**Reinterpreting Science as a Vocation**

**Abstract** Weber’s ‘science as a vocation’ has often been viewed as a therapeutic concept with no functional significance in the fully bureaucratized and professionalized modern science. However, development in the philosophy of science in the last century, especially the Kuhn thesis of the discontinuity of scientific progress and the Duhem-Quine thesis of underdetermination, shows that Weber’s distinction between science as a vocation and science as a profession (career) can answer one of the oldest questions in science studies: What makes scientific breakthroughs possible. The theory is applied empirically to answer the Needham question and explain the evolution of mainstream economics after World War II.

**Keywords**: vocation, profession, worldviews, Duhem-Quine thesis, discontinuity of scientific progress

# Introduction

Two years before his death, Max Weber delivered his famous lecture *Science as a Vocation* at the University of Munich, which still serves a constant source of inspiration for the sociology of science today (Kasavin 2020). One of the most important theoretical postulates in his lecture is the distinction between the two ideal types of academic ethics, ‘science as a vocation’ and ‘science as a profession’ (Weber 1919: 7). Briefly speaking, science as a vocation is the inner-worldly ascetic ethic for scientists, which maintains that ‘science must be pursued ‘for its own sake’’ (Weber 1919: 12) without ‘any eudaemonistic, not to say hedonistic, admixture’ (Weber 1905: 15), while science as a profession maintains that science is not the end, but the means towards the individual achievement and realization of the scientist, in the form of power and pleasure. Such distinction of the motives of scientists can also be found in Einstein’s *Principles of Research*:

In the temple of science are many mansions, and various indeed are the motives that have led them thither. Many take to science out of a joyful sense of superior intellectual power; science is their own special sport to which they look for vivid experience and the satisfaction of ambition; many others are to be found in the temple who have offered the products of their brains on this altar for purely utilitarian purposes. Were an angel of the Lord to come and drive all the people belonging to these two categories out of the temple, the assemblage would be seriously depleted, but there would still be some men, of both present and past times, left inside. Our Planck is one of them, and that is why we love him. (Einstein 1918)

 In Weber’s terminology, science as a vocation and science as a profession are two different worldviews that answer ultimate questions: ‘What is the meaning of life? What purpose does our existence serve? How do we best live our lives?’ (Kalberg 2004: 140). Due to the fundamental importance of worldviews in the rationalization of individual actions, one may reasonably suspect that the worldviews of the scientist might have significant impacts on how and on what he chooses to conduct his research and the subsequent outcome of his research. For example, Einstein continues by claiming that science is not possible without those scientists who do not take to science for power or pleasure:

Of one thing I feel sure: if the types we have just expelled were the only types there were, the temple would never have come to be, any more than a forest can grow which consists of nothing but creepers. (Einstein 1918)

This claim resonates with Weber’s emphasis that ‘to be able to succeed in producing something new in science, you need a calling’ (Weisz 2020: 15). Given the importance of worldviews throughout Weber’s works, it is likely that *Science as a Vocation* was intended as a precursor to a grand research agenda comparable to *The Protestant Ethic*, which aims to study ‘the significance of ascetic rationalism, its ideals of life and cultural influence; further to the development of philosophical and scientific empiricism, to technical development…’ (Weber 1905:109), but was interrupted by his premature death.

The objective of this article is to extend *Science as a Vocation* with the two most important doctrines in the philosophy of science in the last century: the Kuhn thesis and the Duhem-Quine thesis. The central idea is that the discontinuity in scientific progress and the underdetermination of scientific theory jointly imply that any individual attempt to make scientific discoveries is ‘an utter gamble’ (Weber 1919: 7) with little to no hope of success. Consequently, without ascetic scientists who pursue science as a vocation and abandon all hope (‘lasciate ogni speranza’, Weber 1919: 7) of individual success, a scientific community will be content with puzzle-solving within the existing paradigm (Kuhn 1962) and not witness any scientific breakthroughs.

# Review of the Kuhn Thesis and the Duhem-Quine Thesis

## Kuhn’s Thesis of the Discontinuity of Scientific Progress

In 1962, Thomas S. Kuhn criticized his contemporary historians of science for misleadingly portraying ‘scientific change as a linear process of ever-increasing knowledge’ (Shapere 1964: 383), which is ‘no more likely to fit the enterprise … than an image of a national culture drawn from a tourist brochure or a language text’ (Kuhn 1962: 2).[[1]](#footnote-2) The linear development-by-accumulation view is illustrated approximately by Figure 1: science is a system of knowledge $T$ consisting of a set of core theories $C$, and a set of auxiliary hypotheses $A\_{1},A\_{2},A\_{3},…$. Science progresses by the piecemeal accumulation of facts to test $T$, and the subsequent marginal modification, improvement, and extension of $T$. Under this view, the effort of each scientist will make a visible contribution towards scientific progress, so long as one conforms to a certain set of scientific norms and methods.



Figure 1: Science as Development-By-Accumulation

Kuhn argues that the development-by-accumulation view can only characterize the part of scientific progress which he calls ‘normal science’, during which the primary task of scientists is ‘puzzle-solving’ under the existing paradigm with little aim to ‘produce major novelties, conceptual or phenomenal’ (Kuhn 1962: 35), and omits paradigm-shifts, or scientific revolutions, during which ‘an older paradigm is replaced in whole or in part by an incompatible new one’ (Kuhn 1962: 92). Kuhn’s view of scientific progress is approximately illustrated in Figure 2. Scientific progress is characterized by periods of continuous accumulation under the existing paradigms $T\_{1},T\_{2},T\_{3},$ and revolutionary paradigm shifts which render the accumulated knowledge in the previous paradigms partially or entirely obsolete.[[2]](#footnote-3) Therefore, contrary to the development-by-accumulation view, Kuhn’s view implies the individual efforts of many scientists may be ‘wasted’ in the puzzle-solving within a derelict paradigm.



Figure 2: Science as a Sequence of Paradigm Shifts

## The Underdetermination Thesis

The underdetermination thesis states that the empirical evidence available to us at any given time is insufficient to determine what beliefs we should hold in response to it. For practical purposes, we follow Stanford (2017) and distinguish between two forms of underdetermination: holist underdetermination and contrastive underdetermination, but their difference is arguably ontologically insignificant if we take a strict Quinean holist view.

In Duhem (1906), he formulated his famous holism thesis: when a physical theory is tested by experiment, it is not the theory alone, but a large collection of theories, auxiliary hypotheses, and assumptions that are being put to test (Cover, Curd, and Pincock 2012: 334). Let us get back to Figure 1 for an illustration. Assume that $T$ represents Newtonian mechanics, and $C$ is Newton’s laws of motion together with the law of universal gravitation:

$$F\_{12}=G\frac{m\_{1}m\_{2}}{d^{2}}.$$

It is impossible to test the law of universal gravitation by itself, which is clearly devoid of empirical content. To test it using the observed position or velocity of a particular body, we need a myriad of additional theories and auxiliary hypotheses, such as the three laws of motion, the initial conditions of the body, and the assumption that the body is not significantly affected by other forces (Cover, Curd, and Pincock 2012: 335). Moreover, to measure the position or velocity of the body, we need instruments, such as telescopes, cameras, and clocks, which require us to use theories to move away from what we directly observe. Consequently, it is impossible to refute a theory by ‘crucial experiments’ because a theory can always be retained, ‘come what may’ (Quine 1951), by modifying auxiliary hypotheses. The Quinean holism thesis takes this argument to the extreme by claiming that ‘the unit of empirical significance is the whole of science’, or the entirety of human knowledge, including semantic rules and mathematical laws (Quine 1951).

Contrastive underdetermination concerns not the refutation of one theory itself, but the choice between rival theories, and it says that empirical evidence cannot determine which theory we should accept. Kuhn provides at least six arguments for contrastive underdetermination: (1) the theory-ladenness of observation, (2) the ambiguity of shared standards, (3) the collective inconsistency of rules, (4) shifting standards, (5) meaning variance, and (6) problem weighting (Cover, Curd, and Pincock 2012: 191). Getting back to Figure 2, contrastive underdetermination says that empirical evidence cannot tell us how to choose between $T\_{1}$, $T\_{2}$, or $T\_{3}$.

The underdetermination thesis essentially ‘falsified’ falsificationism (Popper 1959), because a theory can always be retained by introducing or modifying auxiliary hypotheses, and, consequently, no significant scientific theory can be falsified (Lakatos 1970; Thagard 1978). The implication is, at any particular point of time, a scientist cannot be certain whether the existing paradigm is in crisis, or where the more ‘progressed’ paradigm lies. In fact, Duhem claims that, in the face of underdetermination, neither logic nor empirical evidence can help with the theory choice, and ‘good sense’ is the only ‘judge of hypotheses which ought to be abandoned’ (Duhem 1906: 216).

## The Kuhn and Duhem-Quine Theses as Challenges to Worldviews

A very curious phenomenon is that, despite their canonical status in modern philosophy of science, the Kuhn thesis and the Duhem-Quine thesis are largely alien to practicing scientists, among whom the understanding of scientific process still consists predominantly of the linear view of scientific progress and falsificationism (Laudan 1982).[[3]](#footnote-4) For example, as a more vivid and detailed version of Figure 1, Might (2012) is widely circulated among PhD students around the world and has been translated into a few dozen languages; one of the most prestigious economics journals, the *Quarterly Journal of Economics*, published Lazear’s *Economic Imperialism* in 2000, which is a defense of the scientific status of mainstream economics using falsificationism.

This phenomenon is difficult to understand unless we take into account the role of worldviews, an often neglected concept in sociological analysis (Kalberg 2004), in determining the beliefs of humans. At the beginning of the twentieth century in the West, following the lead of Germany and the US, the ascetic academic morality of science as a vocation started to gradually give way to the individualistic science as a profession. Rather than maintaining that science must be pursued ‘for its own sake’, the new worldview elevated ‘self-fulfillment’ and its synonyms such as ‘individual achievement’, ‘self-development’ to the end of scholarly pursuit (Biel 1992: 134).[[4]](#footnote-5) ‘Intellectuals are not any more “above” the pursuit of status, power, and wealth than others’ (Smith 2003: 37). As Weber also lamented: ‘He is the philosopher … (who) seeks only true being. Well, who regards science in this light today? Now, the general feeling, particularly among young people, is the opposite, if anything’ (Weber 1919: 14).

Proponents of science as a profession did not legitimize it with blatant advocacy of selfishness but, instead, by claiming that the free pursuit of individual success is the necessary condition for ‘scientific progress’, ‘the most important faction of the process of intellectualization to which we have been subjected for thousands of years’ (Weber 1919: 12). This worldview underlying science as a profession is well supported by the development-by-accumulation view and the Popperian description of science as a mechanical process of hypothesis testing, both of which assert that the scientist can reap individual success as well as foster scientific progress by confidently following some mechanical ‘scientific methods’, but gravely challenged by the Kuhn thesis of discontinuity and the Duhem-Quine thesis of underdetermination. The omission of the latter two theses by practicing scientists is not an epistemological error, but a passive defense of their worldview, i.e., their perceived meaning of life.[[5]](#footnote-6)

# Worldviews and Scientific Progress

## How Scientific Breakthroughs Happen

The underdetermination thesis and the nonlinear structure of scientific progress outlined in Figure 2 pose a serious predicament for a practicing scientist. Imagine being a scientist who stands within the existing paradigm $T\_{1}$. Due to holist underdetermination, he can neither verify nor falsify $T\_{1}$, with logic or empirical evidence. Meanwhile, should he choose to venture outside $T\_{1}$ to search for alternative paradigms, due to contrastive underdetermination, he cannot know if he is on the path to a more ‘progressed’ paradigm, as there are infinite possibilities in the unknown universe of knowledge outside of $T\_{1}$. The uncertainty of scientific progress makes any attempts of scientific breakthroughs ‘an utter gamble’ (Weber 1919: 7) .

The Kuhn and Duhem-Quine theses are universal epistemological statements that apply to every scientist, regardless of experience, intelligence, and other personal characteristics. Therefore, the gamble for scientific discoveries is a ‘fair’ gamble such that ‘the inspiration of an amateur can be as productive scientifically as that of an expert, or even more so’ (Weber 1919: 8). Unless we believe in the myth of geniuses, who are people born with exceptional scientific creativity to lead science from darkness to light, the logical implication of the Kuhn and Duhem-Quine theses is that that ‘there is no such thing as a logical method of having new ideas’ (Popper 1959: 9), and scientific breakthroughs can only be achieved when sufficiently many scientists choose to venture outside the existing paradigm: the only certain way to win a gamble is to make sufficiently many bets. The law of scientific discovery is just the law of large numbers.

## Science as a Vocation as the Driver of Scientific Breakthroughs

Since the Industrial Revolution, no one would doubt that science is a ‘profitable’ endeavor, and it seems only natural that the scientific community will always endeavor towards making scientific breakthroughs. However, there is a crucial omission in such reasoning: in the gamble for scientific breakthroughs, the gain and loss are born by different individuals. As we have argued, science is a ‘fair’ gamble, and it takes no less effort, intelligence, and commitment from an individual scientist to make a failed attempt than a successful attempt, but only those who succeed will be remembered or rewarded. The collective profitability of scientific breakthroughs by no means implies that they are individually profitable.

A scientific discovery revises some of the statements in the existing research paradigm, which always leads to the revision of other statements because the cumulation of knowledge in a scientific subject is a ‘man-made fabric’ consisting of a myriad of interdependent statements (Quine 1951). Those discoveries deemed important enough to be called revolutions or breakthroughs involve the revision of the core statements in the existing paradigm, and consequently render obsolete most of its auxiliary statements and require the reconstruction of an entirely new set of auxiliary statements. Going back to Figure 2 for an illustration, if a scientist within $T\_{1}$ believes that, out of his ‘good sense’, $T\_{1}$ should be abandoned in favor of a new paradigm $T\_{2}$, he is responsible for proposing not only a core theory $C^{2}$ to replace $C^{1}$ but also a set of auxiliary theories $A\_{1}^{2}, A\_{2}^{2}, A\_{3}^{2}$ to replace $A\_{1}^{1}, A\_{2}^{1}, A\_{3}^{1}$. Such is an extremely demanding task, and a scientist must commit lengthy time and extraordinary effort before having the faintest idea of its outcome.

Moreover, due to the sheer number of possibilities arising from abandoning the core statements in the existing paradigm, the probability of a scientist being on the ‘right’ path is negligible at most. By venturing outside the existing paradigm, a scientist puts his entire academic career in jeopardy but stands to gain, with almost certainty, nothing but failure and oblivion. Therefore, the quest of science is incompatible with ‘the invidious concepts of honor, worth, merit, character, and the like’ (Veblen 1899: 235). Unless sufficiently many scientists treat science as a vocation without any eudaemonistic concerns, a scientific community will be content with puzzle-solving and not witness any breakthroughs, or, as Einstein claims, ‘the temple (of science) would never have come to be’.[[6]](#footnote-7)

As in Weber’s other works on the material influence of worldviews, the theodicy problem is also present in scientific development: ‘evil consequences often will ensue from the actions of those who exactly follow the precepts of the moral law’ (Parsons 1963: lvii). An individual scientist who is wholeheartedly committed to science without any selfish motives is destined to fail if his fellow scientists do not share the same worldview, the same way that an honest businessman is destined to fail among a community of dishonest competitors. Therefore, similar to the *Protestant Ethic*, the positive relationship between inner-worldly asceticism (the Protestant capitalistic spirit, science as a vocation) and material progress (economic prosperity, scientific progress) holds only for large-scale societies in the long run (Zhang 2021). It is difficult to give an exact definition of ‘large-scale’, but we will follow Weber and turn our attention to civilization studies when looking for empirical evidence.

## Science as a Profession as the Hindrance to Scientific Breakthroughs

Worldviews constitute the ‘foundational and background force for a methodical-rational organization of life’, and conflicting worldviews necessarily rationalize conflicting ideals of social norms that their disciples strive to establish (Kalberg 2004). Disciples of science as a profession, whose meaning of life is individual achievement and realization, will distort the entire academic institutions and norms towards the glorification of individual success. Due to the incompatibility between scientific progress and individual achievement, such institutions will inevitably discourage or even suppress scientific breakthroughs.

The achievements which the disciples of science as a profession are after are not spiritual experiences, but concrete earthly power, in the form of status, income, and influence within the academic community and society as a whole, the pursuit of which necessarily creates conflicts between individuals. To reconcile such conflicts, the ideal academic order for science a profession needs two institutional features: (1) a rigid and sophisticated hierarchical system as the measure of individual achievement; (2) a ‘meritocratic’ promotion system such that individual achievement is determined by ‘merit’, or one’s contribution to scientific progress.

However, the concept of a meritocratic academic promotion system is self-defeating, as scientific breakthroughs are too rare for the need of individual ranking and are marked by the fundamental mismatch between individual contribution and achievement. Consequently, the academic hierarchy and promotion system established by the disciples of science as a profession must entirely be based on normal scientific activities and outputs, in terms of publications, citations, research grants, and such (Hallonsten 2021b). The academic community becomes an ‘iron cage’ in which the scientist needs to constantly prove his individual merit so as to move up along or simply keep the status quo within the academic hierarchy. In this iron cage, those who attempt to make scientific breakthroughs will be quickly eliminated for failing to produce visible output fast enough according to the criteria of the existing paradigm, as they by definition need to deviate from its core dogmas and practices. Science as a profession slows down scientific progress not only passively by encouraging its disciples to be content with puzzle-solving, but also actively by ostracizing the disciples of science as a vocation and preventing them from attempting scientific breakthroughs.

It is worth pointing out that the above analysis largely disembedded science from the rest of society. In reality, business, political, and military interests have never ceased interfering with academic freedom (Hallonsten 2021a; Whimster 2019). Could worldviews also determine how much other social domains are willing to persecute and manipulate scientists, who are naturally the least powerful elites in a society, for their own interests? If this conjecture is true, what worldviews except for those glorifying power-seeking and individual success could lead to such actions? Besides fostering scientific breakthroughs within academia, asceticism might also be the necessary condition for academic freedom. This discussion, however, cannot be expanded here to avoid digression.

## How Derelict Paradigms Can Prosper

A derelict paradigm will not mechanically reach a crisis period and give way to a more progressed paradigm. Due to underdetermination, scientists within a derelict paradigm can always proliferate in puzzling-solving without acknowledging the crisis of the paradigm, as long as they are willing to forgo their ‘good sense’:

Scientists have thick skins. They do not abandon a theory merely because facts contradict it. They normally either invent some rescue hypothesis to explain what they call a mere anomaly or, if they cannot explain the anomaly, they ignore it, and direct their attention to other problems. (Lakatos 1977: 4)

 If all the members of a scientific community are disciples of science as a profession, they will contently pursue their individual success within the existing academic order, and a derelict paradigm can persist indefinitely with the same liveliness and dynamism as a promising paradigm. There have always been ways of conspicuously claiming intellectual merit without providing any scientific insight: in medieval Europe, the most popular way was rhetoric (Conley 1994); in imperial China, it was poetry and calligraphy (Weber 1919: 50); in modern economics, it is the abuse of mathematics to establish ‘a theoretical system which floats in the air and which bears little relation to what actually happens in the real world’ (Coase 1999). As Veblen points out, the pursuit of individual glory will divert the attention of the scholars to conspicuous research, intellectual ‘fields of speculation or investigation which are reputable and futile, rather than to the quest of scientific knowledge’ (Veblen 1899: 235). Unfortunately, due to underdetermination, such futile intellectual activities can never be distinguished from genuine scientific inquiries without the benefit of hindsight (which is to say, a more progressed scientific paradigm provided by the disciples of science as a vocation).

# Empirical Evidence

In this section, we raise two pieces of empirical evidence to support the fundamental importance of worldviews in determining scientific evolution. First, we use the case of modern mainstream economics to demonstrate how science as a profession hinders scientific progress. Second, we provide an interpretivist answer to the Needham Question: ‘why modern science had not developed in Chinese civilization but only in Europe’ (Needham 1969). As commented at the end of Section 3.2, due to the theodicy problem, we restrict attention to empirical observations at the civilization level.[[7]](#footnote-8)

## Mainstream Economics

Modern academic economic study is dominated by ‘mainstream economics’, a social research paradigm committed to explaining human behavior and social evolution with mathematics and statistics (Lazear 2000). It emerged as a distinct academic discipline from the beginning of the 20th century, and evolved into the dominant economic research paradigm in the West after WWII.[[8]](#footnote-9) It diverges drastically from classical economic studies, such as *Das Kapital* (Marx 1867) and *The Protestant Ethic* *and the Capitalistic Spirit* (Weber 1905), which rely primarily on philosophy, narrative, and interpretation.

Mathematical and statistical economics is heavily criticized for its lack of explanatory power and detachment from social reality (Fullbrook 2004). Many commentators believe that it is a scientific regress: the abuse of mathematics leads to the establishment of ‘a theoretical system which floats in the air and which bears little relation to what actually happens in the real world’ (Coase 1999) and the abuse of statistics lends legitimacy to such ‘post-real models’ (Romer 2016) through illusory statistical ‘causal’ analysis.[[9]](#footnote-10) However, because of their role in natural science (considered hard or ‘real’ science in public perception) and their inaccessibility to laypeople, mathematics and statistics do provide the appearance of intellectual exclusivity and superiority, [[10]](#footnote-11) which can be converted to material benefits such as money and fame.[[11]](#footnote-12) Mainstream economics can be viewed as a form of conspicuous research in the Veblenian sense: it is futile and has nothing to do with the quest of scientific knowledge, but reputable and conspicuous.

Consistent with our theory, the initial conversion of Western economists to mainstream economics was concomitant with the worldview transition from science as a vocation to science as a profession from the 1870s to the 1950s (Smith 2003; Weber 1919). Among post-WWII economists, the status of science as a profession was further consolidated by the rise of economic neoliberalism, which holds the central doctrine that individual profit-maximization leads to social welfare maximization (Hayek 1944; Friedman 1962; Burgin 2012). As disciples of science as a profession, mainstream economists pursue individual success, in the form of wealth, status, and honor, with no less devotion than the Protestants with their ‘calling’. [[12]](#footnote-13)

The rise of mainstream economics is accompanied by the establishment and refinement of an academic iron cage in the form of a meritocratic hierarchy, as predicted by our theory. As an arena, this iron cage needs rankings, rules, and honors to rank and glorify individual achievement. Compared with their pre-WWII predecessors and other social sciences less influenced by neoliberalism, mainstream economics possesses a much more sophisticated award and honor system,[[13]](#footnote-14) a more refined academic hierarchy,[[14]](#footnote-15) a more centralized labor market, and a more pragmatic promotion system that encourages conspicuous outputs, such as publications, grants, and citations.

Within the iron cage of mainstream economics, economists contently pursue their individual achievements in the name of progress; anyone who wants to step out of the paradigm will be alienated and ostracized in the name of meritocracy. Since their dominant worldview is science as a profession, too few economists are willing to sacrifice their careers to attempt breakthroughs. Mainstream economics, as a derelict research paradigm, continues to prosper without providing any contribution to the progress of social science.

## The Grand Titration

In his later years, the British historian, Arnold J. Toynbee, abandoned his own materialistic challenge-response model of civilization development because he believed that the sudden ‘acceleration and retardation’ of social development are recalcitrant to materialism (Toynbee 1987b). The most famous example of such acceleration and retardation in the history of science is the *Grand Titration* puzzle, or the *Needham Question*:‘why modern science had not developed in Chinese (Confucian) civilization but only in Europe’. More specifically, why the science of ancient China, which was at least on par with the West ‘between the first century BC and the fifteenth century AD’, started to lag behind massively in the sixteenth century (Needham 1969).

According to our theory, the emergence of science as a vocation, i.e. inner-worldly asceticism for science, will lead to a proliferation of scientific breakthroughs. In the West, inner-worldly asceticism emerged from the Protestant Reformation in 1517, coinciding with the timing of the Scientific Revolution and China’s lagging behind. Indeed, from the sixteenth century to the beginning of the twentieth century, breakthrough scientists are ‘overwhelmingly Protestant’,[[15]](#footnote-16) which is reminiscent of Weber’s observation about ‘business leaders’ and ‘the higher grades of skilled labor’ (Weber 1905: 3) in the *Protestant Ethic*. [[16]](#footnote-17) The essence of inner-worldly asceticism is as follows: for an inner-worldly ascetic, ‘the order of the world in which the ascetic is situated becomes for him a vocation which he must fulfill rationally’, and ‘all personal secular enjoyment of power is forbidden as a deification of the creaturely, though it is held that a rational legal order within society is pleasing to god’ (Weber 1920: 167-168). The core of this ‘ascetic ideal’ is self-denial, the denial of one’s own will to realization and power (Nietzsche 1887: ch3). [[17]](#footnote-18) As demonstrated in Weber (1905), Western inner-worldly asceticism has its origin in Calvin, not Plato.

The dominant religion in Chinese civilization, Confucianism, did not witness a similar reformation and remained a ‘weaker’ version of Western inner-worldly asceticism for two thousand years. Similar to Protestantism, Confucianism emphasizes self-denial: one of the central doctrines of Neo-Confucianism (ca. 800–1905 AD) is ‘Preserve heavenly laws and extinguish humanly desires’.[[18]](#footnote-19)[[19]](#footnote-20) However, Confucianism is not as thorough as Protestantism in its denial of self-realization and preservation. One of the *Four Books* (四书), *Great Learning* (大学), maintains as a central doctrine that ‘a cultivated person’ and ‘a harmonious/prosperous family’ are the necessary conditions for ‘a prosperous/stable country’ and ‘a peaceful/prosperous world’ (修身, 齐家, 治国, 平天下). One of the *Five Classics* (五经), *Classic of Poetry* (诗经), contains a famous verse: ‘Be wise and intelligent so as to preserve oneself (既明且哲, 以保其身)’. As summarized by Yu Ying-shih (余英時 2014), the worldview of Confucian scholars is a compromise between heavenly laws and humanly desires: ‘between heaven and human’ (天人之际). Therefore, the Confucian scholarly ethic belongs to science as a profession, which maintains that there is no conflict between individual achievement and the success of the collective scholarly endeavor.

Under the influence of Confucianism, Chinese scholarly class showed all symptoms of science as a profession between the first century BC and the nineteenth century AD: a reverence towards seniority, authority, and established classics (conformation to the existing paradigm) (Toynbee 1987a); an obsession with rhetoric, calligraphy, and poetry (reputable and futile intellectual activities) (Weber 1919: 50); a meritocratic intellectual hierarchy embedded in the political bureaucracy and epitomized by the Imperial Examination system.[[20]](#footnote-21) Before the sixteenth century, Chinese civilization accomplished remarkable achievements in astronomy, mathematics, and chemistry according to contemporary standards (Needham 1959) and invented “gunpowder, the compass, and the printing press which ushered in bourgeois society” (Karl 1863). However, after the Protestant Reformation and the rise of science as a vocation as the dominant scholarly worldview for a large proportion of Western scholars, Chinese civilization could no longer rival the exponential scientific progress in the West.

# An Iron Cage without Progress?

Since the beginning of the twentieth century, several generations of Western intellectuals have successfully transformed science into a fully bureaucratized and professionalized iron cage. This iron cage is an arena with ‘the character of sport’ (Weber 1905: 109). It aims to produce in a streamline ‘specialists without spirits’, who are encouraged to fight relentlessly with each other for intellectual supremacy, according to standardized rules called ‘scientific methods’, well-defined academic hierarchies, promotion systems, and labor markets, all in the name of progress. However, no society can live without spirits, and the spirit of this iron cage is nothing but the spirit of individualism and egoism, which was intended as the reaction to the ascetic tradition in Protestantism. This paper argues that science as a vocation is more than a therapeutic concept for idealists, but also the fundamental driver of scientific progress. In abandoning science as a vocation and idolizing the iron cage of modern science, we risk losing both the spirit of science and progress.

References

Berry, Colin. 1981. “The Nobel Scientists and the Origins of Scientific Achievement.” *The British Journal of Sociology* 32 (3): 381–91.

Biel, Steven. 1992. *Independent Intellectuals in the United States, 1910-1945*. The American Social Experience. New York: NYU Press.

Burgin, Angus. 2012. *The Great Persuasion: Reinventing Free Markets since the Depression*. Cambridge: Harvard University Press.

Coase, Ronald. 1999. “Interview with Ronald Coase.” *Newsletter of the International Society for New Institutional Economics*.

Conley, Thomas. 1994. *Rhetoric in the European Tradition*. Chicago: University of Chicago Press.

Cover, J A, Martin Curd, and Christopher Pincock. 2012. *Philosophy of Science: The Central Issues*. New York: Norton.

Debreu, Gerard. 1986. “Theoretic Models: Mathematical Form and Economic Content.” *Econometrica* 54 (6): 1259–70.

Duhem, Pierre M M. 1906. *The Aim and Structure of Physical Theory*. Atheneum Paperbacks. Princeton: Princeton University Press, 1954.

Einstein, Albert. 1918. “Principles of Research.” https://www.site.uottawa.ca/~yymao/misc/Einstein\_PlanckBirthday.html.

Fourcade, Marion, Etienne Ollion, and Yann Algan. 2015. “The Superiority of Economists.” *Journal of Economic Perspectives* 29 (1): 89–114.

Friedman, Milton. 1962. *Capitalism and Freedom*. NONE Series. Chicago: University of Chicago Press, 2009.

Fullbrook, Edward. 2004. *A Guide to What’s Wrong with Economics*. London: Anthem.

Hallonsten, Olof. 2021a. “On the Essential Role of Organized Skepticism in Science’s ‘Internal and Lawful Autonomy’ (Eigengesetzlichkeit).” *Journal of Classical Sociology* 21 (2): 1–22.

———. 2021b. “Stop Evaluating Science: A Historical-Sociological Argument.” *Social Science Information* 60 (1): 7–26.

Hayek, Friedrich. 1944. *The Road to Serfdom*. Chicago: University of Chicago Press, 2007.

Kalberg, Stephen. 2004. “The Past and Present Influence of World Views: Max Weber on a Neglected Sociological Concept.” *Journal of Classical Sociology* 4 (2): 139–63.

Karl. 1863. *Division of Labour and Mechanical Workshop. Tool and Machinery*. Marx/Engels Internet Archive, 2004.

Kasavin, Ilya, ed. 2020. “Special Issue: Science as a Profession and a Vocation: Weberian Meditations.” *Social Epistemology* 34 (2).

Kuhn, Thomas S. 1962. *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press, 2012.

Lakatos, Imre. 1970. “Falsification and the Methodology of Scientific Research Programmes.” In *Criticism and the Growth of Knowledge: Proceedings of the International Colloquium in the Philosophy of Science, London, 1965*, edited by Imre Lakatos and Alan Musgrave, 4:91–196. Cambridge: Cambridge University Press.

———. 1977. “Science and Pseudoscience.” In *Philosophical Papers*, 1:1–7. Cambridge: Cambridge University Press.

Laudan, Larry. 1982. “Commentary: Science at the Bar--Causes for Concern.” *Science, Technology, & Human Values* 7 (4): 16–19.

Lazear, Edward P. 2000. “Economic Imperialism.” *Quarterly Journal of Economics* 115 (1): 99–146.

Littlejohn, Ronnie L. 2010. *Confucianism: An Introduction*. I.B.Tauris Introductions to Religion. London: Bloomsbury Publishing.

Luther, Martin. 1525. *The Bondage of the Will*. Ambassador Classics. Belfast: Ambassador International, 2018.

Marx, Karl. 1867. *Capital, Volumn One*. London: Penguin Books Limited, 2004.

Merton, Robert K. 1938. “Science, Technology and Society in Seventeenth Century England.” *Osiris* 4: 360–632.

Might, Matthew. 2012. “The Illustrated Guide to a Ph.D.” http://matt.might.net/articles/phd-school-in-pictures/.

Needham, Joseph. 1959. *Science and Civilisation in China: Volume 3, Mathematics and the Sciences of the Heavens and the Earth*. Science and Civilisation in China. Cambridge: Cambridge University Press.

———. 1969. *The Grand Titration: Science and Society in East and West*. Taylor & Francis.

Nietzsche, Friedrich. 1887. *On the Genealogy of Morals*. London: Penguin Books Limited, 2013.

Parsons, Talcott. 1963. “Introduction.” In *The Sociology of Religion*. Boston: Beacon Press, 1993.

Popper, Karl. 1959. *The Logic of Scientific Discovery*. Milton Park: Taylor & Francis, 2005.

Quine, Willard V O. 1951. “Two Dogmas of Empiricism.” *The Philosophical Review* 1 (60): 20–42.

Shapere, Dudley. 1964. “The Structure of Scientific Revolutions.” *The Philosophical Review* 73 (3): 383–94.

Smith, Christian, ed. 2003. *The Secular Revolution: Power, Interests, and Conflict in the Secularization of American Public Life*. Berkeley: University of California Press.

Stanford, Kyle. 2017. “Underdetermination of Scientific Theory.” In *The Stanford Encyclopedia of Philosophy*, edited by Edward N Zalta, Winter 201. Metaphysics Research Lab, Stanford University.

Thagard, Paul R. 1978. “Why Astrology Is a Pseudoscience.” *PSA: Proceedings of the Biennial Meeting of the Philosophy of Science Association* 1: 223–34.

Toynbee, Arnold J. 1987a. *A Study of History, Vol. 1: Abridgement of Volumes I-VI*. Edited by D C Somervell. Oxford: Oxford University Press, 1987.

———. 1987b. *A Study of History, Vol. 2: Abridgement of Volumes VII-X*. Edited by D C Somervell. Oxford: Oxford University Press, 1987.

Veblen, Thorstein. 1899. *The Theory of the Leisure Class*. Mineola: Dover Publications, 2012.

Weber, Max. 1905. *The Protestant Ethic and the Spirit of Capitalism*. Amazon: CreateSpace Independent Publishing Platform, 2013.

———. 1915. *The Religion of China: Confucianism and Taoism*. Glencoe: The Free Press, 1951.

———. 1919. *The Vocation Lectures*. Indianapolis: Hackett Publishing Company, 2004.

———. 1920. *The Sociology of Religion*. Boston: Beacon Press, 1993.

Weisz, Eduardo. 2020. “Science, Rationalization, and the Persistence of Enchantment.” *Max Weber Studies* 20 (1): 8–24.

Whimster, Sam. 2019. “On Academic Freedom.” *Max Weber Studies* 19 (2): 246–59.

Zhang, Tong. 2021. “Was Weber Really Wrong? A Comment on Some Recent Empirical Studies on Economic Growth.” *Max Weber Studies* 21 (2): 203–12.

余英時. 2014. “論天人之際\_中國古代思想起源.” 台北: 聯經出版事業公司.

1. In this linear view, ‘science is the constellation of facts, theories, and methods collected in current texts”, and ‘scientific development becomes the piecemeal process by which these items have been added, singly and in combination, to the ever growing stockpile that constitutes scientific technique and knowledge” (Kuhn 1962: 2). [↑](#footnote-ref-2)
2. Kuhn shows that several major episodes in the history of science, such as the Copernican Revolution, Einstein’s discovery of general relativity, Dalton’s discovery of atomic theory, are all revolutions that cannot be classified as puzzle-solving in normal science. [↑](#footnote-ref-3)
3. ‘We can raise that question anew, with the added irony that, this time, the pro-science forces are defending a philosophy of science which is, in its way, every bit as outmoded as the ‘science’ of the creationists” (Laudan 1982: 19). [↑](#footnote-ref-4)
4. Weber also noticed the egoistic tendency of this newly-arisen ethic: ‘Today, that belief had put itself at the service of a number of idols whose shrines are to be found today at every street corner and in every periodical. These idols are “personality” and “experience”’ (Weber 1919: 10). [↑](#footnote-ref-5)
5. ‘Every religion which opposes the world with rational, ethical imperatives finds itself at some point in a state of tension with the irrationalities of the world (Weber 1915: 227)’. When such irrationalities are so grave as to jeopardize the core of a religion’s meaning system, they have to be either reconciled with the worldview through religious innovation or ignored entirely. [↑](#footnote-ref-6)
6. Note that both the Kuhn thesis and the Duhem-Quine thesis are essential for the unprofitability of individual attempts of scientific breakthroughs:

With the nonlinear structure of scientific evolution but without holist underdetermination, a scientist attempting breakthroughs can easily refute an existing derelict paradigm with empirical evidence in an epistemologically definitive way; without contrastive underdetermination, one can easily identify the next more progressed paradigm. Therefore, without underdetermination, a scientist who treats science as a profession can safely facilitate scientific progress while at the same time reap the individual honor of being crowned as a breakthrough scientist should he deviate from a derelict paradigm.

With underdetermination but without the nonlinear structure of scientific revolution, i.e., science progresses accumulatively and linearly without paradigm shifts, attempts of scientific breakthrough will not demand much effort and time from a scientist. If the more progressive paradigm is always an extension but not replacement of the derelict paradigm, attempts of scientific breakthroughs would never offend the scientific community and lead to professional failure or social alienation.

Therefore, the science as a vocation and science as a profession distinction would have no bearing on scientific progress if either one of the two theses were false. [↑](#footnote-ref-7)
7. The theodicy problem does not imply that the theory is less capable in providing interpretive explanations of the dynamics and structures of small-scale scientific communities; it merely implies that the positive relationship between science as a vocation and scientific progress can only be observed for large-scale scientific communities. [↑](#footnote-ref-8)
8. ‘Economics became more mathematical as a discipline throughout the first half of the 20th century, but introduction of new and generalized techniques in the period around the Second World War, as in game theory, would greatly broaden the use of mathematical formulations in economics’ (from the [Mathematical Economics](https://en.wikipedia.org/wiki/Mathematical_economics#:~:text=Mathematical%20economics%20is%20the%20application,and%20analyze%20problems%20in%20economics.&text=Mathematics%20allows%20economists%20to%20form,less%20easily%20be%20expressed%20informally.) entry on Wikipedia). ‘The steady course on which mathematical economics has held for the past four decades sharply contrasts with its progress during the preceding century” (Debreu 1986:1). [↑](#footnote-ref-9)
9. This deplorable situation is probably best summarized by Bernard Guerrien (2004: 4): ‘how such intelligent people can propose—and endlessly study—such stupid models?’ [↑](#footnote-ref-10)
10. As Edward Lazear proudly claims, the use of mathematics and statistics makes economics ‘the premier social science’, and it ensures that ‘economics is not only a social science, it is a genuine science’(Lazear, 2000: 99). [↑](#footnote-ref-11)
11. Since World War II, mainstream economists have achieved remarkably in their wealth, fame, and political influence. They occupy important advisory or executive positions in national governments and international institutions, such as IMF, World Bank, and central banks, and receive extensive media exposure and public attention (Montecinos and Markoff 2009; Hirschman and Berman 2014). They also receive a much higher salary than social scientists who do not use mathematics and statistics (Fourcade, Ollion, and Algan 2015). [↑](#footnote-ref-12)
12. ‘Whatever the underlying dynamic, there is suggestive and convergent evidence that economists are either more candid about pursuing their self-interest, or simply more selfish (by disposition or as a result of training) (Fourcade, Ollion, and Algan 2015).’ [↑](#footnote-ref-13)
13. In 1947, the John Bates Clark Medal was established by the American Economic Association to award ‘American economist under the age of forty who is adjudged to have made a significant contribution to economic thought and knowledge’; in 1968, the Nobel Memorial Prize in Economic Sciences was established; in 1989, the Review of Economic Studies tour was initiated to honor ‘the most promising graduating doctoral students in economics and finance’; in 1993, the Yrjö Jahnsson Award was established to honor European economists under the age of 45 ‘who have made a contribution in theoretical and applied research that is significant to the study of economics in Europe’. [↑](#footnote-ref-14)
14. ‘We document the pronounced hierarchy that exists within the discipline (mainstream economics), especially in comparison with other social sciences. The authority exerted by the field’s most powerful players, which fosters both intellectual cohesiveness and the active management of the discipline’s internal affairs, has few equivalents elsewhere (Fourcade, Ollion, and Algan 2015).’ [↑](#footnote-ref-15)
15. See Merton (1938) for evidence from seventeenth-century England. Berry (1981) shows that, even in the twentieth century, the distribution of Nobel prize winners (birth dates between 1835-1940) in the West is still heavily skewed towards Protestants. [↑](#footnote-ref-16)
16. To avoid excessive digression, we leave aside the discussion about the scientific achievements of the Jewish people and the evolution of Judaism, but the ‘inner similarity’ between Puritanism and Judaism has been noticed by Weber himself (Weber 1920: 259). [↑](#footnote-ref-17)
17. ‘The three great catch words of the ascetic ideal: poverty, humility, and chastity.’ It leads a philosopher to ‘shun showy and ostentatious things – things such as fame, princes, and women; he endures darkness and obscurity; he demands little enough.’ It is ‘the resentment of an insatiable instinct and ambition which would be master over life itself; an attempt made to use power to dam the sources of power; a baleful eye against well-being, joy, and pleasure. A sense of pleasure is experienced and sought in failure, in misfortune, in self-denial.’ It ‘means nothing at all’ for a person who seeks power and self-realization (Nietzsche 1887: ch3). [↑](#footnote-ref-18)
18. The original Chinese text is存天理，灭人欲 from 《朱子语类》. Conventionally, the Chinese character 天is translated into sky or heaven. However, this is a classic example of ‘lost in translation’. The Confucian concept of 天 is not the physical or materialistic concept of sky but more of a purposeful Supreme Being, much like the concept of God in Abrahamic religions. Recently, some sinologists start to use ‘God of Heaven’ as the English translation of 天 (Littlejohn 2010). Therefore, Confucianism shares with Protestantism, although less thoroughly, the doctrine of the incapacitation of human will (Luther 1525). [↑](#footnote-ref-19)
19. Zhu Xi’s explanation of the distinction between heavenly laws and humanly desires clearly shows that Confucian asceticism is of an inner-worldly nature. ‘Food and drink, heavenly laws; delicacies from mountains and seas, humanly desires (饮食, 天理也; 山珍海味, 人欲也)’. ‘Marriage, heavenly laws; three wives and four concubines, humanly desires (夫妻, 天理也; 三妻四妾, 人欲也)’. [↑](#footnote-ref-20)
20. Meritocracy is a Chinese invention. The pillar of Chinese meritocracy is the Imperial Examination system (chaju and keju) established in 134 BC by Han Wudi, whose adoption of Confucianism as the state religion marks the beginning of Confucianism as the dominant worldview of Chinese civilization. In the next two thousand years, the Imperial Examination system underwent transformations but persisted until 1905. In modern China where the legacy of Confucianism is still present despite the intrusion of Communism, the National Examination system (gaokao) is established as the succession to the Imperial Examination system. [↑](#footnote-ref-21)