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Can there be a 'scientific worldview'? A Critical Note

Abstract *In this brief note, a concept of the 'scientific worldview' is examined. In particular, contrary to some of the most often misconceptions regarding the concept, it will be argued (1) that there cannot be a 'scientific worldview' in the traditional sense of a Weltanschauung if science is taken in its strictest sense, (2) that the remaining ontological and epistemic skeleton cannot be a single unified picture of the world (Weltbild), and (3) that the supposed 'truth' of these remaining pictures cannot be unambiguously grounded either in the methodology of science, although the methodology itself can be explanatory and predictively adequate and successful, or in the technological success that is associated with science.*

Keywords: *'world view' vs 'world picture', science, methodology, technology, argument from success*

> *There is no 'scientific world-view' just as there is no uniform enterprise 'science' – except in the minds of metaphysicians, schoolmasters and scientists blinded by the achievements of their own particular niche. Still, there are many things we can learn from the sciences. But we can also learn from the humanities, from religion and from the remnants of ancient traditions that survived the onslaught of Western civilization. No area is unified and perfect, few areas are repulsive and completely without merit. There is no objective principle that could direct us away from the supermarket 'religion' or the supermarket 'art towards the more modern, and much more expensive supermarket 'science'.*
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> *Paul Feyerabend (1994: 146)*

As it is almost universally agreed, it was Immanuel Kant in his 1790 *Kritik der Urteilskraft* who first coined the word *Weltanschauung* (Kant 1914: 116),[1] and although he used it only once and in passing, the term has since then not only conquered the vocabulary of learned European elite of the nineteenth century, but has rapidly spread across all world languages with a high infectious affinity toward all possibly imaginable

1 With an exception of Hans-Georg Gadamer, who curiously attributed it to Hegel's seventeen years younger *The Phenomenology of Mind* (see Naugle 2002: 58, where also a full list of references related to Kant's priority can be found).

intellectual domains, as well as toward popular culture and everyday speech, either in the form of a loanword or a calque (see e.g. Naugle 2002: 58-64; Cobern 1991: 14-16; Wolters 1989: 15), for example as 'worldview' in English-speaking countries, or 'svjetonazor', 'мировоззрение', światopogląd etc. in Slavic languages. Thus today we have an amazing taxonomical multiplicity of philosophical (e.g. idealist, positivist, constructivist, postmodern...), religious (theistic, deistic, atheistic...), political (liberal, conservative, democratic...), economic (Marxist, neoliberal, green...), and other worldviews attributed to individuals, groups of people, local communities and whole cultures. In fact, it would be no exaggeration to claim that there are as many worldviews – both public and private - as there are consciousness people in the world, behind which seems to lurk what Husserl would call *Weltanschauungsnot* (Husserl 1965/1910: 64; cf. Kreiter 2007: 5), a strong inner need for a worldview among humans that seems to be as fundamental as our basic physiological needs, and perhaps, to put it in modern terms, "written somewhere in the language of the genetic code", as speculated by molecular biologist and geneticist Jacques Monod (1970: 183). Kant would certainly be flattered by the extreme impact his minor terminological invention has had to modern Western thought in boosting the awareness of this innate human craving, but nonetheless he would probably be confused not only by the contemporary grandeur of the beast he accidently delivered to the world, but also by great semantic transformations the term has underwent in the course of history. Namely, while Kant used *Weltanschauung* in a rather modest fashion in the sense of a global perceptual outlook at the world, the meaning of the term has afterwards gradually but irreversibly shifted from a mere picture of the world (*Weltbild*), from a body of descriptive ontological ("What is and what counts as the 'world'?"), explanatory ("How the defined world has become such as it is?"), and predictive knowledge ("How the world will look like in the future?") accompanied with an appropriate epistemic justification of that knowledge ("How do we know all this?"), to a universally-aiming prescriptive 'life-view' (*Lebensanschauung*) that "manifests itself in valuations, and the hierarchy of values" (Japers 1919: 1). *Weltanschauung* thus, as it is understood today, should be seen, roughly speaking, as a "picture of reality combined with a sense of its meaning and value, and with principles of action" (Rickman 1967: 493).

However, what about the 'scientific worldview'? That it exists – in the age in which almost every aspect of our daily life is dependent on and pervaded with science – this is the ascertainment that scarcely needs to be evidenced. Moreover, it is said that ever since its foundations has been laid in the work of natural philosophers of the seventeenth century, and spread across by Enlightenment philosophers of the eighteenth century, the scientific worldview was – and still is – one of the strongest forces in shaping and reshaping the culture of the Western world. But, it seems that to grasp what exactly is meant by the 'scientific worldview' is far from being an easy task, and one could spend numerous futile hours in searching the literature for a comprehensive definition or even a short explanatory note about what this worldview is supposed to be. Historians and philosophers of science have said very little about it (but, see Matthews 2009), and, even more curiously, those who are expected to be the most propulsive contemporary advocates of the 'scientific worldview'– working scientists themselves – remain largely silent, as it honestly stands in *Benchmarks for Science Literacy*, a publication of the science education program 'Project 2061' published by the American Association for the Advancement of Science: "The scientific worldview is not something that working scientists spend a lot of time discussing - they just do science" (AAAS 1993: 5).[2] Therefore, the notion of 'scientific worldview' seems to be one of these notions that everybody uses and assumes but nobody really understands, including the academia, education and media. But, in this note we do not wish to contribute to the confusion by trying to answer what the 'scientific worldview' is or should be – our primary intention is to show what the 'scientific worldview' cannot be. In particular, contrary to some of the most often misconceptions, it will be argued that there cannot be a 'scientific worldview' in the traditional sense of a *Weltanschauung* if science is taken in its strictest sense, that the remaining ontological and epistemic skeleton cannot be a single unified picture of the world (*Weltbild*), as well as that the supposed 'truth' of this picture cannot be unambiguously grounded either in the methodology of science, although the methodology itself can be explanatory and predictively adequate and successful, or in the 'technological success that is associated with science.

2 It seems that 'Seinsvergessenheit' is not specific only of philosophers. For example, although in the same manner the famous 'scientific method' is the bread and butter of their everyday work, it seems that the working scientists also rarely can provide its comprehensive definition, as vividly noticed by a biologist and Nobel laureate Peter Medawar: „Ask a scientist what he conceives the scientific method to be, and he will adopt an expression that is at once solemn and shifty-eyed: solemn because he feels he ought to declare an opinion; shifty-eyed because he is wondering how to conceal the fact that he has no opinion to declare" (Medawar 1969: 11).

As the question how does the 'scientific worldview' fit into the above traditional scheme of *Weltanschauungen,* let us be remembered that a worldview encompasses not only a commonly shared knowledge of what exists, a historical explanation of how the existing came to be such as it is, and how it will develop in the course of time, but also an overall perspective on life which should provide us with a system of values aiming at guidance in how we should live, how to distinguish good from bad, right from wrong, purposive from purposeless, or meaningful from meaningless, and what sort of actions should we undertake to fulfill these moral obligations. Now, as science is concerned, its ontological, explanatory, predictive and epistemic domains are granted by the very definition and scope of science (cf. Vidal 2012), but as the possibility of its axiological use is concerned, it seems obvious that natural science as *per definitionem* a systemized body of factual knowledge cannot deal with values, since there is a great logical gap between (descriptive) facts and (normative) values, or between 'what is' and 'what ought to be', as already famously warned by Hume in a well-known passage of his 1739 *A Treatise of Human Nature* (1965: 469).[3] In other words, and putting aside the problem of understanding what is an established 'scientific fact', and how the factual consensus in science is really achieved (for a non-trivial nature of these processes see e.g. Fleck 1979), science can plausibly provide statements of fact on, for example, the transmission spectrum for the Neptune-mass exoplanet GJ 436b, the effects of oxygen doping and pressure on transition temperature in Y0.9Ca0.1Ba2Cu3Oy superconductor, or how mTORC1 in the Paneth cell niche couples intestinal stem-cell function to calorie intake, but the only leap safe from 'Hume's guillotine' that can be made from these statements of fact is potentially to their practical applicability. This limit of science was nicely captured by Erwin Schrödinger, one of the revolutionaries of modern physics, who admitted that science "gives us a lot of factual information, puts all of our experience in a magnificently consistent order, but is ghastly silent about all and sundry that is really near to our heart that really matters to us", although it "sometimes pretends to answer

3 Of course, since Hume offered his arguments there have been attempts to derive 'ought' from 'is', and Searle's (1964) is certainly the most classic example, but it is commonly regarded that Mackie (1977) has offered a convincing rebuttal of Searle (for an early anthology of writings on the 'is-ought' problem see Hudson 1969, and for a recent one Pidgen 2010). In recent times, Harris (2010) has offered a popular account of what he sees as an scientifically plausible 'moral landscape' from his perspective as a neuroscientist. His ideas have been also severely criticized; however, this lies outside the scope of this brief critical note. For a review of this criticism and Harris' response see Harris 2011.

questions in these domains but the answers are very often so silly that we are not inclined to take them seriously (Schrödinger 1996: 95). In that sense, the notion of a 'scientific worldview' sounds more like a contradiction in terms than a strict and straightforward consequence of the scientific practice, which is not and cannot be 'a way of life', as occasionally can be heard in popularizing efforts of working scientists (e.g. Greene 2008), but at best a *Weltbild*, a scientific picture of the world as only one and in fact the most basic constituent of a *Weltanschauung*.

This picture, however, has allegedly one distinguished and superior feature in respect to traditional worldviews. Namely, while, for example, we speak of different religious worldviews (and the same applies to philosophical, political and other worldviews), which seems quite natural in light of the circumstance that there is a variety of theistic, deistic, panentheistic and pantheistic religions and the multiplicity of their subspecies like duotheism, henotheism, monotheism, polytheism and trinitarian theism, we always assume a single unified scientific picture of the world, despite the fact that there is also a disciplinary variety of natural sciences with the multiplicity of their subdisciplines like physical (atomic and molecular physics, condensed matter physics, particle and field physics, nuclear physics…), chemical (inorganic, organic, physical, polymer, electrochemistry, colloid chemistry…), biological (cell biology, genetics, microbiology, virology, biophysics, botany, zoology…), and environmental sciences (geology, mineralogy, volcanology, meteorology, oceanography…). In the 'age of reductionism', as Robert Nozick (1981: 630) labeled the twentieth century, which tended to see all objects, events and processes, including the body, mind and consciousness, exclusively in terms of their physical properties, and consequently all special sciences reduced to physics,[4] this circumstance is easily understood. Greatly inspired by the success of the reductionist program in the nineteenth century physics, where, for example, optics has been reduced to electromagnetism, and thermodynamics to statistical mechanics, it captured both the assumption of the unity of science and the underlying ontological assumption of the unity of the world. Nonetheless, the twentieth century science had also witnessed a major crisis of this program in the sense that "the behavior of large and complex aggregates of elementary particles [turned out] not to be understood in

4 As famously proclaimed by a physicist Richard Feynman, „everything that animals do, atoms do. In other words, there is nothing that living things do that cannot be understood from the point of view that they are made of atoms acting according to the laws of physics." (Feynman 1963: 1-8).

terms of a simple extrapolation of the properties of a few particles; instead, at each level of complexity entirely new properties appear, and the understanding of the new behaviors requires research which is as fundamental in its nature as any other (Anderson 1972: 393),[5] and this general feeling that reductionism is "at best irrelevant and at worst misleading as a description of what science is about" (Dyson 1996: 800) has affected not only physics, but also other natural sciences (see, e.g. Agazzi 1991a; Clayton & Davies 2006). But, if there are different partial scientific *pictures* of different slices of reality, corresponding to qualitatively different, mutually irreducible emergent 'levels of reality' that require an analysis of their own, then both the unity of science and the ontological unity of the world are relativized to the point that we cannot speak about a unified scientific *picture* of the world anymore, just as we cannot speak about the unified religious, political or economic worldview.

Now, the following question arises: does the plurality of scientific pictures of the world that clearly follows from the failure of reductionism mean that this plurality should be treated on the same footing as the plurality characteristic of the traditional worldviews? The expected answer would certainly be negative. In particular, it can be argued that although "ontologically founded unity of science cannot be defended seriously" (Agazzi 1991b: 10), its unity nevertheless can be restored by recalling its methodological unity, since despite the variety of natural sciences they all share a common core of the universal scientific method founded on a careful and systematic observation and the use of experiment. Consequently, there may be different non-overlapping scientific pictures of different empirical domains of the world accessible to

5 To briefly illustrate the problem, let us use a familiar example of water, which, as already known to elementary school children, is at the microscopic level composed of molecules consisting of hydrogen and oxygen atoms. However, there are macroscopic properties of water (like its 'wetness', transparency, or viscosity) that are evidently not the properties of individual molecules of water, but only of a collection of many water molecules in certain conditions. Thus the knowledge of the properties of water molecules and its constituent parts alone will not provide a full predictive power in respect to the emergent properties of water. It requires both a microchemist and a macrochemist, as well as a physical chemist and a quantum physicist, although their own perspectives on the common subject 'water' differ to an extent of actually 'seeing' it differently. In the same manner one could also see the world of human affairs: „Similarly, human beings have unique characteristics (or qualities), such as being able to love, being governed by abstract principles of moral and ethical conduct, or showing high levels of 'need achievement', that emerge as ontogenetically distinct (qualitatively discontinuous) features and cannot be understood by mere reduction to underlying neural, hormonal, and muscular processes." (Lerner 2001:60).

different special sciences but, in contrast to the non-evidential nature of traditional worldviews, an essential difference in respect to these can be found in the assumption that all these pictures, captured in scientific theories, are nonetheless literary (or, at least approximately) true stories of what the world is like. Surely, most working scientists see their work this way. However, as extensively revealed by post-positivist philosophy of science (for its main theses see e.g. Laudan *et al*. 1986), the path from empirical facts to scientific theories is anything but straightforward and unambiguous.[6] In particular, contrary to the assumption that observation and experiment is a 'royal road to true knowledge' or even "the sole source of truth" (Poincaré 1952[1902]: 140), it has been shown (*a*) that neither conclusive verification nor falsification is possible in science, according to the famous Duhem-Quine thesis (Duhem 1954; Quine 1951), (*b*) that the assumed theoretical 'neutrality' of empirical facts, that lies at the heart of the possibility of an objective assessment of rival hypotheses, cannot be rigorously provided, according to the 'theory-ladenness' thesis (Hanson 1958; Kuhn 1962), and (*c*) that empirical data do not unequivocally determine the choice of a theory, i.e. that it is always possible to construct an alternative, and even logically incompatible theory that will save the phenomenon under question as good as its rival, according to the 'underdetermination thesis' (Newton-Smith 1978; Laudan & Leplin 1991). Besides, the 'scientific truth' has been shown to have a high degree of historical contingency. As captured by the so-called 'pessimistic induction' argument (Laudan 1981), what we can learn from the history of science is that this history is a vast graveyard of departed theories that were once 'true' in the sense of adequately explaining empirical facts but are nowadays regarded 'false' about "the deep-structure claims they had made about the world" (Ibid.: 32); accordingly, there is nothing thrilling in the 'truth' of our currently accepted theories, no matter how impressive and successful they may be, since they easily may turn 'false' in the future, just like their predecessors did.[7] Understandably, although perhaps unpleasantly, in one such historical and philosophical perspective, the plurality of 'scientific pictures' of the world is epistemically brought close enough to the plurality of their traditional counterparts.

6 The present author has analyzed these difficulties in details in Kožnjak (2013).
7 Laudan has offered an extensive list of these succesful yet false theories, and the list could be easily extended *ad nauseam* (the crystalline spheres of ancient and medieval astronomy, the effluvial theory of static electricity, the phlogiston theory of chemistry, the caloric theory of heat, the vibratory theory of heat, the optical ether etc.)

This perspective, finally, also brings us nearer to a better understanding of the 'ultimate argument' that is traditionally not only used for corroborating scientific realism itself but also a special status the so-called 'scientific worldview' enjoys in modern society – the argument from the success of science – which in its classical form (Smart 1963: 39; Putnam 1975: 73; van Fraassen 1980: 39; Musgrave 1988) suggests that the success of science (explanatory, predictive, and technological) would be miraculous if scientific theories are non-referring. This sentiment was nicely captured by Paul Davies, who assumed that taking into account "the tremendous power of scientific reasoning demonstrated daily in the many marvels of modern technology" makes it "reasonable then to have some confidence in the scientist's worldview also" (Davies 1983: 6). However, as the history of science taught us, scientific theories need not to be either 'true' or 'false' in order to be empirically successful. In fact, as further argued by van Fraassen (1980), science can and do proceed without much worries about the 'truth'; to be part of science, theories only need to be 'empirically adequate', i.e. capable to provide good agreements with observable phenomena in nature, or to put it in more traditional terms, to plausibly 'save the phenomena'. This is not without consequences also for the technological part of the 'miracle argument'; namely, if the success of technology, which is standardly seen merely as an applied science, should count as evidence for the success of science, than at best this evidence can contribute to the acceptance of empirical adequacy of underlying theories, which however does not refer to any particular 'true' picture of reality. To make it even worse, historians and philosophers of technology (see, e.g. Mumford 1934; Agassi 1966; Smithurst 1995; Petroski 2010) have substantially called into question the standard distinction between science and technology, and particularly the assumption that technology and engineering are reducible to the application of prior scientific knowledge in a simple and trivial manner. Moreover, the history of technology and engineering reveals that practical 'know-how' knowledge has had a life of its own, largely independent of a theoretical domain of science, and that in fact many great inventions that have revolutionized our way of life were constructed either in the absence of a scientific theory (the steam engine, where the explanatory theory came after its development, being the most notable example; see Kerker 1961), or in the presence of a false theory (like in the case internal combustion engine; see Bryant 1967). To be sure, many technological breakthroughs were being made due to purely theoretical predictions, and modern technology seems almost impossible without them, but these advances, according to the underdetermination thesis, could also be predicted and explained on the basis of different, even rival and logically incompatible theories.[8] Left only with empirical adequacy, even the 'success argument' does not sound as a promising ground for building a 'scientific picture' of the world, let alone a *Lebensanschauung*.

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8 To illustrate this point, let us take an example of a technological application of quantum mechanics. For example, recently a Japanese research group has realized a revolutionary terahertz high-speed wireless communication at 1.5 Gbps with a device using the so-called resonant tunneling diode (RTD), predicted and fully explained by the standard quantum mechanics already in 1970s. However, RTDs are also easily explainable within the so-called Bohmian mechanics (see Oriols & Mompart 2012). This poses a dilemma: what 'picture of the world' should evidence the success of this device? As is well known, these two formulations of quantum mechanics, although predictively and empirically equivalent, correspond to two radically different and incommensurable 'world pictures'.

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Postoji li „naučni pogled na svet"? Kritička beleška

Sažetak
U ovoj kratkoj belešci razmatra se koncept 'naučnog pogleda na svet. Uopšteno, nasuprot nekim uobičajenim pogrešnim shvatanjima, ovde se zagovara (1) kako zapravo ne može biti nekog 'naučnog pogleda na svet' u tradicionalnom smislu *Weltanschauung*-a ukoliko nauku pojmimo u njenom strogom smislu, (2) da preostali ontološki i epistemički kostur ne može biti neka jedinstvena slika sveta (*Weltbild*), te (3) da pretpostavljena 'istina' ovih preostalih slikâ sveta ne može jednoznačno biti utemeljena niti u metodologiji nauke, iako ova metodologija može biti eksplanatorno i prediktivno adekvatna i uspešna, niti na tehnološkom uspehu koji se povezuje sa naukom.

Ključne riječi: pogled na svet, slika sveta, nauka, metodologija, tehnologija, argument uspeha