

# ***“Wither the Pragmatism?”***

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## **Abstract**

The fact that Shewhart and Deming were influenced by the work of C.I Lewis (1929) is undisputed Deming (1991) . How he influenced their work is less clear. Lewis’ work was arguably a radical contribution to the pragmatist methods being developed by a few eminent philosophers in the 1920s. Despite their apparent obsession with Lewis’ theory of knowledge, neither Shewhart nor Deming referred to “pragmatism” in their writing. This paper is the first step of an exploration to try to uncover “pragmatism” in Shewhart's work. It is analogous to an archaeological investigation - so whither the pragmatism?

## **Introduction**

This paper is an exploration seeking to uncover elements of pragmatic theory in Shewhart’s theory of statistical quality control. Indeed this is the first stage of a bigger project. I am treating this as an archaeological site. Three important artefacts lay under the surface of a field of study, called quality control and management. These are the works of Shewhart, Lewis and Deming. On the surface, we have the remnants of the late 20<sup>th</sup> century quality movement. Below the surface, we find the “conditioning text” (Xu:1997) of Dr Shewhart and “1<sup>st</sup> order texts” of writers such as Deming, Juran and Feiganbaum. It was they who went on to develop and expand the scope of quality control and management from Shewhart's epochal theories. “A conditioning text” is a concept used to describe how a significant piece of work marks the beginning of a new period in history as an epoch and thus shapes the future development in a particular field of study. In this case, we are referring to the work of Dr Shewhart as a conditioning text. While Shewhart’s work is often recognised by writers on quality management, as the root of the modern quality management ideas,

he is not well known outside this field of study. Neither is his work widely read outside the specialist groups, who continue to follow the work of Deming for example.

It is the conditioning text of Shewhart that will be uncovered here. I will examine his work in relation to Lewis' theory of knowledge (conceptualistic pragmatism). In particular, I will be examining the notion of "management-by-prediction" as a source of pragmatic theory of knowledge. It is quite well known how Shewhart became acquainted with Lewis' work in the early 1930s. This event happened shortly after he published his major work in 1931, but before the 1939 book edited by Deming. Lewis' book was apparently difficult to understand. Both read it several times in an attempt to digest the content (Deming:1991). We can only assume they thought it was worthwhile. Many have since followed in their tracks, and floundered through the esoteric text, like wading through treacle.

Despite the well-hackneyed folklore, few have ventured into the relationship between Shewhart, Deming and Lewis' work in any detail. This paper marks the beginning of a project, to try to understand the relationships in the work of these three internationally recognised scholars who appeared, unwittingly, to be around at the same time and whose work, despite being over 70 years old has still to reach its full potential. It is only right and proper that their work receives more attention than has been previously afforded.

First, some background on how this paper has been constructed. A few days before I sat down to write this paper, a small a poem appeared on one of the many cluttered notice boards in my home. It read...

*"The past is history.*

*The future a mystery.*

*And today is a gift.*

*That is why it is called the Present" Anon.*

If ever a poem were to encapsulate the theme of a paper, this one did, in so few words. In due course, this paper will focus on how knowledge of the past informs our interpretation of the present. An interpretation of the present – in turn - helps to predict the future. I will use this poem to summarise how statistical methods can be used to predict future behaviour of a process, but also the important role pragmatic methods may play in the process.

The paper unfolds in four parts. Part 1 is a brief summary of the pragmatists' work in the late 19<sup>th</sup> and early 20<sup>th</sup> century. Lewis' distinctive contribution to this body of knowledge forms part 2. In part 3, I attempt to show how pragmatic methods may have influenced the later development of Shewhart's original work. A conclusion forms part 4.

### **The Pragmatist Movement**

In this section I will sketch out a brief summary of the pragmatist movement, prior to Lewis' contribution in 1929. The so-called mainstream writers in the pragmatist movement were Charles Peirce (1839- 1914), William James (1842-1910) and John Dewey (1859-1952) (c.f. Chung-Ying:1969; Bird:1986; Harrison-Barbet:2001). Pierce was probably the first of more recent philosophers to take issue with metaphysicians such as Bradley and Royce and their debates on the nature of reality and truth for example. Peirce wrote two notable papers in *Popular Science Monthly* in 1877 and 1888 entitled “The Fixation of Belief” and “How to Make Our Ideas Clear” (Bird,1986:4). Crucially, Pierce defined pragmatism as a theory of *meaning* not *truth*. He described the philosophical debates on truth as absurd, being conducted in an abstract form by his contemporary metaphysicians. For Pierce, truth was a function of the *practical* based on *doubts* and *beliefs* found in human enquiry. Equally, he conjectured that truth had a *public characteristic* as opposed to the *subjectivity* of Cartesian dualism. Therefore, truth was a manifestation of the practice of human inquiry with (publicly) shared meanings. Indeed, his pragmatism, as a theory of meaning, intended to be scientific, in that certain concepts and phenomena could be observed under specified conditions and the results *translated* into practical effects.

At least two dominant schools of philosophical thought had formed, with quite opposing views on how to proceed with the nature of human inquiry. “Rationalists” maintained that ‘human mind’ and sensory perceptions were unreliable as the basis for rigorous debate. Their thesis was that knowledge was beyond or outside the limits of the mind, hence it was *a priori* – before experience. On the other hand, empiricists held a view that only way we could form judgements on the nature of reality was through the senses. At the risk of grossly over-simplifying some complex philosophical debates, we find the pragmatists pitched in-between these two schools, trying to form radical new agenda. Again, an oversimplified account will have to suffice for the brevity required for this paper. The pragmatists were focussing on what was practical and instrumental in human inquiry, rejecting dogma in the process.

Peirce’s work was essentially utilitarian and focussing on desired consequences. He was also adopting an *inductive – hypothesis* logic in his method. As a relatively lone voice at that time, Peirce was receiving quite severe criticism, and his work failed to get much popular attention for at least another twenty years. The pragmatist movement in general was subsequently accused of being anti-intellectual by other philosophers (see Bird,1986).

William James worked mainly as a psychologist. He was referred to by Shewhart (1931) in this respect, but interestingly, not for his work on pragmatic methods. James was a close friend of Peirce and indebted too him for his advise in developing his own work. However it should be noted that they also disagreed on how the notion of pragmatism should be developed as a theory. James' work can be found in a variety of published lectures and papers (see James: 1913; & 1917/1935). While there is not the time or the space to unpack the fullness of the debates in this paper, it is worth noting several points that have a bearing on the following arguments.

James carefully laid out his arguments for pragmatic method by referring to Peirce at the beginning of his paper, entitled *What Pragmatism Means* (1907 – published in James, 1917/1935: pp.,198-217)

“Mr Peirce, after pointing out that our beliefs are really rules for action, said that, to develop a thought’s meaning, we need only determine what conduct it is fitted to produce: that conduct is for its sole significance. And the tangible fact at the root of all our thought-distinctions, however subtle, is that there is no one of them so fine as to consist in anything but a possible difference in practice. To attain perfect clearness in our thoughts of an object, then, we need only consider what conceivable effects of a practical kind the object may involve- what sensations we are to expect from it, and what reactions we must prepare. Our conception of these effects, whether immediate or remote, is then for us the whole of our conception of the object, so far as that conception has positive significance at all.

This is the principle of Pierce, the principle of pragmatism. It lay entirely unnoticed by anyone for twenty years...” (p.200).

James, a devoutly religious man, wrote several papers on religion, e.g. *The Varieties of Religious Experience* (1902) and *The Will to Believe* (1897) whilst simultaneously developing his pragmatic method. Here, we can see the evolution of the practical features of pragmatism. Specifically, the notions of truth and utility have a particular part to play. James interpreted “practical” to mean the particular import that a *belief* has in the life of the individual. Put succinctly...*what practical difference does it make if an idea is true or not?* In science, a concept has to be verifiable to be true – but verified *ideas* serve our need to *predict* and cope with our environment. We will see later how Shewhart used the notion of belief in his work.

In his interpretation of “*practical*”, James sought to demonstrate how philosophical debates, pale into insignificance when concrete examples were sought to elucidate or illuminate issues.

“There can *be* no difference anywhere that doesn’t *make* a difference elsewhere- no difference in abstract truth that doesn’t express itself in a difference in a concrete fact and in conduct consequent upon that fact, imposed on somebody, somewhere, and somewhen” (op-cit:201). James dismisses the ‘absolute’ nature of metaphysical debates, suggesting, theories should become instruments, not answers to problems.

And in a beautifully eloquent phrase ... “We don’t lie back on them (theories) we move forward, and on occasion make nature over and over again by their aid. Pragmatism unstiffens all our theories, limbers them up and sets each one at work. Being nothing essentially new, it harmonises with many ancient philosophical tendencies. It agrees with nominalism, for instance, in all ways appealing to particulars; with utilitarianism in emphasising practical aspects; with positivism in its disdain for verbal solutions, useless questions and metaphysical abstractions.

All these, you see, are *anti-intellectualist* tendencies. Against rationalism as a pretension and a method pragmatism is fully armed and militant. But at the outset, at least, it stands for no particular results. It has no dogmas, no doctrines save its method” (ibid.:203).

Pursuing the practical theme, James developed the notion of “*cash-value*”, which relates to the utility of the concept or theory being employed. Concepts and theories all have a *relative cash-value* for helping the inquirer interpret the present..

To briefly explain James ideas (and at the risk of doing a grave injustice to his work) in this respect, he developed a notion of a “stream of consciousness”, developed as part of his theory of radical empiricism and psychology. In essence, the stream of consciousness aims to describe how sentient beings experience activities on a daily basis. He appeared to suggest a "Heracleitean state of flux" whereby experience of reality, creates an awareness of personal identity and a level of consciousness. The "here and now" are understood using concepts developed from past experience. Past experiences have a relative cash-value to the given situation – just as the rooms down the corridor of the hotel. Past experience provides a cash-value for interpreting a complex stream of consciousness.

James suggested in his paper entitled “What is Pragmatism” that there was nothing new in what the pragmatists were arguing, quoting eminent philosophers back to Plato, Aristotle and Socrates. Not surprisingly, Plato had developed similar arguments in his imaginary dialogue with Theaetetus, for his Theory of Knowledge. The Platonic dialogue deconstructed various theories of knowledge, and at one stage

Socrates was considering the Protagorean thesis of “man is the measure of all things” and the "Heracleitean state of flux". Like James’ stream of consciousness, we see a similar exposition from Socrates, but with some careful manoeuvring to avoid the argument, that if everything is in a state of flux – then knowledge of anything is impossible, which leads to scepticism and solipsism.

“*Socrates*: Their doctrine that ‘being’ (so-called) and ‘becoming’ are produced by motion, ‘not-being’ and perished by rest, is well supported by such proofs as these: the hot or fire, which generates and controls all other things, is by itself generated by movement and friction – both forms of change.... And so with the condition of the soul. The soul acquires knowledge and is kept going and improved by learning and practice, which are of the nature of movements (Plato;1934:36-7)

It would appear that Plato was an early advocate for continual improvement!

In sum, in this short introduction to the pragmatist movement, I have been highlighting some of the important issues being addressed by these scholars almost a century ago. The focus of their work was the practical element of interpreting human experience, in an attempt to interpret experience of reality and predict the future. By taking this a stage further, we were able to see how this notion led to a stream of consciousness, and the Heracleitean state of flux.

Examining the world from this view point is to take a systems perspective of the universe. From this systems perspective, we have to try to understand what constitutes knowledge and reality. Indeed the epistemological questions are how do we know what we know from this view point? So, to provide more focus for the paper, we concentrate on Lewis' contribution to pragmatism and pragmatic methods and his theory of knowledge.

### **Mind and The World Order: Outline of a Theory of Knowledge**

In this section of the paper I will focus on Lewis’ notion of *a priori* and how this influenced his form of pragmatism and pragmatic method. I will then show how his

theory of *a priori* influenced the interpretation of the present to predict the future. It has to be said that Lewis' work does not lend itself to being condensed. Every page appears to be an important element of his detailed argument, treading carefully between the solipsist traps of empiricism, and the 'impractical' consequences of *a priori* theories. Venturing forth with cautious optimism, I will offer an overview of specific features of Lewis' treatise.

For clarity and historical accuracy, Lewis was considered to be 'outside' the mainstream pragmatists referred to above. He did however recognise their earlier contribution, which spurred him to develop his own particular brand of pragmatism, labelled "conceptualistic pragmatism" (Lewis,1929;xi). Lewis' work differed from the others in several ways, but especially because of his doctrine of *a priori* truth. He adopted a polemic argument against the so-called metaphysicians with this doctrine. In chapter 1 he outlines his arguments slowly and meticulously, while simultaneously attacking the metaphysicians along the way. Three theses are developed, and are worth repeating in full, particularly as there is insufficient space to consider these in detail in this paper.

"The construction here attempted turns principally upon three theses: (1) *A priori* truth is definitive in nature and rises exclusively from the analysis of concepts. That *reality* may be delimited *a priori*, is due, not to forms of intuition or categories which confine the content of experience, but simply to the fact that whatever is dominated "real" must be something discriminated in experience by criteria which are antecedently determined. (2) While the delineation of concepts is *a priori*, the application of any particular concept to particular given experience is hypothetical; the choice of conceptual systems for such application is instrumental or pragmatic, and empirical truth is never more than probable. (3) That experience in general is such as to be capable of conceptual interpretation, requires no peculiar and metaphysical assumption about the conformity of experience to the mind or its categories; it could not conceivably be otherwise. If this last statement is a tautology, then at least it must be true, and the assertion of a tautology is significant if it is supposed that it can be significantly denied" (Lewis,1929: x-xi).

Let us try to use these three theses in relation to the poem at the beginning of this paper. Put simply, Lewis argued that philosophers had no special insight, enabling them to pose as prophets. Metaphysics had become a dumping ground for abstract debates with a tenuous link to science. In contradistinction – suggested Lewis – progression in science, is the sole activity of mind. Minds do not invent new ideas in an abstract world, devoid of reality. Therefore, a pivotal feature of Lewis' work was the primacy given to mind and its relationship to, and integral part of reality. To support, and win this argument, he had to show flaws in the work of metaphysicians, while avoiding the solipsist traps or dilemmas of extreme scepticism.

Lewis makes some interesting points while deconstructing the work of metaphysicians: science – he argues – is not just reporting facts – but significantly an activity that distinguishes *speculative* from *reflective* inquiry. His argument is aimed at the *speculative* naval gazing (metaphysics) which has little practical value. However, he supports *reflective* inquiry, which helps one move forward in practice. Not wanting to dismiss theory *per-se*, he insisted on its practical value for interpreting the present. What mattered, was, how theory was defined, generated and used.

The nature of his polemic against metaphysics is manifest here...

“But that philosophical legerdemain which, with only experience for its datum, would condemn this experience to the status of appearance and disclose a reality more edifying, is still with us ... But at least we must observe that such metaphysics turns away from one type of problem which is real and soluble to another which may not... If metaphysicians try to work on the problem of defining reality – paradoxically they will create something esoteric and transcendent of ordinary experience. Any metaphysics which portrays reality as something strangely unfamiliar or beyond the ordinary grasp stamps itself as the thaumaturgy, and is false upon the face of it” (Lewis, 1929:pp8, 9).

In discussing the nature of reality, he argues that the ordering of experience leads to categories that stand at the side, above or before experience, and are therefore *a*

*priori*. In contrast, experience of reality can only be understood in terms of experience. The correct understanding of reality must be in empirical clues. “If they are not contained within that segment of experience which constitutes the phenomenon itself, they must be discoverable by the conjunction with what precedes or follows” (ibid.: 12-13).

Uniquely, mind is capable of interpreting and judging if something is real or unreal. It is the reflective nature of mind, drawing on past experience, to interpret the present, that allows us to predict, with probability, the future behaviour of some observed phenomena. Mind also acts in a similar way when interpreting the canons of logic, the distinction between good and evil in ethics, and the distinction between real and unreal in experience. Classifying experience into categories is an activity of mind – not metaphysics. Therefore, the way we interpret the present is a judgement of what appears real and unreal to a mind. More critically, mind is capable of bringing experience to itself to make interpretations and discriminations and to make an evaluation. And here we see the sum of his argument for the primacy of mind in his methodology.

“Thus philosophy is, so to speak, the mind’s own study of itself in action; and the method of it is simply reflective. It seeks to formulate explicitly what from the beginning is our own creation and possession” (ibid:18). Therefore the existence of a *priori* set of categories independent of the mind is untenable in his methodology.

Having established the premise of his treatise, the activities of a (philosophical) mind are examined in more detail. We have to be critical as opposed to descriptive. This is part of the reflective function of the mind, which should be dialectical and Socratic because the “truth” is a function of mind – it has just to be brought to the fore more clearly.

Lewis tries to define his alternative position on *a priori*, because his methodology implies mind’s activities are reflective, discriminating and evaluating. They therefore rely on an interpretation of past experience to “prove” *x*, which he then argues, is an

act of “persuasion”. Interpreting a *a priori* for his methodology he compares it with the notion of a purpose. The mind is capable of generating a purpose, which is not necessarily drawn from experience, but must take shape *in* experience. If a purpose has no use-value, then it will soon disappear from mind’s focus. Similarly “what is *a priori* and of the mind is prior to the content of the given, yet in another sense not altogether independent of experience in general” (ibid.:24). Therefore, mind is in control of the *a priori* – and by definition a function of mind. An activity of mind must be chosen from its vast repertoire of past experience the criteria for interpretation of the real.

“The content of experience cannot evaluate or interpret itself. Nevertheless the validity of such interpretation must reflect the character of experience in general, and *meet the pragmatic test of value as a guide to action* (ibid.:27) (emphasis added).

Thus, as Lewis concludes his first chapter we have a firm basis of the arguments to follow in relation to his interpretation of mind and *a priori*.

“The reflective method is pragmatic in the same sense that it is empirical and analytic. It supposes that the categories and principles which it seeks, must already be implicit in human experience and human attitude. The significance of such fundamental conceptions must always be practical because thought and action are *continuous*, and because no other origin of them can be plausible than an origin which reflects their bearing on experience. Further, it claims for philosophy itself the pragmatic sanction that reflection is but a further stretch of that critical examination of our own constructions and interpretations by which we free them from inconsistency and render them more useful” (ibid.:34) (emphasis added).

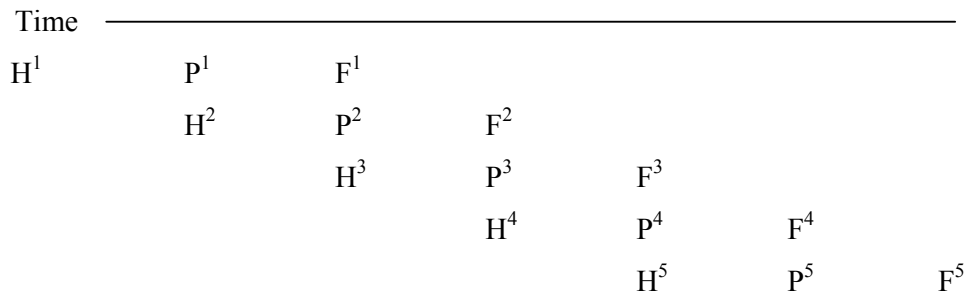
In sum, we can have seen how Lewis has attempted to dismiss the grand metaphysical theses, hinging on an independent, *a priori* notion of reality. He has made mind the pivotal part of his argument and methodology for a pragmatic method of interpreting reality – hence the title of his book. Mind is not a purely descriptive organ that passively processes data – that would lead to a deterministic view of mankind. The

mind is reflective, building up its own *a priori* database from experience, to analyse the present and future experiences. The mind is also discriminating and evaluating, making judgements between what is real and unreal in “world order”.

While Lewis does not elaborate too much on notions such as the James' stream of consciousness, he does acknowledge that we are in motion – life does not stand still – this *is* world order. The final chapter of the book, entitled Experience and Order, covers this topic and will not be further considered here.

For the purpose of this paper, my object is to tease out the notion of management-by-prediction as part of a pragmatic theory of knowledge. We have already seen how he suggests we should interpret the past, but how does one predict the future from the present? Figure 1 attempts to show the complex interaction of the three notions of history, present and future.

Figure 1 The HPF process of prediction.



Key: H=History; P=Present; F=Future

Figure 1 may help to understand Lewis' riddle, quoted by Shewhart (1939) “Knowing begins and ends in experience; but it does not end in the experience in which it begins” (Lewis,1934, quoted in Shewhart,1939:80). Starting with P1 an interpretation takes place based on knowledge of concepts from the past in H1 (*knowing begins and ends in experience*). Interpretation of P1 leads to predictions of the future using existing knowledge of concepts. The concomitance of P1 and H1 leads to a prediction

for F1. Moving across Figure 1 in time sequence, P1 become H2 and F1 becomes P2 (*but it does not end in the experience in which it begins*). P2 is then interpreted with concepts and knowledge, gained from H2, to predict the future in F2. F2 now becomes P3. P3 is interpreted using H3, which was previously P2, and before that F1. P3 is the predictor for F3 and so on – ad infinitum.

If we briefly reconsider Lewis' riddle we can see more clearly what he meant by following H3-P2 –F1, which all have the same root, but their substantive form changes as the process moves on. A metamorphosis occurs, and knowledge of the concepts grows with experience. However, the HPF process of prediction, while attempting to understand the process being described by Lewis, may appear deterministic at first sight. However, this is clearly not the case, because 'we' are 'swimming' in a stream of random data, which is our experience of reality. We assimilate, interpret and discriminate as we move on through this world order, with mind as acting as our arbiter in the process.

Lewis acknowledges the random nature of experience. How can we possibly know what we do not know for instance? Similarly, one thing does not follow naturally from another, which is what would be required for us to be 'certain' about knowledge and predicting the future. If the world was so orderly, nothing would be worth learning, because we would not be able to do anything about it. (Ibid:355)

To create a sense of order in the here and now, Lewis uses a notion called an "instant mental reaction to experience" (ibid:358) which constitutes an 'island of knowledge'. This is an important feature of Lewis' thesis in his attempt to avoid the solipsist traps and scepticism. In short, we have to recognise the limitations of *instant mental reactions* to experience as they flow through minds. Minds are limited in what they can assimilate at any one time. We may never know what we do not know in the world order. But significantly, there are no absolutes, so we become pragmatic in how we interpret the present, in an attempt to predict the future. This is not a compromise to the metaphysicians position, this is the nature of reality *per-se* in a pragmatist theory of knowledge.

Finally, we must recognise an important distinction in Lewis' work, in relation to the *a priori*. He distinguishes between the analytic and interpretative nature of the mind, which is itself, an *a priori* truth about our ability to perform these functions from the *a priori* truths of logic and mathematics.

“The *a priori* is knowable simply through the reflective and critical formulation of our own principles of classification and interpretation ... It is the *a priori* element of knowledge which is the pragmatic, not the empirical” (Lewis, 1929:232, 266).

In contrast, logical and mathematical solutions and interpretations are in one sense absolute in the metaphysical sense, because they are consistent and adequate for the purpose. They are equally pragmatic in being useful in the right conditions.

“On the one side we have the abstract concepts themselves with their purely logical implications. The truth about these is absolute in the fashion in which pure mathematics offers the typical illustrations. Such purely abstract *a priori* truth answers only to the criteria of consistency and adequacy. It is absolute and eternal. On the otherside, there is the actual brute facts of given experience...It is between these two, in the choice of conceptual systems for application and in assigning of sensuous denotation to the abstract concept that there is a pragmatic element in truth and knowledge. In this middle ground of trial and error of expanding experience and the continual shift and modification of conception in our effort to cope with it, the drama of human interpretation and the control of nature is forever being played” (ibid.:272).

To briefly summarise this short section of Lewis' treatise we have seen how he wove his own distinctive path to maintain a grip on certain features of *a priori* (maths and logic). Mind was the sole creator and arbiter of theory generated from experience. Thus he had two distinct *a priori* positions. This stance also set him against the pure empiricists, who relied on the senses as the source of knowledge. Hence, in true

pragmatist fashion, he trod a 'middle ground' relying on a thesis of practical value and expediency to progress through random streams of information called the world order.

### **A Search for Pragmatism in Shewhart's Theory**

We have to look quite closely and carefully to find just how Lewis may have influenced Shewhart and Deming's work. Given that Shewhart had not read Lewis' work when he published his first book in 1931, there is a remarkable similarity in the way they addressed their subject areas, with different purposes. Lewis was developing a radical theory of knowledge in the field of philosophy. Shewhart was addressing the problems of quality control as a research worker in a firm, mass-producing telephone equipment. Both were concerned with the notion of prediction as a pivotal part of their theories. Lewis focussed on the role of mind in interpreting reality, and what the conditions were to be able to 'predict' into the future.

For Shewhart, the notion of prediction was central to his thesis, because it lay at the root of his definition of control...

*“ a phenomenon will be said to be in control when, through the use of past experience, we can predict, at least within limits, how the phenomenon may be expected to vary in the future. Here it is understood that the prediction within limits means that we can state, at least approximately, the probability that the observed phenomenon will fall within given limits... The specific problem that concerns us at the present moment is the information of a scientific basis for prediction, taking into account the element of chance, where for the purpose of our discussion, any unknown cause of a phenomenon will be termed a chance cause” (Shewhart, 1931:6,7)*  
(emphasis in original).

In Shewhart's thesis, being in a state of statistical control was an operation involving an “engineer”. Being able to predict was a key feature of this activity. Five steps were defined to maintain this “state” forming part of Shewhart's theory of knowledge. It provides the criterion for a process of a state of statistical control and as such is an important artefact on this site of investigation. To see the importance of these five

steps, we have to first understand an issue that Shewhart had taken with existing *modus-operandi* in engineering and manufacturing.

Shewhart took issue with the “exact” nature of engineering discourse and epistemologies. In a polemic aimed at engineers we find a similar type of argument used by Lewis against the metaphysicians.

“It is conceivable that some time man will have a knowledge of all the laws of nature so that he can *predict* the future quality of a product. This might be considered a goal for applied science, but indications today are that it is not a practical one... In fact if we are to believe, as do many of the leaders of scientific thought today, that possibly the only kind of objective constancy in this world is of a statistical nature, then it follows that the complete realisation of the sixth stage is not merely a long way off but impossible” (Shewhart, 1931:352-3) (emphasis added)

Thus, just as Lewis took issue with the grand theories of the metaphysicians, Shewhart took issue with engineers' deterministic and objective view of the world. In a similar vein he attempts to show the fallacies with “industrial programs” (Shewhart, 1931:354).

Shewhart argued how these procedures were flawed because the sources of variation appear in the last four stages of the process, thus leading to 100% inspection.

“One could specify what he wanted, someone else could take this specification as a guide and make the thing, and an inspector or quality judge could measure the thing to see if it met specifications. A beautifully simple picture!

The whole picture, however, is radically different just as soon as we admit that we have only a probable science” (Shewhart, 1939:44).

Shewhart's theory is the antithesis of this approach. The application of statistical methods to mass production requires a revolution to the “exact” thinking of engineering. The notion of being able to predict the future performance of a process

based on an analysis of past performance indicates the fundamental difference to engineering discourse and a remarkable similarity to pragmatic methods.

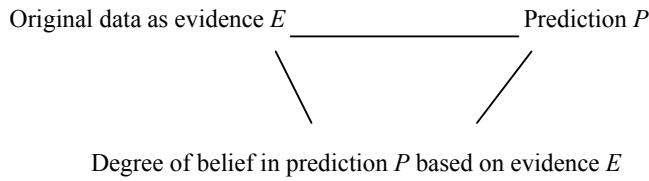
To demonstrate how he could apply statistical methods to mass production, Shewhart used what he described as the three steps of the “old methods” of production.

“The three steps constitute a dynamic scientific process of acquiring knowledge. From this view point, it might be better to show them as a form of spiral gradually approaching a circular path which would represent the idealised case where no evidence is found in step III to indicate a need for changing the specification (or scientific hypothesis) no matter how many times we repeat the three steps. Mass production in this way constitutes a continuing and self-corrective method for making the most efficient use of raw and fabricated material” (Shewhart, 1939:45).

The cycle of improvement, referred to here, was the forerunner of the PDSA Shewhart cycle. To make this theory and process work, Shewhart had to address a wide range of issues covering topics related to pragmatism with philosophy of science, logic and psychology.

Shewhart was adept at using small figures and models to get his ideas across. A major part of his thesis in relation to prediction, and the cycle of improvement, were the postulate of three components to knowledge, evidence, prediction and degree of belief.

Chapter 3 of Shewhart (1939) is worthy of much closer attention than can be afforded here. This is where he appears to use Lewis’ work more than in other parts of this book. If we make a comparison with the way his theory was developed in his 1931 book, we can see how the notion of control and prediction were mutually dependent concepts, developed on the basis of reliable methods of measurement, sampling and probability theory. These concepts remain central to his thesis, but in the 1939 book, we may detect the 'pragmatic influence' of Lewis on his thinking.

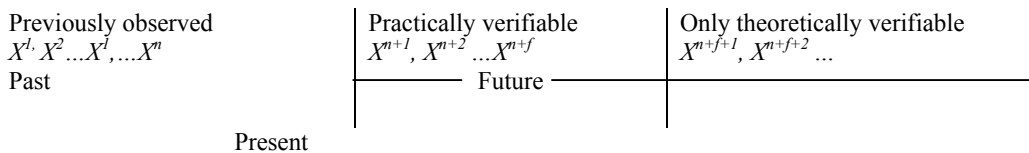


(Shewhart, 1939:86) Figure 11

Here, Shewhart made a distinction to show how statisticians may prefer to use more emotive language than scientific, while engineers mainly use the latter.

“Strange as it may seem in the face of this situation the statistician sometimes rushes in to help the scientist and engineer do a scientific job and forgets that a lot of his professional lingo is more emotive than scientific witness for example, the statisticians use of such phrases as statistical facts, confidence limit, probable error, most probable value and best estimate, to mention only a few” (p84).

This discussion predicates Figure 11 above and is analysed in some detail. The three components of knowledge form the basis of Shewhart’s epistemology. How we know what we know in Shewhart’s thesis, draws on the combination of scientific and emotive language. He acknowledges that there is no quantitative method of measuring the degree of belief in evidence in his model. This is where he has to be pragmatic and draw on notions such as intuition. Using another model to try to explain the dynamic nature of systems thinking, and how statistical methods fit, we can see the links with Lewis’ riddle described above.



(Shewhart, 193:133)

In explaining this model, Shewhart makes another link to Lewis, using a short quotation. This has since gained some currency since it (re)appeared in Deming (1993).

First Lewis (1929) ..”if there is to be any knowledge at all, some knowledge must be *a priori*” (quoted in Shewhart 1939:88). Shewhart’s own phrase to make a similar point was “What has just been said illustrates the generally accepted conclusion that *we can not have facts without some theory*” (op-cit.) (emphasis in original).

This relates to a crucial and very sensitive issue in this type of epistemology. How mind interacts with our experience of reality is the subject of numerous epistemological debates and theories. Here, we can see how Shewhart took Lewis’ premise as part of his own theory. However, we have to dig deep into the text to establish what theory Shewhart may have had in relation to mind. In the 1931 book, the extended bibliography refers readers to texts on philosophy, logic and psychology for example. Indeed, Shewhart was quite eclectic in his reading, demonstrating a scholarly approach to constructing a new theory.

“Philosophy for hypotheses on the nature of reality, functions of laws, theories and causal explanations, into the field of logic because it represents what we know about formal methods available in the theory of deduction and induction. How do data depend on the mind? What are the effect of factual experience and the effect of reasoning upon the observer? Perhaps more important, however, is that the mental experience involving reasoning influences to a marked extent what we serve” (p.482).

Apparently, Shewhart did not pursue the issue of mind in any detail at this point. However, if we study the text carefully we can find some illuminations on the role of the engineer. In Shewhart’s theory the ubiquitous engineer and statistician play pivotal roles. Engineers have to be in charge of designing products and processes, as well as being trained in statistical methods. Take this following passage as an example.

“The operation of control is in this sense a *dynamic process* involving a chain of actions, whereas the criterion of control is simply a tool used in this process. The successful quality engineer, like the successful research worker, is *not a pure reason*

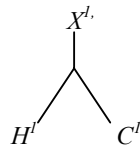
*machine* but instead is a *biological unit* reacting to and acting upon an ever changing environment” (Shewhart, 1939:38) (emphasis added).

Shewhart does not appear to develop or define the notion of biological unit, but it does indicate a close relationship with the product and processes, suggesting, mind engages in an activity of continual improvements. Part of this process involves the notion of management by prediction. Shewhart suggests there are at least three types of prediction to be considered, referring back to one of his previous examples.

“...the first, the type of prediction involved in a student range .... the second, the type involved in the tolerance range.... The third type of prediction,  $P^3$  is that involved in estimation and will be considered first since it is the one with which the statistician is most familiar.... Obviously all scientific predictions must have definite meanings and we shall accordingly choose the following.

*Criterion of meaning:* Every sentence in order to have definite scientific meaning must be practically or at least theoretically verifiable as either true or false upon the basis of experimental measurements either practically or theoretically obtainable by carrying out a definite and previously specified operation in the future. The meaning of such a sentence is the method of justification” (Shewhart, 1939:93-94).

The three types of prediction are built into a figure to show how data is collected and used for prediction, and by implication control (Shewhart, 1939:89) (see Fig 22, *ibid*: 102 for the complete figure involving prediction).



Where  $X$  is the data being gathered,  $H$  is the person collecting the data, and  $C$  is the conditions. The concomitance of the three signs in the figure represents the original data being collected, to be used in various forms of prediction. From this we consider the final point from Figure 11, which is the notion of belief. The notion of belief is duly qualified in Postulate II :

“In what follows we need to keep clearly in mind that the statement that the quality of product is in a state of statistical control involves a prediction  $P$  which may or may not be true, and it involves the evidence  $E$  for believing in the prediction. *The statement itself is a probable inference.* I shall assume the basic.

*Postulate II.* The objective degree of rational belief  $p\exists'$  in an inference involving a prediction  $P$  based upon evidence  $E$  is not an intrinsic property like a *truth* but inheres in the inference through some relation of the prediction  $P$  to the evidence  $E$ ”

(Shewhart, 1939:42) (emphasis in original)

Shewhart now combines several concepts to explain the process being discussed. A combination of mental, physical and mathematical concepts to assist in making predictions based on evidence provided at any one time. The prediction is not a *truth*, but a probable inference. The notion of prediction is complicated, and worthy of more space than can be provided here. But we should note that the state of statistical control was defined as a *state, an operation, and a judgement*. The judge of quality had to be familiar with all the consequences associated with Figure 11 above, whilst recognising the rules of probable inference and rules of evidence (ibid:43).

The final point left to raise here, is the role of Shewhart’s control charts. The control charts have been described as the voice of the process, or the process talking to us (Burr quoted in Deming:1986). So how do they reflect the pragmatic methods being searched for? The control charts display the information by which the engineer can interpret whether the process is in or out of control. Random and non-random data indicates whether the processes are stable or unstable. Unstable processes, display non-random patterns of variation on the control chart, making it impossible to predict the future performance of the process. Conversely, stable processes display random patterns of variation, and therefore may be used to predict with a degree of certainty the future behaviour of the process.

It follows therefore that control charts are inherently pragmatic in the way they convey information from the process. The information allows the management and control of the future performance of the process. An indicator of non-random data on

a control chart requires the engineer to interpret the signal on the basis of past experience and knowledge. Control charts ‘tell’ part of the story, which the engineer has to interpret as a “biological unit”. The engineer uses theory and knowledge gained from past experience to interpret the signal. The small dot on a control chart is the ultimate symbol for management by prediction, it is a sign sending a message to the engineer’s mind. Is it a signal or noise? What is the process saying? The interpretation of that small dot, or sign and any decisions to act on it, will be taken on an “economic” basis. The economic basis is sufficient to interpret it as a pragmatic decision. Economic theory provides a basis and justification for the rationale behind the decision. Economic theory is the means to interpret the data and predict whether any actions need to be taken.

### **Conclusion**

The aim of this paper was to prepare the ground for uncovering elements of pragmatism in Shewhart’s work. Shewhart and Deming were both apparently influenced by Lewis, but for some reason they did not use a 'pragmatic' discourse in their own writing. This investigation on the surface of this archaeological site has revealed similarities between Shewhart and Lewis’ theses. Indeed, we found strong pragmatist tendencies in Shewhart’s 1931 work, written before he read Lewis.

The application of statistical theory to mass production meant observing the production process as a system. Systems are dynamic and theories of knowledge pertaining to systems thinking may be problematic, because every thing appears to be in a state of flux. This raised the problem of how sentient beings react with, or act upon a system that is in a state of flux? We have seen a degree of semantic manipulation by philosophers wrestling with this age-old problem. Shewhart appears to have addressed this in a unique manner with the application of statistical methods and the development of control charts. The control charts display variation as data gathered from the process. Data has to be interpreted by the engineer, and thus a pragmatic activity takes place, because of the requirement to be economic. The state of statistical control is an ideal, but probably unattainable goal, and thus the decision to act is not final, but a step along a never ending path. A ‘justifiable’ decision made

to day, on an interpretation of evidence, need not be 'justifiable' tomorrow because the conditions will have changed.

If we return to the poem used at the beginning of this paper, we can see how Lewis and Shewhart attempted to address the riddle. Lewis, from the basis of a philosophy driven by practical results. Shewhart, from the basis of trying to solve a quality problem in a high-volume, mass-production industrial system. Both addressed the problems with defining and using a *priori* logic - Lewis more than Shewhart. Both addressed the problems of measuring the present - Shewhart probably more than Lewis in sheer practical terms. And they both addressed the problems of prediction. This paper has only scratched the surface and prepared the site for further, more rigorous investigation.

Future work will involve examining the closer relationship between sampling, probability and statistical theories and laws with the precepts of pragmatic methods. It is clear, there is a great deal of overlap, but one wonders where this begins and ends.

However, Shewhart had developed the major tenets of his work before he read Lewis' work, and we know from his bibliography, that several other philosophers influenced him. For the time being, it appears plausible to suggest that Shewhart and Deming used Lewis' work as a form of *post-hoc rationalisation*. So the work goes on...the site remains open.

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