential nature of the scientific experiment. And finally, I consider the way in which Spengler and Heidegger's scientific thought, despite sharing many commonalities, ultimately diverges.[6]

From Modern Science, to Mathematics, then to Metaphysics

This section briefly outlines Spengler and Heidegger's views on the foundational role that mathematics plays in modern science and indeed all forms of human activity, and their account of its profoundly metaphysical character.[7] I argue that Heidegger and Spengler have a common conception of the 'mathematical' and will attempt to define their rather peculiar understanding of this concept.[8] Initially I approach this definition negatively, by exploring that which both philosophers agree the 'mathematical' most definitely is *not*, before I attempt to give a more positive account. In doing so I demonstrate that both Spengler and Heidegger hold the 'mathematical' to be a

non-mathematical, praxis-oriented metaphysical projection that creates the modern scientific object.

Both philosophers argue that modern science is the essential phenomena of modernity, the one that captures or even gives the tone to the rest of Western Civilisation. Heidegger claimed that the rise of modern science was "decisive for the essential definition of the thing" and that the associated transformation of *Dasein* "changed the character of modern thought and thus of metaphysics."[9] He later stated that, "the reality within which man of today moves and attempts to maintain himself is, with regard to its fundamental characteristics, determined on an increasing scale by and in conjunction with that which we call Western European science."[10] Spengler similarly states that when one identifies the theme of Western physics, "we have *ipso facto* defined also the kind of existence, the *content* of existence as lived by contemporary man."[11] Science, for both, is not merely a system of knowledge, but something that, in an essential sense, one lives.

Spengler and Heidegger also argue that the truly significant characteristic of modern science is the fact that it is *mathematical* in nature. Now it might be objected that this is a rather facile point.[12] It has long been a truism that the distinction between modern science and medieval science lies in the nature of their approach to their subject matter: modern science supposedly focuses on measurement, experimentation and calculation, whilst medieval science preferred systems and proofs.[13] So with regards to modern science the term 'mathematical' is often used as a metaphor to summarise the above attributes of modern science, and to differentiate it from the more speculative (perhaps mythological) forms of other sciences. However, it should be noted that both Heidegger and Spengler deny this separation between modern science and preceding forms of science on the basis of measurement, experimentation, etc. Heidegger, in *What Is a Thing?*, argues that ancient/medieval science (like modern) started from facts, experimented, and applied calculation and measurement, whilst modern science (like medieval/ancient) also employs universal propositions and concepts.[14] And Spengler, in his analyses of ancient and Arabian science (or Apollinian and Magian, to use his terminology), also makes clear that they too employed measurement and calculation, and casts doubt on the extent to which modern science, which he holds to be just as 'conceptual' as its predecessors, is truly founded on factual, experiential knowledge. So, for both philosophers, to say that a science is 'mathematical' is *not* to say that it is experimental, factual, etc.

So, what then do Heidegger and Spengler mean by the mathematical? An obvious answer that we can quickly discount is that the mathematical means the systematic use of numbers. Classical/Apollinian science and Arabic/Magian science both employed highly developed forms of mathematics, geometry and algebra respectively. So other forms of science, before Western modern science, have also used mathematics. So, in what sense then for both

philosophers is Western science's 'mathematical' nature supposed to set it apart from preceding forms of science?

The answer given, which reveals that which is most singular about both Spengler and Heidegger's account of the 'mathematical' nature of modern science, is that they both argue this nature is itself *nothing mathematical*. Both philosophers argue that beneath and before mathematics (understood as the science of number, quantity and space) lies a more fundamental form of mathematics, which I shall refer to hereafter as the 'mathematical.'[15] The 'mathematical' for both thinkers in its originary sense is a projection made upon the world that anticipates and orders the way in which entities come to presence. It is, Heidegger says, "the metaphysical projection of the thingness of the things."[16] This metaphysical characterisation of the nature of mathematics echoes Spengler's statement that mathematics is "a metaphysic of the highest rank" which "contains the ultimate meaning of the world-as-nature."[17]

So how then does number, for many perhaps the essential feature of what we typically mean by mathematics, relate to the 'mathematical'? For both philosophers the numerical is an instance of the 'mathematical' projection. It is the most familiar, and for Spengler the most profound, form but does not exhaust or define what the 'mathematical' is. Numbers, for Spengler, are the most basic form of ordering the phenomena that present themselves within a cultural horizon of disclosure. When we grasp the entities of the world around us numerically, as three chairs for instance to use Heidegger's example, we recognise something that we already knew in advance of our encounter with the chairs, namely their 'threeness.' We recall to ourselves that which we had already cognised, via the 'mathematical' projection, the ontological assertion that there are entities in the world of which we can have *a priori* knowledge.

So, what then is this 'mathematical,' this mathematics as 'metaphysics'? Again, proceeding negatively, both philosophers can agree on what it is not. Although they stress the connection between modern science and the 'mathematical' they also stress the fact that the 'mathematical' should not be considered as a form or type of science, and thereby be said to 'have' a metaphysics in the sense that one might say that physics 'has' a metaphysics. "Mathematics," Heidegger states, "is as little a natural science as philosophy is one of the humanities."[18] Spengler, likewise, argues that, "If mathematics were a mere science like astronomy or mineralogy, it would be possible to define their object. This man is not and never has been able to do."[19] The 'mathematical,' for both thinkers, is unlike other sciences. For, unlike those sciences, it has no object but creates the field in which there can be objects. It operates as an ontological structure, more fundamental than those of the sciences, that vouchsafes that the entities of the world are knowable in advance. In this way the 'mathematical' provides the conditions necessary for the sciences to have objects (i.e., specialised fields of study and activity).

Indeed, for both thinkers reflection on the 'mathematical,' as it is has appeared historically, reveals it to be a, or indeed, *the* form of metaphysics. And what is truly distinctive about modern science, as opposed to all previous forms of science, is the manner of the projection. Entities are brought to presence and cognised as objects, whose attributes are held secure and grounded over against the knowing human 'subject.' Thus modern science is said to be mathematical not because it employs numerical calculation but because it projects the way in which entities can appear in advance of their appearance, such that they appear as objects with attributes capable of calculation. So, what then is the relationship of the numerical to the 'mathematical' as understood by Spengler and Heidegger? To answer this we need to explore in more detail both thinkers' understanding of 'number,' mathematics and 'the mathematical.'

Both Heidegger and Spengler approach a positive account of what the nature of modern science (or more specifically, modern mathematical physics) *is* by contrasting it with that of the Ancients.[20] And both identify Descartes as the foundational thinker of modern science, the one who marks the decisive break with classical thought and who instantiates those key features that we now consider to be characteristic of the modern.[21] To summarise briefly what I take to be the key aspects of their analysis of Cartesian thought, I would argue that both thinkers identify the epistemological and ontological implications of Descartes's stance towards the natural world, and the subjectivist implications of such an outlook, as the truly significant aspects of his philosophical contribution. For Heidegger, Descartes's elaboration of the 'mathematical' stance towards what is enshrines two positions: the ontological position that entities exist in such a way that they can be appropriated in a uniform, law-governed manner, and the epistemological position that entities must be amenable to reason, the self-grounding producer of propositions. Heidegger states that, "The I, as 'I think,' is the ground upon which . . . all certainty and truth becomes based. But thought, assertion, logos, is, at the same time, the guideline for the determination of being, the categories."[22] In this process reason becomes "explicitly posited according to its own demand as the first ground of all knowledge and the guideline of the determination of the things."[23]

Spengler takes a similar tack. Anticipating Heidegger's points about the ontological and epistemological implications of Descartes's thought, Spengler points to the role of mathematics in the normative specification of the necessary structure of the world.[24] He further argues that Descartes's privileging of reason denies and dissolves the phenomenal, that he compels the mathematical to be "an abstract relation royally indifferent to all phenomenal support and capable of holding its own against 'Nature' on all occasions."[25]

And both Heidegger and Spengler stress the significance of the privileging of the notion of *extension* as a result of Descartes's innovations, but a spatial

concept of extension that is divorced from concrete entities. Heidegger says that extension following Descartes, "is a state-of-Being constitutive for the entity we are talking about; it is that which must already "be" before any other ways in which Being is determined, so that these can "be" what they are. Extension must be "assigned" primarily to the corporeal Thing."[26] The entities of the world become objects whose nature, above all other properties, is to be extended in a system of Cartesian co-ordinates. In contrast to the Classical consideration of individual bodies, says Spengler, we now know "only the abstract space-element of the point, which can neither be seen, nor measured, nor yet named, but represents simply a centre of reference."[27]

So, to clarify, the 'mathematical' is the metaphysical projection that underpins our dealings with the world. How then does this relate to mathematics as field of study and academic discipline? For both philosophers, mathematics (the discipline) is the analysis of the things disclosed by means of the 'mathematical' projection. It is what we do with the objects that we project mathematically. Thus mathematics is connected to the 'mathematical' projection without the two being the same thing, just as numbering is not the same as number (or rather, the numbered). The one is a process (of projection), the other the manipulation/utilisation of the projected.

And yet there is more to Spengler and Heidegger's account of the 'mathematical' than its role as a metaphysical projection. The metaphysical dimension, for both philosophers, is also inextricably connected to epistemological issues. Glazebrook argues that Heidegger's insight into "the essence of science as projective is that the projection at work in science sets up not only the realm of beings to be investigated, but also the epistemic criteria that determine what counts as knowledge in science."[28] Spengler too stresses the epistemic function of the 'mathematical' in the role of 'unconscious presuppositions,' the implicit norms that govern not just what types of entity are to appear in scientific investigation, but also what constitutes a properly 'scientific' experience and what sort of conclusions one is permitted to draw from them. An analysis of this dimension of the 'mathematical' in Spengler and Heidegger leads us to consideration of the role of the experiment in modern science and the nature of experiential or empirical evidence.

The wider significance of Spengler and Heidegger's accounts of the 'mathematical,' and its foundational role in the development and operation of modern science, is that it is these relatively overlooked aspects of their thought that underpin their better-known positions on the nature of modern technology.[29] For both Heidegger and Spengler, in effect, modern science and its 'mathematical' projection, are the harbingers of the technological mode of human existence. The latter did not proceed from the former as an accidental or unintended consequence, rather the former was developed to enable to latter. The nature of the 'mathematical' projection paved the way to the contemporary technological disclosure of beings. For both philosophers, the

technological domination of nature was always the ultimate goal of modern mathematical science. And thus, any account of either thinkers' technological outlook must take account of their theories of the 'mathematical.'

Modern Science as Praxis

There is a danger that both Spengler and Heidegger's accounts of the 'mathematical' and modern science might be seen to be somewhat esoteric, driven by purely philosophical or antiquarian considerations rather than the actuality of modern scientific practice. I argue, however, that both Spengler and Heidegger's accounts of mathematical modern science, despite the historical breadth of their analyses, do seek to account for just that actuality. In identifying the features that set modern science apart from all previous forms of science, both Spengler and Heidegger emphasise the extent to which science is to be understood as a form of activity (i.e., something humans do) rather than a system of knowledge. Both philosophers reject the then popular view that science is to be understood epistemologically, in terms of the validity or empirical corroboration of its knowledge claims. Science, for Heidegger and Spengler, is a dynamic process geared towards and derived from human praxis. Most importantly, both philosophers identify the prioritisation of research and experiment as being of paramount philosophical significance in understanding the development and current nature of modern science and seek to account for this development with reference to science's 'mathematical' nature.

Science, in the late nineteenth and early twentieth century underwent a radical change in status that, Schnädelbach argues, stemmed from an alteration in the function of science. He states that, "in modern industry, science, as fundamental inquiry and technology, has itself become a productive force." And this in turn was itself made possible because the new, modern conception of science was "inherently technologically applicable."[30] Science's new position within industry resulted in significant internal changes within the social organization and cognitive ethos of scientific practice. As science settled into its new role as motor of the industrial revolution, its social structure began to reflect that of the industrial world in which it found itself. The role of scientist became increasingly professionalized, in order to ensure productivity, and science became increasingly subject to the division of labour. That is, science was reorganized into a variety of specialist areas with their own methodologies, and the role of specialist became a professional career. Along with this specialization and professionalization came depersonalization. The new science was no longer conceived of as a system of static truths developed by one or more particular individuals, but a collective enterprise of anonymous researchers whose progress is contingent upon the application of procedural rules.

The above changes in the social organization and practice of science corresponded to an alteration in the way in which scientific knowledge itself was conceptualised. Schnädelbach here notes a process at work within science, which he terms *dynamisation*. A science whose everyday function is to maintain a process of innovation amenable to industrial development has become a research-science. 'Science' no longer refers to the content of science, a body of universal and necessary truths, but the empirical procedure employed for acquiring and testing knowledge. And it is these procedures that confer upon a theory its 'scientific' status. Thus experience, of a suitably 'scientific' kind, takes precedence over theory, and theories become viewed as "intermediate stages on the way to knowledge, on which further progress can be made only by means of experience."[31] Theory, now understood as the systematization of 'scientific' experiences, is held to be open to constant revision in the light of new experiences. Innovation is internalized as a guiding principle of modern science and science is conceived of as a dynamic process.

Thus construed, as a dynamic process of research, the previous model of science, as a static system of universal truths, is deferred to the future. It becomes a destination, a "regulative Idea" and "no longer a concept which is constitutive of the reality of science in the present."[32] The present of science rather is viewed as a transient stage on the way to this systematic destination, the ultimate aim whose attainment is guaranteed by effort in the present in accordance with the empirical procedures of science. Dynamic science is temporalized science, and it is characterized by what Schnädelbach, citing Plessner, calls the "yearning for the spurious infinite."[33]

One might object at this point that in pointing to these features both philosophers are just taking note of the evident novelties of modern science, writ large in the sudden societal transformation prompted by Germany's rapid industrialisation.[34] In other words that this is journalism, not penetrating philosophical analysis. Granted perhaps, but what is philosophically significant here is the way in which both thinkers connect these features (research, experiment) of the new science to modern science's 'mathematical' nature. Both philosophers, in their approach to science, are not content to remain at the epistemic, internalist level of scientific analysis, but seek to explain science's apparently contingent historical developments, not merely at the level of theory but also in terms of developments in science's social structure and mode of praxis. Given modern science's 'mathematical' nature, and given the metaphysical nature of the 'mathematical' projection, the restless character of current scientific practice, of science *as research*, is a necessary consequence.

For example, on Heidegger's account the novel contemporary emphasis on research and experiment as the key features of modern scientific activity is not depicted as a contingent matter, but rather a direct result of the 'mathematical' projection. The 'mathematical' projects in advance of our specific experience of entities the manner in which those entities will be, the manner

in which they will appear. And having advanced beyond the experience of those entities in making this projection, it is then necessary to return to those entities and ensure that our experience of those entities is now in accordance with the prior projection. As Glazebrook notes, for Heidegger "modern science is metaphysical insofar as its determination of its object brings with it a mathematical grounding of knowledge."[35] That we experience those entities in a uniform measurable manner that conforms to the projection that prescribed the nature of those entities in the first place becomes vital. And hence, for Heidegger, the emphasis in modern science on experimentation.

Similarly, Spengler states that,

> Experience means to us an *activity* of the intellect, which does not resignedly confine itself to receiving, acknowledging and arranging momentary and purely present impressions, but seeks them out and calls them up in order to overcome them in their sensuous presence and to bring them into an unbounded unity in which their sensuous discreteness is dissolved. Experience in our sense possesses the tendency *from particular to infinite*.[36]

For Spengler, too, experimentation is not the passive reception of the particulars of a specific entity, but an active process whereby the entity is obliged to disclose itself in accordance with a uniform mathematical structure known in advance. Spengler argues that both experiment and observation are profoundly theory-laden. He states, "that which physics . . . thinks it finds in its methods and its results was already there, underlying and implicit in the choice and manner of its search."[37] In other words, the mathematical projection not only predetermines that the entities of the world reveal themselves in accordance with that mathematical structure, but the methods and results of experiment are also likewise predetermined. Observation, which Spengler duly accords great significance in modern science, is never neutral and no concepts are generated by scientific experiment. For Spengler, as for Heidegger, "the modern experimental method entails observation, but observation follows behind and is determined by theory."[38] It is for this reason that Heidegger suggest that when we think in the modern sense of "theory as observation" we are using observation in a novel and unusual sense, as "an entrapping and securing refining of the real."[39]

Even those sections of Spengler's writings in which he argues for the theory-ladenness of observation are themselves part of Spengler's efforts to identify and describe the new features of modern science. Spengler's account of the presuppositions of scientific observation has as one of its primary objectives the analysis of one of the key features of the 'new' empirical and dynamic concept of scientific practice, namely the elevated role of scientific 'experience.' "Nothing," Spengler states, "seems to us more self-evident and unambiguous than 'experience' as the source of exact science."[40] Experience, let us recall, had become the watchword for modern science in Spengler's time. Or, more specifically, experiences of an appropriately scientific sort

were held to be the foundation of scientific knowledge claims. It was the scientific experiences that rendered such knowledge 'scientific.' And, in turn, it was the research procedure for acquiring and testing knowledge that marked an experience as 'scientific.' Thus, experience holds primacy over theory, and theory is taken to be endlessly revisable in the light of such experience. However, Spengler's concern with scientific 'experience' operates at several levels. He wishes to direct our attention to experience's new role as the criterion of the 'scientific' and motor of scientific progress. "(E)xperiment, based on working hypotheses and employing the methods of measurement, is nothing but the systematic and exhaustive exploitation of this 'experience," he argues, connecting the supposed experimental basis of modern science to the new, empirical concept of scientific experience.[41] He also wishes, via his argument for the theory-ladenness of observation, to establish that experience's conceptual priority over theory does not entail actual priority in practice. Empirical facts do not validate theories. For, as he observes, "every fact, even the simplest, contains *ab initio* a theory."[42]

Heidegger likewise lays emphasis on the interrelation between experience and experiment in modern science. He too queries the positivistic notion of the priority of facts over theory. He notes that in the sixteenth and seventeenth century scientists "understood that there are no mere facts, but that a fact is only what it is in the light of the fundamental conception, and always depends upon how far that conception reaches."[43] For Heidegger experimentation represents what Glazebrook terms "methodological idealism."[44] It proceeds from the idea of the natural object and arranges matters such that the experimental object conforms to the idea, and regulates the observation of the experiment similarly. "The mathematical is based on such a . . . determination of the thing, which is not experientially created out of the thing and yet lies at the base of every determination of the things, making them possible and making room for them."[45] Thus our everyday experience of things as they happen to appear to us is to be distinguished from our 'empirical' experience of the experiment. For Heidegger "the experiment does not take its validity and force of proof from ordinary, everyday experience. Rather, it constructs empirical findings outside the realm of such experience."[46]

However, Spengler also wants to point out that this very concept of 'experience' has a peculiarly modern character. Its "aggressive dynamic connotation" implies a culturally specific worldview.[47] Experience, in the sense in which it is employed in this modern scientific concept, is for Spengler a purely Western (or in his terminology, Faustian) concept. It is not to be found (nor could it possibly be found) in any culture other than the Western, nor could it exist before the advent of modern science.

Experience thus possesses a dynamic, extensive quality. As Spengler puts it, experience has a "causal element."[48] Sensory-impressions are not passively received, but actively brought-forth, and thus 'empirical' or scientific

experience is not to be understood as the same as everyday experience.[49] It is experience of the appropriate sort as structured and mandated by the mathematical projection, which generates knowledge of the sort already guaranteed by that projection.[50]

Spengler here also draws our attention to the way in which science has become dynamic, a ceaseless process of the rational *cogito* that apprehends the individual, the sensuous, by moving beyond it, to the scientific depiction of them as mathematical objects. And likewise, Heidegger's statement that, "Modern science is experimental because of the mathematical project. The experimenting urge to the facts is a necessary consequence of the preceding mathematical skipping of all facts," and that, "the project also determines the mode of taking in and studying what shows itself," connects this restless movement of the sciences, its new focus on research and experiment, to the nature of the mathematical projection that underpins it.[51] Science projects, experiment secures the ground projected in order to enable further projection, etc. Scientific thought for both Spengler and Heidegger is, in actuality, conceptual preparation for praxis. It goes ahead and prepares the ground for subsequent human activity. And in preparing that ground, it also secures the ground for it to launch itself forward, to extend its conceptual scope ever further. Thus, the new forms of applied science and technology that proliferated in Spengler and Heidegger's lifetimes represent the forms of praxis that science has conceptually enabled.

Scientific activity in the modern age, for both Heidegger and Spengler, pursues an endless goal, with continuous movement more important than the destination. The manner in which both philosophers depict this movement, with science constantly moving to secure new ground in order to project itself further, has clearly Nietzschean overtones.[52] This Nietzschean theme will be explored briefly in the next section, as it indicates an area in which Spengler and Heidegger's scientific outlook, despite their shared Nietzschean commitments, ultimately appears to diverge.

Infinity and Etherealisation

Spengler and Heidegger's depiction of science as an activity that prepares the ground for the application of power, and secures the ground for the further extension of that activity, calls to mind Nietzsche's concept of the Will-to-Power. Indeed Heidegger's account of the Will-to-Power in his *The Word of Nietzsche: God is dead*, in which the human subject wills itself power in order to be able to will itself further power, dovetails nicely with his later accounts of the nature of science and the fundamental role of the mathematical projection.[53] Science certainly appears as the conceptual vanguard of the technological appropriation of the world by which radically subjective western man wills the world and employs technology to make that will actual. And Spengler's account of the nature and practice of science puts forward a very

similar and equally Nietzschean thesis, in which modern 'mathematical' science and technology represent the culmination of Western man's Will-to-Power.[54] Now to point out that two Weimar philosophers have a bit of a Nietzsche influence is far from exciting, I grant you. But what is significant here is the specific use that Heidegger and Spengler make of Nietzsche's philosophy, namely that application of the concept of the Will-to-Power to the analysis and explication of the ('mathematical') nature and practice of modern science.

Thus far, my account has noted a considerable amount of overlap and agreement between the two philosophers both in terms of topics covered and conclusions drawn. However, one area of *apparent* discord concerns the subject of infinity. The theme of infinity is one that runs throughout Spengler's analysis of mathematics, modern science and metaphysics, indeed his entire analysis of Western civilisation. If you were to ask Spengler what the Will-to-Power is *for*, what purpose it serves, he would argue that it serves the Will-to-Infinity, western culture's governing cultural theme: the yearning of the individual will to move unimpeded outwards to all points. "Infinite space is the ideal that the Western soul has always striven to find, and to see immediately actualised, in its world-around."[55] Now the various intricacies of Spengler's understanding of infinity are of no particular concern to us here. What is of interest here is the related concept of etherealisation. Etherealisation, according to Spengler, is a process (at least initially) by which western man, in its 'mathematical' projection progressively removes the impediments (material, conceptual, etc.) that impede or slow the free movement of the will across existence. In mathematics and physics, Spengler argues, we see this in the progressive movement away from the individual details of the material bodies of our sensuous experience to a description of the world and its contents in terms of non-material spatial points related to one another purely in terms of function. The drag of the material is etherealised and no longer hinders the movement of the will outwards.

Here, I argue, is one point on which Spengler and Heidegger appear to have parted company. On the other topics discussed here; the relation of the 'mathematical' to science, the role science as the harbinger of technology, the centrality of the Will-to-Power in the analysis of modern science, one tends to find broad agreement. And yet one searches in vain for anything resembling Spengler's Will-to-Infinity concept, or an account of etherealisation, in Heidegger's later philosophy.

And yet, it is interesting to speculate whether some form of etherealisation, shorn of Spengler Will-to-Infinity doesn't play some small role in the development of Heidegger's scientific and technological thought. Heidegger's account of how modern science and the mathematical projection moves from an analysis of the construction our current understanding of a thing as an 'object' (in *What Is a Thing?* [1935–1936]) to a description of

entities as 'vanishing' into the "objectlessness of standing reserve" in *The Question concerning Technology*.[56] The works are of a piece thematically, in that both contain the 'mathematical' projection, the same view of science, the same echoes of the Will-to-Power, and yet between one and the other the mathematically constructed objects of science lose the last vestiges of their ontological independence.

The one paragraph in *Science and Reflection* [1954] in which Heidegger seems to account for this alteration in the status of the scientific mentions that in the most recent phase of atomic physics things have changed somewhat. For now "even the *object vanishes also*, and . . . the subject-object relation as pure relation . . . takes precedence *over* the object and the subject, to become secured as standing-reserve."[57] This sounds very similar to Spengler's concept of etherealisation, albeit detached from his infinity concept. The latest forms of modern science 'etherealise' the object by presenting it in terms of purely relational functionality, and it is this that enables it to attain the 'objectlessness' of pure resource and be sucked up into the standing reserve. In other words it seems that it might be by means of Spenglerian 'etherealisation' that Heidegger moves from his account of the scientific creation of the object to the standing-reserve of his later thought.[58] Glazebrook notes that the difference in material nature between the objects formerly depicted by Newtonian physics and now depicted by quantum physics is of secondary importance to Heidegger.[59] For him, she suggests, it is their commonality, the way in which nature is set up in advance as a set of forces that can be calculated and secured in a way that renders them available to further exploitation, that is of philosophical significance. In other words, it is the ways in which both Newtonian physics and Quantum Theory are both part of the mathematical projection that is key. Spengler would not dispute this point, that the same mathematical projection that serves the Western Will-to-Power is at work in both physical theories. For him however it is the material difference in the nature depicted by the two theories that it is truly important. On his account the transition from Newtonian to Quantum physics marks another stage in the progressive etherealization of existence, the rendering of matter immaterial. Comparing modern physics to Impressionist art, he writes:

> The things are not even bodies, but light-resistances in space, and their illusive density is to be unmasked by the brushstroke. What is received and rendered is the *impression* of such resistances, which are tacitly evaluated as simple functions of a transcendent extension. The artist's inner eye penetrates the body, breaks the spell of its material bounding surfaces and sacrifices it to the majesty of Space. And with this impression, under its influence, he feels an endless *movement-quality* in the sensuous element."[60]

The two philosophers clearly deviate here, but I suggest that this has more to do with a difference of emphasis than with fundamental disagreement. At the

root of both accounts, Spengler's etherealisation and Heidegger's Enframing, lies a shared view of the 'mathematical.'

Conclusion

In this paper I have argued that notions of the 'mathematical' play a foundational role in the thought of both Heidegger and Spengler, yet the mathematical dimensions of their thought have been thus far downplayed (in Heidegger's case) or overlooked (in Spengler's case) in most analyses of their work. Both thinkers put forward peculiar views of the 'mathematical,' and its role in modern science, which nonetheless bear remarkable similarity to each other's and play a similar role in underpinning key elements of their better-known views on technology and modern civilisation. I have suggested in passing that a comparison of the two thinkers might provide an explanation for the transition of Heidegger's account of the way in which entities are brought to presence from the construction of the concrete scientific object in *What Is a Thing?* to the objectlessness of entities as resource in *The Question concerning Technology*, namely via the process that Spengler terms *etherealisation*.

The above discussion has hopefully demonstrated that both Heidegger and Spengler have fairly coherent, developed theories of science that are not simply the scissor and paste application of their general themes to the subject of science, but represent a sustained attempt to trace the development of the character of modern science with reference to its historical evolution, and to identify its essential features in light of current scientific practice, in particular the historically peculiar character of experiment and scientific experience.

It is my hope that an awareness of the above suggests firstly the need for further analysis of Spengler views on mathematics and modern science, and a reappraisal of the importance of those views for the better-known aspects of his thought. Whether or not one views my account here of Spengler's philosophical kinship to Heidegger as persuasive, I would argue that it nonetheless demonstrates that whatever the character of Spengler's philosophy might be, it is not merely the cyclical philosophy of history that it is typically taken to be. And secondly, that we at least entertain the possibility that the close proximity of thought between Spengler and Heidegger on the topics discussed here might indicate the presence of some influence of the former on the latter, which in turn might necessitate a reappraisal of our current conceptions of both Heidegger's intellectual sources and the significance of Spengler's philosophical legacy.[61]

School of Religion, Philosophy and Classics,
University of KwaZulu-Natal

Notes

1. Gier, *Wittgenstein and Phenomenology*.

2. This focus on mathematics is, to the best of my knowledge, quite singular within Continental philosophy of science. For more on this subject, see Babich, "Philosophy of Science," "Critical Philosophy of Science," and "Early Continental Philosophy of Science," or Gutting, "Introduction."

3. Regarding Spengler, Strauss, "World View," and regarding Heidegger, Rouse, "Heidegger on Science"; Glazebrook, *Heidegger's Philosophy of Science*, and "Why Read Heidegger," constitute notable exceptions to this general neglect.

4. This is despite the fact that Heidegger explores the question of the nature of mathematics in *Being and Time*, and *Plato's Sophist*, and that his views on mathematics, both in his earlier and later work, show a remarkable degree of consistency.

5. Whilst Martin Heidegger (1889–1976) and Oswald Spengler (1880–1936) were Weimar contemporaries, Spengler's work in this area precedes that of Heidegger. We know that Heidegger was familiar with Spengler's philosophy, particularly the first volume of *The Decline of the West*, upon which he lectured in 1920. See Meyer, "Geschichtslose Geschichte."

6. There do not appear to any obvious common influences on Heidegger and Spengler with regards to mathematics and its relations to science that seems capable of accounting for their proximity on these topics. Spengler's view on the mathematical projection might stem from Vaihinger's fictionalism, which emphasised the fictional nature of mathematics and portrayed science as a (largely) imaginary psychological construct founded on those fictions. It is possible that both Spengler (possibly via Vaihinger) and Heidegger are both drawing from the same Nietzschean well, although the essentials of Heidegger's views on the mathematical seem to have been present in his work *prior* to his Nietzschean turn in the late 1930s.

7. Recent developments in Spengler scholarship have suggested that Spengler's philosophy should be considered as forming two distinct phases, rather than a coherent whole. (See, for instance, Farrenkopf, *Prophet of Decline*, or Conte, *Oswald Spengler*.) In this paper, I draw exclusively upon Spengler's early philosophy, as exemplified in his first work (*The Decline of the West*, vol. 1), which I consider to be in the *Lebensphilosophie* tradition, with a strong phenomenological component. It is in the philosophy of the early Spengler that his most sustained and detailed engagement with the subjects of mathematics, science and technology are to be found, and it is in his early work too that his closest affinities to Heidegger's thought on mathematics, science and technology are to be found. Thus, whenever I mention Spengler's philosophy in this paper, it is to his earlier philosophy that I am referring.

8. It should be noted that Spengler never uses the term, the 'mathematical,' to refer to the metaphysical projection that underpins modern science, preferring to use the term 'number' (*Zahl*). For convenience however, I have used the term 'mathematical' throughout to refer to the mathematical projection, regardless of which philosopher I am discussing.

9. Heidegger, *What Is a Thing?*, 65 [1935–1936]. Throughout the paper, the year in which the work cited was originally published or presented will be given in square brackets.

10. Heidegger, "Science and Reflection," 156 [1954].

11. Spengler, *The Decline of the West*, 314 [1918]. Heidegger, like Spengler, also gave priority to physics. He claimed that of the sciences, it was the "normative one in the modern age." Heidegger, *The Question concerning Technology*, 118 [1938].

12. One might also object that this point was also made by Koyré and Husserl (*Crisis*), from whom Heidegger might well have absorbed it. Yet, Spengler's (*Decline*, vol. 1: 1918) and Heidegger's (*What Is a Thing?*: 1935–1936) predate/coincide with Koyré (*Closed World*: 1953) and Husserl (*Crisis* [based on Prague lectures]: 1935).

13. Both Spengler and Heidegger reject the notion that 'science' began in the 1700s in the West, and endorse some form of the *longue durée* thesis with regards to the history of science. Spengler in particular would, I suspect, be sympathetic to Duhem's claim that the beginnings of what we now consider to be modern science are to be found in the thirteenth century.

14. Heidegger, *What Is a Thing?*, 66–68 [1935–1936].

15. It should be noted that for Spengler (and perhaps for Heidegger too) each culture/epoch has its own unique mathematics (understood as science or discipline). Thus, there is no single, supra-cultural practice or branch of knowledge called mathematics to which science can be said to refer.

16. Heidegger, *What Is a Thing?*, 68 [1935–1936].

17. Spengler, *The Decline of the West*, 56 [1918].

18. Heidegger, *What Is a Thing?*, 69 [1935–1936]. Glazebrook explores in detail Heidegger's shifting perspectives in the relationships between metaphysics, philosophy and science. Glazebrook, *Heidegger's Philosophy of Science*.

19. Spengler, *The Decline of the West*, 60 [1918].

20. It should be noted that although both philosophers employ this method, the science of the Ancients occupies a different place in their histories of Life/Being. For Heidegger, the Ancients represent an earlier stage of the development of science. Its analysis allows us to identify the points at which and ways in which our modern science began to diverge. For Spengler, on the other hand, the science of the Ancients represents the expression of a completely separate culture, the development of which has no essential bearing on the (historically) subsequent development of modern science.

21. Granted, Heidegger does also devote some attention to the significance of Galileo for the formation of the modern scientific outlook (as does Spengler but far more briefly), but I don't think it particularly contentious to suggest that the figure of Descartes plays a more significant role in his discussions of modern mathematical science.

22. Heidegger, *What Is a Thing?*, 106 [1935–1936].

23. Ibid., 106 [1935–1936].

24. Spengler, *The Decline of the West*, 57 [1918].

25. Ibid., 88 [1918].

26. Heidegger, *Being and Time*, 123–124 [1927].

27. Spengler, *The Decline of the West*, 82 [1918].

28. Glazebrook, *Heidegger's Philosophy of Science*, 7.

29. Jeffrey Herf (1984) has probably done more than any other scholar to draw attention to the technological dimensions of Spengler's thought. However, the purpose of Herf's focus on Spengler's technological thinking was to identify its political function, not to explore the role that it played in Spengler's philosophical system. Consequently, Herf tends to conflate Spengler's views on science with his views on technology, and also overlooks the significant differences between Spengler's early and later thought. I argue rather that Spengler's views on science and technology, thought clearly connected, are quite distinct, and that Spengler's views on science and technology alter radically between his early and later periods. It should be noted that the fact that Herf's analysis is not particularly relevant to the reconstruction of the role that science and technology played in Spengler's philosophical system does not in and of itself imply any criticism of Herf's account of the role that science and technology played in Spengler's political thought.

30. Schnädelbach, *Philosophy in Germany*, 67.

31. Ibid., 88.

32. Ibid., 89.

33. Cited in ibid., 89.

34. One might also question whether Schnädelbach's historical account is entirely correct. However, for our purposes, what is of importance here is that Schnädelbach offers us a reconstruction of the intellectual history of the period that is not motivated by a commitment to a Heideggerian or Spenglerian outlook, yet which results in a view of events which seconds that of Heidegger and Spengler.

35. Glazebrook, *Heidegger's Philosophy of Science*, 64.

36. Spengler, *The Decline of the West*, 394 [1918].

37. Ibid., 378 [1918].

38. Glazebrook, *Heidegger's Philosophy of Science*, 95.

39. Heidegger, "Science and Reflection," 167 [1954].

40. Spengler, *The Decline of the West*, 393.

41. Ibid., 393.

42. Ibid., 379.

43. Heidegger, *What Is a Thing?*, 67 [1935–1936].

44. Glazebrook, *Heidegger's Philosophy of Science*, 72.

45. Heidegger, *What Is a Thing?*, 89 [1935–1936].

46. Glazebrook flags Heidegger's distinction between experience and the empirical as "a Heideggerian innovation." I would argue however that Heidegger was pre-empted by Spengler on this matter. Glazebrook, *Heidegger's Philosophy of Science*, 84.

47. Spengler, *The Decline of the West*, 394.

48. Ibid.

49. Turning to Classical science, and its focus on the surfaces of self-contained bodies, Spengler notes that such a concept of experience would have seemed anathema to Classical scientists. He writes, "What for us is the way to acquire knowledge is for the Greek the way to lose it." Ibid.

50. In this way it has clear similarities to Kuhn's notion of puzzle-solving activities during periods of normal science. Kuhn, *Structure*.

51. Heidegger, *What Is a Thing?*, 93 [1935–1936].

52. Cooper also notes the Nietzschean aspects of Spengler's thought on science and technology, attributing much of Spengler's philosophical outlook to the intellectual legacy of Nietzsche and Dilthey. Unfortunately Cooper, like Herf, fails to differentiate between early and late Spenglerian philosophy and overlooks the distinctively Kantian influence on the proto-phenomenological tone of the earlier works. Cooper, "Reactionary Modernism," 1999; Herf, *Reactionary Modernism*, 1984.

53. Heidegger states that, "The will is, as the will to power, the command to more power. In order that the will in its overpowering of itself may surpass its particular level at any given time, that level, once reached, must be made secure and held fast. The making secure of a particular level of power is the necessary condition for the heightening of power." Heidegger, "The Word of Nietzsche," 80 [1936–1940].

54. Spengler states that, "the will-to-power . . . appears also in the sense-transcending energy, the *dynamic* of Western number." Spengler, *The Decline of the West*, 88.

55. Ibid., 175 [1918].

56. Heidegger, "The Question concerning Technology," 19 [1950].

57. Heidegger, "Science and Reflection," 173 [1954].

58. Space does not permit more than a brief consideration of this topic, but it is a subject to which I hope to attend in subsequent papers.

59. Glazebrook, *Heidegger's Philosophy of Science*, 248–251.

60. Spengler, *The Decline of the West*, 286.

61. The possibility of Spengler's influence on Heidegger's philosophy is ignored by most Heidegger commentators and when considered is usually deemed to be of very minor significance. Rockmore and Zimmerman have done much to address this gap in Heidegger scholarship, however, their consideration of Spengler's possible influence is in both cases restricted to Heidegger's conceptualisation of technology, and the parallels between Spengler's views on mathematics and science and those of Heidegger has not yet been properly recognised. Rockmore, *On Heidegger's Nazism and Philosophy*; Zimmerman, *Heidegger's Confrontation with Modernity*.

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