Hayek, Mach, and the Re-ordering of Mind

Maria N Ivanova
m.ivanova@gold.ac.uk

Abstract

This paper argues that Friedrich A. v. Hayek’s theory of mind and the relation between mental and physical events, most systematically presented in his 1952 book, *The Sensory Order*, is indebted to Ernst Mach’s theory, and, in particular, to his *Analysis of Sensations*, above and beyond what Hayek himself along with multiple admirers of his work ever cared to admit. By highlighting a number of important similarities between Mach’s and Hayek’s theories of the psychical/phenomenal and physical world/order, the paper aims to show that key aspects of Hayek’s theory of mind can be traced back to Mach’s theoretical foundations.
Hayek, Mach, and the Re-ordering of Mind

This order which we call mind is thus the order prevailing in a particular part of the physical universe – that part of it which is ourselves.

Hayek (1952, 178)

Introduction

The theoretical and methodological foundations of Friedrich A. von Hayek’s work have been much debated. Accounts emphasizing singular theoretical breaks and methodological turning points in Hayek’s thought have played a prominent role in those debates (e.g. Caldwell, 1988; Fleetwood, 1995; Hutchinson, 1981). This paper takes a different approach in that it seeks to emphasize a remarkable degree of continuity in Hayek’s intellectual trajectory. I argue that the transformations – one or many – that Hayek might have undergone appear superficial against the backdrop of long-standing traits of his thought that could be traced back to foundational influences he experienced in the years following World War One in his native Vienna. This paper engages with one of those influences stemming from Hayek’s exposure to the ideas of Ernst Mach, a physicist turned philosopher of science and a famous anti-metaphysical thinker at the time, whose often neglected, and even more often misrepresented, influence on Hayek’s theory of mind is difficult to exaggerate.

This paper argues that Hayek’s theory of mind and the relation between mental and physical events, most systematically presented in his 1952 book, The Sensory Order, is indebted to Mach’s theory, and, in particular, to his Analysis of Sensations, above and beyond what Hayek himself along with multiple admirers of his work ever cared to admit. While many writers have acknowledged, typically in passing, that Mach’s ideas at one time influenced Hayek, very few have actually grappled with a closer examination of how significant this influence was or why it endured. In fact, the majority have contented themselves with Hayek’s self-congratulating version of the affair (i.e. that he
had crafted a ‘critique’ of Mach’s theory), without any serious study or assessment of the impact of Mach’s ideas on Hayek based on an engagement with the former’s own work. Notably, despite Hayek’s claim to have refuted the phenomenalist foundations of Mach’s philosophical conclusions, the underpinnings of his theory of mind are taken over directly from Mach while the main thesis of The Sensory Order reads like ‘an ambitious extrapolation of Mach’s own thesis concerning the nature and status of sensations’ (Smith, 1997, 15).

The purpose of this paper is not to defend Mach’s psychology or his philosophy but rather to demonstrate that Hayek’s venture into ‘theoretical psychology’ – his theory of the sensory order – becomes fully comprehensible only by reestablishing its original link to Mach’s theoretical system. By pointing to the continuity in Hayek’s work, I do not mean to imply that said continuity signifies a lack of contradictions. On the contrary, contradictions abound. And some of those contradictions stem directly from Hayek’s attempt to separate the ‘rational kernel’ of Mach’s psychology from the allegedly ‘metaphysical’ shell of his philosophy by integrating the former into his approach while attempting to discard the latter. Arguably, in-built contradictions of Hayek’s own approach can account for the widely differing interpretations of his work offered by various scholars and for the need to resort to transitions, transformations, breaks, phases, and periods in an attempt to make sense of his meandering through subjectivism, apriorism, empiricism, materialism, less materialism, and dualism ‘for practical purposes’, to name but a few. For Hayek is a pragmatist and even an opportunist depending on what he wants to argue. Thus, on his own admission, he is a materialist in asserting that mental qualities could be explained by the operation of the same kind of processes as those occurring in the material world (Hayek, 1952, 177). But at the same time, he is less materialistic than the dualists that defend the existence of mind as a separate substance. However, he could also content himself with a dualistic view of the world ‘for practical purposes’, that is, when he
wants to object to the behaviorism of John B. Watson, the physicalism of Otto Neurath, and other varieties of materialism (Ibid, 179).

The remainder of this paper proceeds to outline some essential features of Mach’s and Hayek’s theories of the psychical/phenomenal and physical world/order. By highlighting a number of similarities between them I attempt to show that key aspects of Hayek’s theory of mind can be traced back to Mach’s theoretical foundations. The paper concludes with an examination of the validity of the criticisms Hayek levels against Mach.

From Elements to Compounds to a Unified System: The World as a Continuum

Mach’s theoretical perspective has conventionally been placed within the philosophical tradition of neutral monism whose central idea is generally construed as that physics and psychology, or the study of physical and mental events, are different ways of constructing theories about what is originally given as ‘neutral’ matter. In Mach’s version of neutral monism, what is originally given is not ‘matter’ but homogenous elements which represent the ultimate constituents of all physical and mental phenomena. These elements form compounds or complexes whose patterns of combination are constantly changing. The difference between mental and physical phenomena arises from the different ways in which the elements are combined or arranged. Thus, both mind (the ego) and matter (the body) are complexes or combinations of elements. ‘Thing, body, matter, are nothing apart from the combinations of the elements, the colors, sounds, and so forth’ (Mach, 1914, 6).

Similarly, the ego is ‘that complex of memories, moods, and feelings, joined to a particular body (the human body)’ (Ibid, 3). Once we have discovered that

the supposed unities ‘body’ and ‘ego’ are only makeshifts, designed for provisional orientation and for definite practical ends…, [t]he antithesis between ego and world, between sensation (appearance) and thing, then
vanishes, and we have simply to deal with the connexion of the elements... of which this antithesis was only a partially appropriate and imperfect expression. This connexion is nothing more or less than the combination of the above-mentioned elements with other similar elements (time and space). (Ibid, 13)

The terms ‘elements’, understood as the ultimate constituents of all things, and ‘sensations’ are not identical (some confusion here arises from the fact that Mach frequently refers to ‘sensations’ as ‘elements of experience’, for example). This does not mean that sensations are intrinsically different from the elements but rather that elements become sensations only when ‘standing to one another in a certain known relation’ (connexion) of functional dependence on each other (Ibid, 243). ‘In another functional relation [the elements] are at the same time physical objects’ (Ibid, 16). Thus, Mach’s elements are neither physical nor psychical. It is their ordering in any concrete situation/configuration (‘the nature of the connexion’) that allows them to be classified as the one or the other. Mach, long before Hayek, suggested that human mind uses the sensory order in order to classify objects. The need to ‘arrange’ facts and phenomena thereby forming a mental system of classification arises from the limitations of the human cognitive capacity and memory, in particular (Mach, 1911, 55). Science emerges as a result of the inability of human mind to retain all individual facts. This is why we need classification, systematization, various shorthand formulae for collections of empirical facts, such as scientific laws, and theories as systems of ordered facts.

In Mach’s view, all science should be based on evidence which is gathered through sensations. While experience represents Mach's epistemic base, his notion of it is rather specific and, as we shall see, closely aligned with the one adopted by Hayek. Experience has an immediate (sensory) component and an a priori component which, in contradistinction to Kantian philosophy, is not of transcendental nature but is itself formed in experience and manifested in ‘memory-traces of former experience and their interconnection (association)’ present not only in higher-level organisms but also in elementary ones (Mach, 1914, 100). Individual memory which plays an
essential role in classifying and retaining personal experience has a hereditary component reflective of the ‘experience of the race’. Thus, sensations, the starting point of all perceptions that form human experience, arise through the interaction between immediate sensory impulses and pre-existing cognitive structures. It is because of these structures that we are able to classify the relations between the elements constituting sensations as in the example of a melody that cannot be recognized by capturing its single sounds but only by capturing the relations between them (Becchio, 2011, 174).

The fact that all fields of scientific inquiry have the same source of evidence – sensations – serves as a key rational for the unification of sciences that Mach thought would eventually occur. But it is not just the source of evidence that is common to all sciences, they also share the same purpose – the adaptation of thoughts to facts and of the thoughts to each other – along with the same method. In contradistinction to traditional anti-metaphysicians who challenged the conclusions of metaphysics based on its speculative method and favored the observational method instead, Mach takes a different path. Scientific conclusions may be tentative but it is the method of attaining knowledge, not the knowledge itself, whose validity must be ensured. The soundness of the scientific method must be certified by its ability to successfully relate concepts and ideas to their empirical base. In Mach’s view, the method of science is neither subjective, as in metaphysics, nor objective as in traditional empiricism, but impersonal (Cohen, 1968). ‘The ego, Mach (1914, 24) famously wrote, must be given up’. It is important to elucidate the exact meaning of that.

Mach sees the world as a continuum of connexions of elements in constant flux. The ego is also a continuum or ‘continuity’ as Mach sometimes prefers to call it. More precisely, the ego is a temporary continuum in the larger, more permanent continuum of the world. It is not the ego per se but ‘continuity alone’ that is important. Continuity, however, is only ‘a means’ of maintaining and
preserving the contents of the ego which are not ultimately confined to the individual but can endure even after their death.

*Contents of consciousness […] that are of universal significance, break through [the] limits of the individual, and, attached of course to individuals again, can enjoy a continued existence of an impersonal, superpersonal kind, independently of the personality by means of which they were developed. To contribute to this is the greatest happiness of the artist, the scientist, the inventor, the social reformer, etc. (Ibid, 24)*

The purpose of this analysis is not to provide a justification or even assess the plausibility of Mach’s idea of unified science but simply to suggest that said idea could be seen as logically following from Mach’s conception of the universe as a continuum.

**How the Limited Ability of Human Mind to Comprehend the Unitary Order, of Which It Forms Part, Produces the Appearance of Two Orders**

*The Sensory Order* developed out of a manuscript entitled ‘Contributions to the Theory of the Development of Consciousness’ that Hayek wrote in the summer of 1920 while still a student at the University of Vienna. Hayek’s renewed attention to this problematique, some 25 years after he had first encountered and abandoned it, can be fully understood only within the context of his endeavor to prove that there is ‘no other way’ to study social phenomena than through understanding of individual action and behavior (Hayek, 1948, 3). The stated purpose of the 1920 paper was to develop a physiological explanation of ‘consciousness phenomena’ (Bewusstseinserscheinungen) thereby integrating the study of consciousness ‘into the world view of natural science’ (Hayek, 2006[1920]), 199). The purpose of *The Sensory Order*, although more ambitious in scope and somewhat more sophisticatedly phrased is practically unchanged: it aims to develop a physiologically based theory of mind and consciousness. The 1920 paper represented a reaction to and an
attempted critique of some aspects of Mach’s theoretical system. In the 1952 book, Hayek mentions approvingly Mach’s psychology but denounces his philosophy on the grounds of its phenomenalist tendencies. And yet both the topic of the book and its chosen title evoke a direct reference to Mach’s *Analysis of Sensations and the Relation of the Physical to the Psychical*.

As Hayek states early in the book, *The Sensory Order* represents his take on the traditional mind-body problem, or the relation between mental and physical events. He takes on the somewhat tricky task of showing how the two orders – the objective, physical one which is the subject of physical sciences and the subjective, mental or phenomenal one which we experience as individuals – are similar but not identical. The task is tricky because Hayek, similarly to Mach, sees the mental order as a part of the physical order (although, a part ‘whose precise position in that larger order we shall never be able to determine’ (Hayek, 1952, 5)) and intends to show that there is a systematic structural similarity between the two. The trickiness of the entire enterprise is compounded by the fact that it is laid down not on an original Hayekian ‘individualist’ and anti-collectivist foundation but on the borrowed wholistic and anti-ego, Machian one. The resort to this shortcut has augmented the number and magnitude of Hayekian contradictions, some of which will be discussed below.

Hayek’s ontological categorization of all things existing in the world (he systematically prefers to call these things ‘events’ whereas Mach’s terms of choice are sensations, (sensory) elements, or phenomena) is analogous to the one developed by Mach. The latter identifies three different categories or subsets of element compounds: the objects of the physical world designated by the letters A, B, C…, which exhibit strong event regularities and are the subject of physics. The second category designated by K, L, M… represents ‘the complex, known as our own body, which is a part of the former complexes distinguished by certain peculiarities’. The final category designated by α, β, γ… includes memory images, perceptions, abstract concepts, etc., that is, the totality of
mental life. The combination of the last two categories constitutes ‘the ego’ and is the subject of psychology. Mach argues that these three subsets are not only connected but codetermine one other (Mach 1914, 8ff.). Hayek similarly identifies three different structures each consisting of multiple distinct elements that relate to each other thereby forming an order: the physical order of the external world, or of the physical stimuli; the neural order of the fibres, and of the impulses proceeding in these fibres, and the mental or phenomenal order of sensations and other mental qualities (Hayek, 1952, 39ff.).

Hayek defines the sensory or phenomenal order as a subset of the larger mental order. The peculiar attributes of the latter, such as images, emotions, and abstract concepts, are organized according to the same general principles that govern the order of sensory qualities. The mental order itself is a part of the physical order being located in a sub-system of the latter (the organism). This sub-system is in some respects similar to and in others different from the more comprehensive physical order. Hayek emphasizes that the difference between the phenomenal and physical order is not tantamount to the difference between ‘reality’ and ‘appearance’ but arises from the difference between the effects that the physical objects have on each other and the effects of they have on us.

In so far as the similarities or differences of the phenomena as perceived by us do not correspond with the similarities or differences which the perceived events manifest in their relations to each other, we are not entitled to assume that the world appears to us as it does because it is like that; the question why it appears to us as it does becomes a genuine problem. (Ibid, 6)

This genuine problem indeed is due to be solved by the science of psychology which should ‘take the physical world as represented by modern physics as given and try to reconstruct the process by which the organism classifies the physical events in the manner which is familiar to us as the order of sensory qualities’ (Ibid, 7). Hayek then proceeds to reconstruct mental activity as physical activity by equating the mental or phenomenal order with the neural order existing between the fibers in the central nervous system and the impulses transmitted by them in response to external stimuli. On his
reading, the neural order and the mental or phenomenal order are not only isomorphous but identical to the point that postulating ‘a separate set of terms for the mental order would be redundant’ (Ibid, 39-40).

Hayek’s intent to disprove Mach’s view of parallelism between mental and physical events along with the related behaviorist contention of direct correspondence between stimulus and response (which he thought Mach was also guilty of) hinges on the attempt to show that the two orders are similar but not identical. On the one hand, Hayek argues that the mental and the physical world are ‘two different orders in which the same elements can be arranged’ (Ibid, 4). The arrangement of these elements is such that the phenomenal, respectively, mental order reproduces the order existing in the physical world. This reproduction is achieved through “classification” (as we shall call it) of the stimuli by the organism [which] can be said to “reproduce” the “objective” relations between those stimuli in the physical world’ (Ibid, 42). The mental order thus models the physical order. Notably, the central agent of classification – mind – represents simultaneously the process of classification resulting in the establishment of the mental order and that order itself. The mind is thus itself an instance of spontaneous order analogous to that existing in the physical world.

On the other hand, Hayek asserts that there is no one-to-one correspondence between stimulus and response, respectively, between the physical and phenomenal order, as demonstrated, for example, by the fact that elements of a similar kind in the physical world may appear different to our senses. This is why sensory perceptions of events differ from their scientific presentation. This problem has occupied Hayek since his 1920 paper, where he first attempted to figure out how a physiological stimulus is converted into a conscious sense experience. The last observable point in the process that takes place between the external stimulus and the emergence of sensation is the arousal of ganglion cells in the brain. Beyond that point, there is a gap until the final appearance of
the original stimulus as conscious sense experience. It is the reconstruction of what is happening during that gap that Hayek attempted to accomplish. At that time, he was already critical of the perspective of ‘psycho-physical parallelism’ which, according to his presentation, saw the conversion of the impulses into sensations by the brain as a simple inexplicable process and thus as a basic fact which did not merit further examination. As a representative example of that perspective, Hayek quotes from W. Jerusalem’s *Lehrbuch der Psychologie* (although, by Hayek’s own admission, Jerusalem was not a ‘parallelist in the strict sense of the word’): ‘When the impulse reaches the cortex, it is inexplicably converted into a mental state, from a simple stimulus into a sensation’ and ‘The simple or pure sensation is therefore an elementary mental process which we analyze’ (Hayek, 2006[1920], 200, fn. 1). Hayek then proceeds on the assumption that these statements represent the gist of the phenomenological perspective with Mach as a key representative to mount a critique against him on that basis.

The lack of direct correspondence between stimulus and response is also a central problem in *The Sensory Order*. This time Hayek targets not only phenomenalism but also various behaviorist perspectives that were influential at the time along with Neurath’s physicalism (Caldwell, 2004). Based on the assertion of direct correspondence between stimulus and response, behaviorists either deny or disregard the existence of two separate orders. Mach’s views on that subject are somewhat more subtle. He indeed states that there is ‘complete parallelism of the psychical and the physical...[and thus] no gulf between the two provinces’ (Ibid, 60). Mach also assumes that there is some correspondence between physiological factors and resultant sensory qualities even though the connection is different from the one elicit by Hayek. Mach’s parallelism, should not be taken to imply that there is a complete identity between mental (psychical) and physical phenomena, neither should they be construed as different aspects of the same reality. As Mach explains, if the principle of parallelism is understood to mean that
a definite element or constituent of a physiological event must correspond to everything which we can
distinguish as having some sort of psychological unity, to every relation, to every form, in a word to everything
that we can denote by a general conception, then this formulation can only be characterized as dubious and
misleading. (Ibid, 70)

Rather, and particularly in more complicated cases, the similarity between the psychical and the
physical ‘arises not from the presence of one common element, but from a common system of
elements’ (Ibid). In this context, Mach also admits to some problems with the concept of
parallelism. Chief among those is the impossibility to identify the physical counterparts to memory
and association: ‘In this respect it seems as if there were almost no analogy between the organic and
the inorganic’ (Ibid, 101). And yet, he attributes this problem to the insufficient development of
physics and psychology. Thus, while believing that ‘a comprehension of memory on physical lines’
may not be unattainable in principle, Mach acknowledges that at the present level of scientific
development ‘we are still very far removed from it’ (Ibid, 238). In his view, what is needed is not
dualistic explanations but ‘a science which, [by] embracing both the organic and the inorganic, shall
[be able to] interpret the facts that are common to the two departments’ (Ibid, 101). It is important
to emphasize that Mach’s conception of sensations emerging as a result of the interaction of
immediate sensory experience and pre-existing cognitive structures embedded in physiological
memory poses an immediate and serious challenge to the claim of his alleged espousal of the notion
of identity between the physical and phenomenal world mediated by the direct correspondence
between stimulus and response.

In contradistinction to behaviorism, Neurath’s physicalism, and his interpretation of Mach’s
phenomenalism, Hayek argues that the organism can respond in different ways to the same stimulus
or in the same way to different stimuli depending on their particular combinations. In some cases,
several different stimuli may be required to produce a particular sensation. The reason for the lack of
one-to-one correspondence between stimulus and response lies in the fact that the nervous system is
an imperfect instrument of classification. More specifically, the production of impulses in response to external events (stimuli) is mediated by receptor organs which perform a sort of initial classification of stimuli. These receptor organs are imperfectly selective. They do not respond to all kinds of stimuli but only to ‘adequate stimuli’. Sometimes, however, events other than ‘adequate stimuli’ can trigger impulses in given nervous fibres.

Further to the denial of direct correspondence between stimulus and response, Hayek rejects the so-called theory of the specific nervous energy of impulses, supported by Johannes Mueller, according to which differences in the attributes of individual impulses are responsible for difference in the sensory qualities (that is, sensations produced by impulses in different fibres would be different, similar or equal depending of the properties of the corresponding impulses). On Hayek’s presentation, the specific effect of a particular impulse is not determined by the attributes of the stimulus which caused it or by the attributes of the impulse but by the position of the fibre which carries the impulse in the structure of the nervous system. There is no qualitative difference between impulses, and, therefore, no correspondence between the attributes of impulses and the attributes of sensory qualities. In that respect, Hayek’s impulses seem much like Mach’s homogenous elements. It is the order of the nervous fibres carrying the impulses that determines the sensory qualities (that is, the neural order determines the sensory order).

A key point that Hayek makes is that the nervous system does not respond to any particular stimulus but to undifferentiated masses of stimuli which are classified into groups in subsequent steps. Importantly, external events acting as stimuli are classified on the basis of the effects they have on other external events and not according to their effects on our senses. This is the classification developed by the physical sciences that Hayek adopted for at least two reasons. First, to argue that the physical world exists independently of our sense perceptions and second, to argue
that in the process of human interaction with the world the nervous system/mind classifies sensory
data in a way that model the order existing in the physical world without, however, being able to
achieve perfect correspondence. The process of classification results in two different kinds of
physiological memory as traces left behind in response to external events: the map and the model.
The map is a semi-permanent record of the structure of connexion or paths through which chains
of impulses can run representing ‘the kind of world in which the organism has existed in the past’
and thus a record of the relationships between different kinds of stimuli the organism has reacted to.
The model represents the pattern of impulses within a given network of semi-permanent channels at
any given moment thus reproducing the particular environment in which the organism is placed at
that particular moment (Hayek, 1952, 112-5).

As the above analysis suggests, the correspondence between stimulus and response,
respectively, between physical and mental events, is imperfect because, according to Hayek, the
nervous system along with its superstructure, the mind, constitutes an imperfect instrument/process
of classification. Despite the fact that the classification process and results are bound to undergo
frequent adjustment in a trial-and-error process where the organism chooses the paths of least
resistance based on the reevaluation of past experience, the ‘order that we call mind’ remains only ‘a
partial reproduction of the environmental order’. Does this mean that the mental and physical
orders are objectively different? Not at all. The two orders appear different to us because of the
‘limitations of the powers of our own mind fully to comprehend the unitary order to which they
belong’ (Ibid, 191).

In sum, Hayek’s attempted refutation of the parallelism between the physical and
phenomenal world is not ultimately based on any assertion of objective differences between the two
orders but on the inability of the human brain to figure out and explain its own working which is a
necessary precondition for establishing a strict identification between mental and physical events. Arguably, this constitutes less of a refutation of the psycho-physical parallelism than a confirmation of the lowly status of human beings as animal organisms forced to constantly readjust their mental patterns and behavior in the struggle for survival but ultimately unable to even comprehend the larger order of things.

Man is a Natural Being in the Continuum of Events Where All Things are Defined Relationally

The above analysis has touched upon a number of similarities between Mach’s and Hayek’s respective theories which will be developed in a more systematic form below. It is important to keep in mind that this is not an exhaustive account of what Mach and Hayek have in common.

Knowledge is of Organic Nature and Always Due to Experience

Hayek and Mach share a naturalist view of man as an animal that differs in degree but not in kind from other biological organisms. ‘The mental differences between man and animal are not qualitative but only quantitative’ (Mach, 1976[1905], 53). ‘Man forms his concepts in the same way as animals’, although with support by language and social intercourse (Ibid, 93). References to animal societies appear throughout Hayek’s oeuvre not only in relation to human behavior and mental patterns but also as justification for key institutions of capitalist society, such as private property (e.g. Hayek, 1982, 75). Hayek and Mach see the process of acquisition of knowledge and its scientific development as part of the human struggle for survival through adaptation to the natural and social environment. Hayek is by far the more conservative of them both. Unlike Mach
(1976[1905], 359), who in the spirit of social reformism appeals for mobilizing energy to realize ‘the ideal of a moral world order’ with the help of psychological and sociological insights gained through the advancement of modern science, Hayek is not only skeptical of but outright hostile to any putative attempt on the part of the human animal to creatively transform his/her environment with the help of reason – that ‘dangerous explosive’ which may blow up a civilization if not handled cautiously (Hayek, 1967, 93). For him, adaptation and not transformation is the name of the game. Thus, Hayek’s human animal is at once ‘conservative’ in that it relies heavily on previously accumulated experience and ‘futuristic’ in that it struggles to adapt to a changing environment through the accumulation of new knowledge and the assimilation into new behavioral patterns (Forsyth, 1988, 243).

The biological view of man finds a natural counterpart in a biologically oriented epistemology where knowledge is seen as having ‘an organic nature’. The origins of an evolutionary perspective of knowledge precede Darwin’s theory and could be traced back at least to Herbert Spencer’s *The Principles of Psychology*, first published in 1855, where Spencer proposes to expand the doctrine that all knowledge (‘intelligence’) is acquired through experience to include not only the experience of each individual, but also ‘the experiences of all ancestral individuals’ because what is ‘*a priori* for the individual [is] *a posteriori* for that entire series of individuals of which he forms the last term’ (1920, Vol. II, 195). In close alignment with this view, Hayek and Mach share a biologically oriented epistemology where knowledge is created through the interaction of individual sensory experience and pre-sensory cognitive structures formed as a result of the combination of past individual experience and the ‘experience of the race’. Mach sees phylogenesis repeated in ontogenesis ‘in an abbreviated form’. Key epistemological concepts, such as cause and effect, have developed ‘instinctively and involuntarily’ in the course of human evolution. ‘We may, indeed, say that our sense of causality is not acquired by the individual, but has been perfected in the
development of the race’ (Mach, 1919, 485). Hayek (1952, 60) also emphasizes that the process of the formation of the order of sensory qualities had phylogenetic and ontogenetic aspects as ‘some of the connexions formed in the development of the species become embedded in the structure of the central nervous system while others will be formed during the life of the individual’. Thus, while all knowledge is due to experience, the latter is not limited to sensory experience: knowledge has an a priori, pre-sensory but still empirical component.

There is no experience and thus no learning without memory. Memory and heredity are linked: ‘Heredity, instinct and the like may then be described as memory reaching beyond the individual’ (Mach, 1976[1905], 35). Both ancestral experience and past individual experience leave traces in the brain: ‘One might almost say that each individual thinks with his past’ (Hayek, quoted in Caldwell, 2004, 241). Memory is thus the a priori mechanism that enables the emergence of all mental phenomena through the translation of physiological impulses into unified sense experiences. While Hayek’s presentation of these processes is better known today, the foundational insights originated in Mach as evident, for example, by the following extended quotation:

"It is well known that a very prominent position is given, in psychology, to the laws of association... The differences of mental process, in simple memory of an experience, in serious occupation, and in the free exercise of fancy or day-dreaming, can easily be understood by means of the concomitant circumstances. It would, however, be a complete mistake to try to reduce all [...] psychical processes to associations acquired during the life of the individual. In none of its phases do we meet with the psyche as a tabula rasa. At the very least we should have to assume innate associations side by side with the acquired. The innate impulses, which, to a psychology that is purely introspective and confined to itself, must necessarily appear to be innate associations, are reduced by biology to innate organic connexions, and, in particular, to nervous connexions. It is therefore worth while to inquire whether all associations, including those acquired by the individual, do not depend upon innate connexions, of which some have been strengthened by use. But in any case we must also ask whether the processes for the connection of which in highly differentiated organisms special paths have been evolved, are not rather primary facts that already exist in lower organisms, and whether it is not their repeated occurrence accompanied by one another that has led to the formation of the paths in question. (Mach, 1914, 239-241)"
Both in his 1920 paper and in the 1952 book, Hayek seeks to provide an explanation of how external stimuli cause physiological responses by the brain which, in turn, result in the emergence of sensory experience which may not be directly identical with the external event that triggered it. Hayek’s analysis of these processes is not only consistent with Mach’s theory but could be seen as building upon it. Stimuli cause physiological impulses that are converted into sensations in the process of interaction between new sensory data and pre-existing cognitive structures embedded in physiological memory. New experience is classified by the mind based on its relation to previous experience. As Hayek (1952, xix) notes: ‘[e]very sensation, even the ‘purest’, must … be regarded as an interpretation of an event in the light of the past experience of the individual or the species’. By substituting ‘judgment’ for ‘interpretation’, Mach describes a similar process:

The process of judgment… consists in the enrichment, extension, and supplementation of sensational presentations by other sensational presentations under the guidance of sense-given facts. If the process is over, and the image has assumed a familiar shape, making its appearance in consciousness as a completed presentation, then we have no longer to do with a judgment but merely with a simple memory… Intuitive knowledge of the sort just described impresses itself upon the memory, and makes its appearance in the form of recollections which spontaneously supplement every fact presented by the senses. (Mach, 1914, 317-9)

In sum, some of the essential insights of Hayek’s psychology and epistemology, such as the notion of experience as a combination of individual and ancestral experience along with the role of memory in the formation of new experience can be traced back to Mach’s theoretical foundations. Overall, Hayek’s epistemology follows in the footsteps of Mach’s empiricist, biologically oriented theory of knowledge. Hayek himself describes his stance as ‘empiricist’ stressing that his opposition to some views traditionally associated with empiricism stems not from the rejection of the latter from ‘an opposite point of view’ but from ‘a more consistent and radical application of [empiricism’s] basic idea’:

Precisely because all our knowledge, including the initial order of our different sensory experiences of the world, is due to experience, it must contain elements which cannot be contradicted by experience… Sensory experience
presupposes, therefore, an order of experienced objects which precedes that experience and which cannot be contradicted by it, though it is itself due to other, earlier experience. (Hayek, 1952, 172)

**Monism: The Universe as a Continuum of Events**

Hayek’s empiricist epistemology builds upon a materialist ontology. For he, similarly to Mach, is a monist. This statement may appear disconcerting to those who would rather approach Hayek by way of established authoritative views on the subject. Numerous writers have repeatedly cited one another to certify Hayek as a ‘subjective idealist’ whose thought builds upon a Kantian foundation. Claims, such as Gray’s (1982) that ‘Hayek's theory of knowledge is Kantian… in affirming that the order we find in the world is given to it by the organizing structure of our own mind’ are remarkable in how unsubstantiated and counterfactual they are in relation to Hayek’s own exposition in *The Sensory Order*. Mind does not give the world its ‘organizing structure’; rather, it learns to model the ‘organizing structure’ already existing in said world. And even the word ‘structure’ is not quite compatible with Hayek’s meaning. The mind is not a structure or at best it is a sequence of structures in constant flux, that is, a process and so is the order in the physical world. The qualification of Hayek as a ‘subjective idealist’ is further questionable in light of his view of man as a natural being and his biological and empiricist theory of knowledge. Portraying Hayek’s ‘organism’ as the transcendental subject who employs the synthesizing process and the categories of the pure reason to filter sense experience thereby rendering the world from a thing-in-itself into a thing-for-us (e.g. Fleetwood, 1995) sounds somewhat peculiar in light of Hayek’s exposition of abstract conceptual thinking as a higher-level stage of an essentially physiological process common to all biological beings, such as turtles, goats, and humans, among others.

The notion of a Kantian heritage cannot but seem incomprehensible to the discerning reader of *The Sensory Order* where Hayek proposes a causal or physiological theory of mind and
consciousness based on the premise that mental states are the product of causal relations (Feser, 2011). Hayek’s theory is physicalist in that he perceived mental activity as essentially reducible to and explicable by physiological activity: ‘in some ultimate sense mental phenomena are “nothing but” physical processes’ (Hayek, 1952, 191). Hayek’s theory is also materialist in that his account of the determination of mental qualities explained them ‘by the operation of processes of the same kind as those which we observe in the material world’ (Ibid, 177). Hayek’s mind is not a substance but an ‘order of events, different from the order of events which we encounter in the physical world, but determined by the same kind of forces as those that rule in that world’ (Ibid, 178). This means that the mind and its working are characterized by the same type of regularities that one encounters in the physical world. Ultimately, there is no ‘objective difference’ between mental and physical events. Any appearance of a difference is solely attributable to the limitations of the human brain to ‘fully comprehend the unitary order’ of the universe.

Further, Hayek is a monist because he, similarly to Mach, sees the universe as ‘a continuum of physical events, which is in principle explicable by one and the same scientific method’ (Forsyth, 1988, 240). As Hayek (1942, 51-2) notes:

The distinction between the search for generic principles and the explanation of concrete phenomena has thus no necessary connection with the distinction between the study of nature and the study of society. In both fields we need generalisations in order to explain concrete and unique events. Whenever we attempt to explain or understand a particular phenomenon we can do so only by recognising it or its parts as members of certain classes of phenomena, and the explanation of the particular phenomenon presupposes the existence of general rules.

As mental activities are ultimately ‘nothing but’ physical processes, evidently the same methodological principles should apply to the study of the former. Unsurprisingly, Hayek, similarly to Mach, sees the ego or ‘I’ as a continuum of events; more precisely as the ‘universal relatedness of all events’ to a common reference point when consciousness ‘is awake’ (Hayek, 1952, 138). Hayek and Mach are in agreement that the difference between lower-order and higher-order mental
processes is not qualitative but quantitative, that is, is determined by their varying degrees of complexity. Consciousness is no exception. According to Mach (1976[1905], 17), there is ‘a continuous transition’ from the concrete ideas of ordinary thought to the most abstract scientific ones. Concepts develop from ‘the simplest rudiments’ to the highest level of scientific inquiry with ‘each higher level using the lower ones as a foundation’ (Ibid, 97). Hayek similarly asserts that there is ‘no substantial difference’ between sensation and perception as essentially similar acts of classification performed by the central nervous system. All mental phenomena from sense perceptions and images to concepts and ideas are acts of classification performed by the brain. They constitute different stages in a range of processes where ‘the “higher” mental activities are merely a repetition at successive levels of processes of classification of essentially the same character as those by which the different sensory qualities have come to be distinguished in the first instance’ (Hayek, 1952, 77-8; 174-5).

In conclusion, while Hayek is clearly not an ‘idealist’, subjectivism and individualism are undeniable features of his philosophy. How do they tie in with his materialism? Is ‘subjective materialism’ always an oxymoron? ‘Materialism, Schopenhauer (1909, 167) posits, is the philosophy of the subject that forgets to take account of itself’. The application of this aphoristic pronouncement to Hayek’s case makes for some interesting revelations. Hayek is a defender of subjectivism but his individualism, similarly to his liberalism, is of bizarre sort. His causal theory of mind is incapable of explaining consciousness, intentionality, inference, or the descriptive and argumentative functions of language (Feser, 2011; Forsyth, 1988; Popper, 1953; Smith, 1997). It is ultimately incapable of explaining what constitutes true individuality and what makes an individual unique for reasons other than biology and experience. Thus, much in line with Mach’s appeal, the ego of Hayek’s individual has been given up.
All Things and Events are Defined Relationally

Both Hayek and Mach postulate that it is not the simple constituent elements of things or events that matter but the connexions between those elements and their constantly changing combinations. One cannot help but wonder as to whether writers who fail to acknowledge this similarity, or argue that this relational view of things constitutes a novel and superior feature of Hayek’s theory in contradistinction to Mach, have actually paid any serious attention to the latter’s work. Birner (1996), for example, posits that ‘one of the great differences’ between Hayek’s and Mach’s psychology constitutes in the former’s discovery

> that the sensory (or other mental) qualities are not in some manner originally attached to, or an original attribute of, the individual physiological impulses, but that the whole of these qualities is determined by the system of connexions by which the impulses can be transmitted from neuron to neuron; that it is thus the position of the individual impulse or group of impulses in the whole system of such connexions which gives it its distinctive quality; that this system of connexions is acquired in the course of the development of the species and the individual by a kind of ‘experience’ or ‘learning’; and that it reproduces therefore at every stage of its development certain relationships existing in the physical environment between the stimuli evoking the impulses. (Hayek, 1952, 53)

In actuality, the idea that the mental and physical order can be defined in terms of the relations between their elements, which plays such a prominent role in Hayek’s theoretical system, builds upon an unmistakably Machian foundation.

One of Mach’s central theses is that the elements or sensations should not be considered as isolated phenomena but in their functional dependence on each other. As mentioned above, the elements become sensations only when they stand in a specific relation (connexion) to each other. Hence, ‘[e]very scientific problem that can have any meaning for a human individual is concerned with the ascertainment of the dependence of the elements on one another’ (Mach, 1914, 243). Mach’s relational view of the elements leads him to question the usefulness of the traditional notion of causality for the study of natural phenomena. In his view, the ‘connexions of nature’ are far too complex in order to be adequately captured or explained by the simple cause-and-effect determinism
employed by physics. Therefore, he proposes the replacement of the traditional understanding of causality by a conception similar to the mathematical conception of function that would emphasize not only the dependence of phenomena on one another but also, and more accurately, the dependence of the characteristics of phenomena on one another (Mach, 1914, 89). ‘An inquirer, states Mach (1919, 579) must regard the phenomena as dependent on one another in the same way that the geometer regards the sides and angles of a triangle as dependent on one another.’ This mutual dependence could be better understood with the following reformulation of the traditional law of causality:

Let us call the totality of the phenomena on which a phenomenon a can be considered as dependent, the cause. If this totality is given, a is determined, and determined uniquely. Thus the law of causality may also be expressed in the form: “The effect is determined by the cause”. (Mach, 1911, 63-64)

Hayek’s assertions that an event has a meaning only within given order and only in relation to other events within the same order and that all questions about the nature of sensory qualities can be reduced to the question of what determines the pattern of their ordering build directly on Mach’s foundational insights. Let us further recall that Mach specifically states that the parallelism between the mental and physical is based not on the presence of ‘one common element’ but on ‘a common system of elements’. There is a striking similarity between this view and Hayek’s notion of the relation between the mental and physical order where the former is a structural reflection, albeit imperfect, of the latter. According to Hayek, the solution of the whole mind-body problem boils down to showing that ‘there can exist a system of relations between … physiological events which is identical with the system of relations existing between the corresponding mental events’ (Hayek, 1952, 2, emphasis added).
Hayek’s Criticisms of Mach Refuted

This section takes a closer look at some of Hayek’s criticisms of Mach and phenomenalism presented in *The Sensory Order* which are based on three main points. First, that Mach’s theory is centered on the ‘meaningless’ concept of ‘elementary and constant’ also known as ‘pure and simple’ sensations as ultimate constituents of the world; second, that Mach rejects the notion of an objectively existing physical world which is different from our sense experience, and third, that Mach and phenomenalists in general construe the task of science as merely describing the phenomenal world. I shall examine these claims in turn. The purpose of my analysis is not to assess whether Mach’s views are right or wrong in absolute terms but rather to demonstrate that Hayek’s criticisms are largely based on misunderstanding or misrepresentation of those views. It is further asserted that Mach’s theory is more sophisticated than Hayek and others allow it to be.

Mach is mentioned two times in *The Sensory Order*: Once in the Preface, where Hayek speaks of his initial encounter with his ideas and the subsequent sudden realization ‘how a consistent development of Mach’s analysis of perceptual organization made his own concept of sensory elements superfluous and otiose, an idle construction in conflict with most of his acute psychological analysis’ (1952, vi). There is a second reference towards the end of the book where Hayek again asserts his empowerment from Mach’s theory and the refutation of his philosophy as follows:

*although the theory developed here was suggested in the first instance by the psychological views which Ernst Mach has outlined in his *Analysis of Sensations* and elsewhere, its systematic development leads to a refutation of his and similar phenomenalist philosophies: by destroying the conception of elementary and constant sensations as ultimate constituents of the world, it restores the necessity of a belief in an objective physical world which is different from that presented to us by our senses.*

Hayek’s preoccupation with the ‘pure and simple’ or ‘constant and elementary’ sensations is somewhat peculiar. Neither phrase appears in *The Analysis of Sensations* or, to my knowledge, in any
other of Mach’s books. The most likely source of the notion of ‘pure and simple’ sensations seems to have been Jerusalem’s psychology textbook cited in Hayek’s 1920 paper. As the preceding analysis makes clear, a key insight of Mach’s theory is that elements or sensations cannot be analyzed as isolated phenomena, categorically and independently of each other, but only in their relation of functional interdependence. Sensations ‘always occur in a complex… nothing exist in isolation’ and this fact can be only provisionally disregarded for the purpose of scientific inquiry:

*Just as the physicist must be free to analyze the material world for the purpose of scientific investigation, and to dismantle it into parts without therefore forgetting the general connected nature of the world, so the psychologist too must be equally free, if he is to obtain any result.* (Mach, 1976[1905], 359)

Hayek is well aware of Mach’s relational treatment of the elements as evidenced by his remarks on the circumstances that inspired the writing of the 1920 paper presented in the early 1980s, where he evokes his sudden revelation that the concept of ‘simple and pure sensations’ in Mach’s psychology was ‘meaningless’:

*Since Mach had qualified so many of the connections between sensations as ‘relations’, I was finally forced to conclude that the whole structure of the sensory world is derived from relations and that one might therefore throw out altogether the concept of pure and simple sensations which plays such a large role in Mach.* (Quoted in Caldwell, 2004, 242)

Hayek’s argument is neither novel nor original. In fact, Mach himself responds to similar criticisms in the fifth edition of *The Analysis of Sensations*: ‘For me the elements A B C ... are immediately and indubitably given, and for me they can never afterwards be volatilized away by considerations which ultimately are always based on their existence’ (Mach, 1914, 45).

In my view, the argument that the concept of elements is meaningless because it is the relations between the elements that count is meaningless in its own right. This claim is based on the misunderstanding of the role of said elements in Mach’s theoretical system. The notion of the homogenous elements as constituents of all things, much like the impersonal method of science, is a
theoretical device through which Mach seeks to overcome the dichotomy of mind and body, subjectivism and objectivism, idealism and materialism, ontology and epistemology (Baç, 2000). It would be a completely different exercise to assess whether this task was or could be at all accomplished. Mach himself refers to the elements as ‘fictions’. He calls them ‘tentative’ and ‘preliminary’ and compares them to the elements of chemistry (Mach, 1976[2005]). Statements, such as ‘[f]or us, colors, sounds, spaces, times, . . . are provisionally the ultimate elements, whose given connexion it is our business to investigate’ (Mach, 1914, 29-30, emphasis added), seem to suggest that Mach wishes to avoid the display of any dogmatic certainty about the fundamental nature of the world (Cohen, 1968). This brings us to our next question as to whether he rejects the existence of an objective world different from the one we could get to know through our senses.

As an empiricist and phenomenologist, although highly unconventional one, Mach asserts that our interaction with physical objects produces ‘effects we call sensations’. This is how we acquire information about these objects which is then converted into ‘mental symbols’. The only way for us to get to know the world is through our own sensations. To hypothesize about any properties of objects that cannot be established through sensations is a meaningless task (Mach, 1914, 12).

*A thing that is beyond the ken of knowledge, a thing that cannot be exhibited to the senses, has no meaning in natural science. I have not the remotest desire of setting limits to the imagination of men, but I have a faint suspicion that the persons who imagine they have conceptions of ‘absolute motions’, in the majority of cases have in mind the memory pictures of some actually experienced relative motion;* (Mach, 1919, 568)

Should this be taken to imply that Mach rejects the existence of ‘an objective world...’? Perhaps. What we can state with certainty is that he rejects the existence of the world as an ‘unknowable entity’ on the ground that ‘the ego is not a monad isolated from the world but part of it’ (Mach, 1976[1905], 361).
According to Hayek’s final criticism, phenomenalists and positivists construe the task of science as merely describing the phenomenal world. Their basic thesis that ‘all phenomena are subject to invariable laws’ cannot possibly be true ‘if the term phenomenon is taken in its strict meaning of things as they appear to us’ (Hayek, 1952, 173). In what follows, I argue that this criticism is not relevant to Mach’s case for two main reasons. First, there are no invariable laws in Mach’s world; in fact, there is nothing invariable in that world. Second, Mach’s notion of ‘description’ is not the same as the literal one and the purpose of science is not exhausted by providing descriptions of phenomena.

Mach is a phenomenologist of a special kind who could not be labeled as positivist in any justifiable way. His philosophy and theory of science are nondeterministic in the widest sense of the word: ‘The universe is like a machine in which the motion of certain parts is determined by that of others, only nothing is determined about the motion of the whole machine (Mach, 1911, 69). People acquire knowledge of the world not only by relying on their senses but with the help of intuition and intuitive knowledge which play an essential role in scientific enterprise: ‘Intuition is organically older and more strongly based than conceptual thought… It is from intuition that the first clear ideas, concepts and reflections develop’ (Mach 1976[1905], 109). ‘An instinctive, irreflective knowledge’ always precedes the scientific investigation of phenomena (Mach, 1919, 1). The purpose of scientific inquiry is to study the connexions between elements, the functional interdependence of phenomena. Concepts, theories, and laws are not set in stone; they are means of provisional knowledge or orientation, useful as long as they serve their purpose: ‘theories are like dry leaves which fall away when they have long ceased to be the lungs of the tree of science’ (Mach, 1911, 74).

Mach never commits himself exclusively to deduction or induction as the ‘right’ method of scientific inquiry but emphasizes the usefulness of both.
As a natural inquirer, I am accustomed to begin with some special and definite inquiry, and allow the same to act upon me in all its phases, and to ascend from the special aspects to more general points of view. I followed this custom also in the investigation of the development of physical knowledge. I was obliged to proceed in this manner for the reason that a theory of theory was too difficult a task for me, being doubly difficult in a province in which a minimum of indisputable, general, and independent truths from which everything can be deduced is not furnished at the start, but must first be sought for. (Mach, 1919, 581)

…it is rather strange that most enquirers … denote induction as the principal means of enquiry, as though the natural sciences had nothing to do but directly classify individual facts that lie openly about. Not that we wish to deny that to be important too, but it does not exhaust the enquirer’s task: be must above all find the relevant characteristics and their connections, which is much harder than classifying what is known already. The name ‘inductive sciences’ for the natural sciences is therefore not justified. (Mach, 1976[1905], 231)

Mach indeed states that scientific explanations are descriptions for the purpose of ‘economy’; that is, they are descriptions of countless individual facts presented in a short form. This does not exhaust the purpose of science or of the scientist. What sets apart the gifted scientists with a broad view from the naïve observers with a narrow view is that the former can use their intuition to ‘clearly perceive principles through all the facts’, ‘recognizing a principle directly as the key for understanding all facts in a domain and seeing in their minds how it penetrates all facts’ while the latter are detracted by ‘secondary circumstances’ and ‘find it difficult to select and pay attention to what is essential. Productive scientists do not simply enumerate facts and arrange them in lists but either ‘reconstruct’ them or build ‘ideal cases’ from their ‘own reservoir of ideas’ (Feierabend, 1984, 6-7).

Mach’s notion of scientific ‘description’ is thus quite specific: it is based not on the assumption that all phenomena are subject to invariable laws but on the presupposition of the functional interdependence of the elements. ‘Description is a building up of facts in thought, and this building up is, in the experimental sciences, often the condition of actual execution… Science completes in thought facts that are only partly given’ (Mach, 1895, 253). Mach’s definition of the purpose of science as the adaptation of thoughts to facts does not entail a mechanical repetition of the unaltered facts through the medium of thought but is rather ‘a dialectical process that transforms both
ingredients’ (Feierabend, 1984, 8-9). Ideas are different from sensations and concepts are different from facts: ‘the factual elements contained in concepts must not mislead us into identifying these mental formations, always requiring correction, with the facts themselves’ (Mach, 1976 [1905], 99). Ultimately, there can never be a one-to-one correspondence between facts and thoughts. The specter that haunted Hayek was never there.

Conclusion

This paper has argued that key aspects of Hayek’s theory of mind are not only ‘suggested’ by the ‘psychological views’ of Ernst Mach but build directly upon them. The similarities between the two thinkers extend beyond psychology to include aspects of ontology and epistemology. It is further argued that some of the criticisms Hayek leveled against Mach concern nonessential points, are due to the uncritical acceptance of common misinterpretations of Mach’s theory, or are plainly wrong. The view taken here is that Hayek never became fully aware of how significant the influence of Mach’s ideas on his own truly was.

References


Mach, Ernst (1914) *The Analysis of Sensations and the Relation of the Physical to the Psychical*. Chicago: Open Court.


1 Mach’s Analysis of Sensations was first published in German in 1886 and translated into English the year after. All references in this paper are from the 5th English edition of 1914. All emphasis is in the original if not stated otherwise.