Chapter 12
Supervenience and the Mind-Body Problem in Psychiatry

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Contents

Pre-introduction

The first time I heard the technical word ‘supervenience’ was perhaps in 1996 when I was a PhD student in the Department of Psychiatry at the University of Cambridge. The reason I enrolled in a PhD course under the supervision of Prof. German Berrios, professor of epistemology of psychiatry in Cambridge, was not to conduct empirical research but to investigate theoretical aspects of psychiatry. I had no doubt that the core of the conceptual complexities in psychiatry lay in the

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I. S. Marková, E. Chen (eds.), *Rethinking Psychopathology*, Theory and History in the Human and Social Sciences, https://doi.org/10.1007/978-3-030-43439-7_12

mind-body problem; hence I attempted to investigate the mystery of the mind-body relationship. I surveyed a vast body of literature concerning philosophy of mind. During this time, Prof. Berrios advised me to peruse Jaegwon Kim's (1993) *Supervenience and Mind*. At first glance, I vaguely anticipated that Kim's perspective would provide a powerful tool to illuminate the relationship between mental processes and brain processes. At the same time, I soon recognized that I did not have enough time to examine such a complicated topic in the few years of my PhD course. I was realistic enough to abandon epistemological research and to turn to an empirical study. As a result, I conducted data-based research concerning disorders of 'executive functions', possibly on account of the dysfunction of their putative biological bases, i.e. the prefrontal cortex and its affiliated structures.

Since receiving my PhD, I have thought about the thesis of mind-body supervenience on occasion. Now I am honoured to have the opportunity to submit a piece of homework assigned to me by Prof. Berrios after more than 20 years.

Introduction

While the mind-body problem has occupied the minds of philosophers for centuries, today it is rephrased as the mind-brain problem. Since psychiatry is inevitably concerned with both the mental and biological aspects of psychiatric illnesses, the epistemology of psychiatry cannot escape this problem. The objective of this article is to address the mind-brain problem from the viewpoint of 'supervenience' (Kim 1993), one of the cardinal notions of analytic philosophy.

The word 'supervenience' derives from the Latin word *supervenio*, which means 'to overtake or to come upon'. It is used in the vernacular to mean 'to follow closely' or 'to occur as an unexpected or extraneous development' (Collins English Dictionary 2018). However, this use of 'supervenience' is not equivalent to the philosophical use of the term.

When discussed in analytic philosophy, supervenience is described as follows: a set of properties *A* (the supervenient set) supervenes upon another set of properties *B* (the subvenient set or supervenience base) if and only if no two things can differ with respect to *A* properties without also differing with respect to their *B* properties. In other words, there cannot be a change in the supervenient set without a related change in the subvenient set. Consequently, it has been stated in moral philosophy that moral properties supervene on natural properties; similarly, aesthetic properties supervene on non-aesthetic properties in philosophy of art. In the case of the mind-body problem, or rather the mind-brain problem, this can be paraphrased as follows: a mental process supervenes on its supervenience base, i.e. a neurobiological process. Therefore, there cannot be a change in mental processes without there being a change in the underlying neurobiological processes.

A Short History of Supervenience

It has been speculated that the first philosopher to use the word 'supervenience' was Lloyd Morgan (1923), the British emergentist. Characterizing the nature of emergence, he argued that emergent properties 'supervene' on their base properties. For him, emergence is characterized as a relation in which emergent properties are distinct from their subvenient properties and arise unpredictably from them. However, his use of the term was in its vernacular sense, rather than in its current philosophical use.

It is often claimed that the philosophical thesis of supervenience can be traced back to moral philosophy in the works of such philosophers as G. E. Moore and R. M. Hare. For example, G. E. Moore (1922, p. 273) maintained that 'one of the most important facts about qualitative difference…[is that] two things cannot differ in quality without differing in intrinsic nature'. Although he did not use the word 'supervenience', he was essentially describing this thesis. R. M. Hare (1952) evidently made use of the word in its contemporary meaning, when he delineated a moral-natural relationship. According to his view, ethical predicates are 'supervenient predicates', in that there could be no difference in a moral respect without a difference in some descriptive (non-moral) respect. It is obvious that this idea can be applied to any two sets of properties.

Through the lens of philosophy of mind, Donald Davidson (1980) was the first to apply the term 'supervenience' to discussions associated with the mind-brain relation. He wrote as follows:

[M]ental characteristics are in some sense dependent, or supervenient, on physical characteristics. Such supervenience might be taken to mean that there cannot be two events alike in all physical respects but differing in some mental respect, or that an object cannot alter in some mental respect without altering in some physical respect. (Davidson 1980, p. 141)

When he used the idea of 'supervenience', he intended to refute reductionism, the belief that mental properties are reducible to their physical properties. He wrote: 'Dependence or supervenience of this kind does not entail reducibility through law or definition…' (Davidson 1980, p. 141).

The concept of supervenience has been deepened since the time of Davidson's argument. This advance was made possible by philosophers of non-reductive physicalism or those of analytic aesthetics. The former include Terence Horgan (1982, 1993), Jaegwon Kim (1993, 1998) and David Lewis (1983) and the latter Frank Sibley (1965), Jerrold Levinson (1983) and Nick Zangwill (1994).

Supervenience and Philosophy of Mind

The concept of supervenience associated with the mind-brain relation has three implications: *dependence, covariation* and *non-reducibility* (Kim 1993). First, mental processes are dependent on their subvenient neurobiological bases. Mentality is

physically based, anchored in the physical nature of objects. Second, there is a pattern of property covariation between the mental and the neurobiological. The mental properties vary in concurrence with neurobiological properties. Third, property covariation involved in supervenience can exist even when mental properties are not reducible to their subvenient neurobiological bases. The mind-brain supervenience is necessary, but not wholly sufficient for the reduction of mind to brain.

Aesthetics and Philosophy of Mind

Links between aesthetics and the philosophy of mind had not been well-recognized before Frank Sibley (1965) discussed relationships between the aesthetic and the non-aesthetic. An application of his conception of supervenience as it relates to the mind-body problem will be discussed later. Aesthetics is a branch of philosophy which investigates the conceptual and theoretical aspects of art and aesthetic experience. Aesthetic properties, whose nature is considered to be one of the main topics of aesthetics, have been examined in order to understand when and how a work of art carries aesthetic values. Levinson (2009) listed some of the hallmarks of aesthetic property status as follows: having a gestalt character, requiring taste for discernment, having an evaluative aspect, affording pleasure or displeasure in mere contemplation, being non-condition-governed, being emergent on lower-level perceptual properties, requiring imagination for attribution, requiring metaphorical thought for attribution, being notably a focus of aesthetic experience and being notably present in works of art.

Although the status of aesthetic properties is open to some debate, there is a wide agreement that aesthetic properties are qualitative properties; that is to say, they are perceptual, observable and directly experienceable. These properties are relevant to the aesthetically attractive value of the work to which they are attributed. Philosophers with special interest in aesthetics have debated whether work of art is physical or mental, abstract or concrete, created or discovered and culturally free or culturally bound (Levinson 1983). Such questions regarding dichotomous properties, associated with art, are of particular importance to philosophy of mind. This is because most lively discussions concerning the relationships between the aesthetic and the non-aesthetic are, with minor modifications, applicable to the relationships between the mental and the neurobiological.

Supervenience and Aesthetics

In philosophy of mind, the irreducibility of qualia to physical entities has always been at the very heart of the mind-body problem. The term ‘qualia’ in this case refers to the qualitative aspects of our mental lives, which are introspectively accessible and genuinely subjective. The literature on qualia includes thought experi-

ments, such as 'Mary's room' (Jackson 1982), 'a philosophical zombie' (Chalmers 1996) and discussions about 'being a bat' (Nagel 1974). However, instead of delicate devices of imagination, more appropriate and more concrete examples are provided by aesthetic supervenience. It is self-evident that aesthetic properties are qualitative, phenomenal and irreducible to their physical bases. Nevertheless, they are anchored in the physical nature of objects. To improve the qualia of a painting, a certain chromatic work is necessary so as to change its physical base. To make the qualia of a piece of music more beautiful, a certain physical operation is necessary in order to improve its acoustic waves. There is no doubt that, regardless of the artistic medium in which they are found, aesthetic properties have their own non-aesthetic, physical bases; hence, through an examination of the supervenience between the aesthetic and the non-aesthetic, the potential consequences of the supervenience between the mental and the physical in question can be illuminated without resorting to a fantasy of delicate and complicated argument.

The claim of aesthetic supervenience received its first impetus from Frank Sibley (1965). According to Sibley, (a) aesthetic properties are distinguishable from non-aesthetic properties, (b) the existence of aesthetic properties depends on the existence of non-aesthetic properties, and (c) aesthetic properties are established by non-aesthetic properties. Therefore, any changes in aesthetic properties cannot occur without a change in non-aesthetic properties. Sibley did not mention the notion of 'supervenience'; nevertheless, his characterization of aesthetic–non-aesthetic relationships bears a strong resemblance to the supervenience model in the mind-body debate. While it remains open to argument whether the debate surrounding aesthetic supervenience is attributable to Sibley, his idea has been followed by subsequent philosophers, such as Jerrold Levinson (1983), Gregory Currie (1990) and Nick Zangwill (2001). Levinson defined aesthetic supervenience as follows: 'Two objects (e.g., artworks) that differ *aesthetically* necessarily differ *nonaesthetically* (i.e. there could not be two objects that are aesthetically *different* yet nonaesthetically *identical*): fixing the nonaesthetic properties of an object fixes its aesthetic properties' (Levinson 1983, p. 93). At the same time, the explicative strength of aesthetic supervenience has been questioned (Benovsky 2012; Currie 1990; MacKinnon 2001). Aesthetic supervenience certainly tells us little regarding what physical properties are relevant for aesthetic attribution, even though an aesthetic property of a work of art is entirely based on its subvenient properties. Aesthetic supervenience remains only a phenomenological relation between covarying patterns of aesthetic and non-aesthetic properties. It is doubtful that aesthetic supervenience might explain how the aesthetic properties emerge from non-aesthetic properties.

The Mind-Body Supervenience in Depression

The mind-body problem is of importance to psychiatry for the following reason: every day, a psychiatrist is inevitably concerned with both the subjective and objective aspects of psychiatric illnesses. Whether it is mental or biological, the psychia-

trist is like a hyperactive teenager switching between two TV channels, one referring to the mind and the other to the brain. Aetiological theories of mental illnesses are either mind-based or brain-based. Likewise, psychiatric therapies are either psychologically based or biologically based. Whatever the practice, a psychiatrist cannot escape the mind-brain problem.

A study by Setoyama et al. (2016) provides an example of research concerning the mind-body problem. In their article titled 'Plasma Metabolites Predict Severity of Depression and Suicidal Ideation in Psychiatric Patients-A Multicenter Pilot Analysis', the authors discuss the data they collected for the severity of depression and suicidal ideation as well as the metabolome analysis of blood plasma. They found that five plasma metabolites (3-hydroxybutyrate (3HB), betaine, citrate, creatinine and gamma-aminobutyric acid (GABA)) were associated with the severity of depression and suicidal ideation. Then, the authors attempted to create a classification model to discriminate between patients with suicidal ideation and those without suicidal ideation, using artificial intelligence learning techniques. They succeeded in producing a pilot algorithm to predict a grade of suicidal ideation according to levels of citrate and kynurenine.

This study is based merely on correlation. Even when these two variables are found to be significantly correlated, correlation does not imply causation. Therefore, no one can maintain that plasma metabolites cause depression and suicidal ideation. Even so, this type of research would be advanced by the use of sophisticated techniques, and an enormous amount of data would be accumulated that could maintain the biological foundations of mental symptoms such as depression and suicidal ideation. If further minute findings regarding metabolites could be obtained hereafter, the philosophical question of how to understand the relationship between the metabolites and mental states could arise.

The relationship between the metabolites and mental states is related to supervenience as follows: a set of mental states supervenes upon a set of brain metabolites only if no two things can differ with respect to mental states without also differing with respect to their metabolite states. In other words, there cannot be a mental difference without a neurobiological difference. In Kim's sense, 'mental properties supervene on physical properties, in that necessarily, for any mental property M, if anything has M at time t, there exists a physical base (or supervenient) property P such that it has P at t, and necessarily anything that has P at a time has M at that time' (Kim 1993, p. 313). From this viewpoint, the mind-brain supervenience states a pattern of property covariation between the mental and the physical. However, this relation does not elucidate the nature of the dependence relation that might explain why the mental supervenes on the physical.

The Aesthetic–Non-aesthetic Supervenience and the Mind-Body Supervenience

Kim explained *supervenience* by using an example of a painting and its physical base:

'To make your painting more beautiful, more expressive, or more dramatic, you must do physical work on the painting and thereby alter the physical supervenience base of the aesthetic properties you want to improve. There is no direct way of making your painting more beautiful or less beautiful: you must change it physically if you want to change it aesthetically – there is no other way' (Kim 1998, p. 43).

In this context, the beauty of a painting supervenes on the physical properties.

We may compare the aesthetic-physical supervenience with the mind-body supervenience. In the case of aesthetic-physical supervenience, we can use two examples: a painting and music. In both of these, aesthetic properties supervene on non-aesthetic properties. For example, an abstract painting is dynamic or peaceful due to a certain visuospatial arrangement of colours and shapes, and a symphony performance is uplifting or solemn because of a certain acoustic arrangement of sounds. This means that an object has the aesthetic properties by virtue of its non-aesthetic properties. If something has an aesthetic property, then it has some non-aesthetic property that is sufficient for the aesthetic property.

However, there is an important difference between a painting and a piece of music: a painting is static, whereas a piece of music is dynamic. Music is in a sense a physical acoustic phenomenon with the vibration of microphysical properties. Over a period of time, music is performed simultaneously with sound waves. This is why the music-acoustic supervenience is more reminiscent of the mind-body supervenience than the picture-chromatic supervenience. The mental process proceeds continuously over time. Likewise, the neurobiological process proceeds continuously over time. For this reason, music is a more suitable example for understanding the mind-brain supervenience.

The Music-Acoustic Supervenience

Since music is composed of the interplay of multiple dimensions, the elements of a piece of music can be described as follows: rhythm, dynamics, melody, harmony, tone colour, texture and form, etc. As the stream of consciousness is the flow of thought in the conscious mind (James 1890), all of the musical elements are presented in the flow of sonic sequence according to a temporal axis. For example, rhythm consists of duration and tempo; the former is concerned with the length of a sound or silence and the latter with the speed of the beat. Melody is the element associated with the linear series of pitches, which is the quality of notes perceived as 'higher' or 'lower'. From another point of view, both rhythm and melody are acoustic phenomena coming from a musician's instrument or a singer's vocal cords, those are physical in nature.

Because of the physical nature of musical elements, a supervenience consists of the relation between a piece of music and the acoustic properties of sound waves, the former supervenes on the latter. In the music-acoustic supervenience, there are three conditions: *dependence, covariation* and *non-reducibility*. First, sound flows in music are dependent upon their subvenient acoustic processes. A piece of music is not free-floating but physically based, and it is anchored in the acoustic nature of

sound waves. Second, a pattern of covariation holds between the musical properties and the acoustic properties. The musical properties vary simultaneously with the subvenient acoustic properties. Third, even though the music-acoustic supervenience involves a covarying relationship, musical properties are not reducible to their subvenient acoustic bases. The music-acoustic supervenience does not justify the reduction of music to acoustic physics.

Understanding the Mind-Brain Supervenience in Depression Through Musical Supervenience

With reference to musical supervenience, the mind-brain supervenience in depression can be examined. When transposing music into a painting, Kim's own description regarding the aesthetic-physical supervenience in a painting can be paraphrased as follows: melody and rhythm supervene on physical acoustic events; there is no difference in melody or rhythm without some difference in a physical acoustic phenomenon; to make your music more beautiful, you must perform physical acoustic operations and thereby alter the acoustic subvenient bases of the musical properties you want to improve. When it comes to depression, the mind-brain relationship can be described as follows: mental states, such as depression and suicidal ideation, supervene on neurobiological events; there is no difference in depression and suicidal ideation without some difference in a neurobiological phenomenon; to improve mental states, neurobiological operations are essential, and thereby the neurobiological subvenient bases of the mental states are altered. There is no other way of improving mental states: neurobiological states must change if mental states change. Every time depression worsens or improves, there are changes occurring in the neurobiological bases such as changes in metabolites. Without changes in the neurobiological subvenient bases, any mental states cannot alter.

The musical supervenience and the mind-brain supervenience can be juxtaposed as follows: music is anchored in the physical nature of sound waves, and likewise, a mental process is anchored in the physical nature of objects and events. There is no free-floating music without a physical base, and likewise, there is no free-floating depression or suicidal ideation without a neurobiological base. Musical properties are varying in concurrence with physical acoustic properties, and in the same way, the mental properties are varying in concurrence with neurobiological properties.

The Nature of Covariance in the Mind-Body Supervenience in Light of Musical Supervenience

The mental-biological supervenience means that it is mental-neurobiological covariance. The mental varies simultaneously with the neurobiological. However, the mental-biological supervenience thesis itself is silent on the nature of the covariance

involved. It tells us neither what kind of covariance it is nor how the covariance grounds or explains the relationship between properties. A hint can be obtained when we consider the relationship between a scale in music and its emotional atmosphere. Here, a scale means a collection of pitches. Each scale has its own characteristic feeling. For example, a major scale expresses a happy, hopeful and joyful feeling. A minor scale conveys a depressive, sad and subdued mood. Another scale is the Okinawan scale. This scale carries a unique, tranquil, subtropical atmosphere.

By comparing the major and Okinawan scales, we can see the differences in the frequencies.

An octave of the major scale consists of seven tones: Do, Re, Mi, Fa, So, La and Te. On the other hand, in the Okinawan scale, Re and La drop out from the major scale, resulting in a scale comprised of only Do, Mi, Fa, So and Te (Fig. 12.1). The difference between the major and Okinawan scales is merely the presence or the absence of Re and La. The major scale has its own happy and joyful atmosphere. The Okinawan scale has a more exotic, delightful and peaceful feeling, which is distinctly different from that of the major scale. However, the difference in atmosphere between the two scales is due to the presence or the absence of Re and La. Theoretically, every piece of music can be arranged into a piece of music having an Okinawan flavour, only by excluding Re and La. This exclusion is a physical acoustical operation in nature (Fig. 12.2).

The analogy of two things, i.e. the difference between the major scale and the Okinawan scale on the one hand, and the difference between severe depression and mild depression on the other, could be thought as follows: a piece of music with the major scale *M* supervenes on a series of the acoustic physical events with Do, Re, Mi, Fa, So, La, and Te, while a piece of music with Okinawan scale *M'* arranged from *M* supervenes on a series of the acoustic physical events with Do, Mi, Fa, So, and Te. Equally, severe suicidal ideation would supervene on the neurobiological states *A* of metabolites, and mild suicidal ideation would supervene on the neurobiological states *A'* of metabolites. The difference of musical qualia between *M* and *M'* supervenes on the difference between the presence and absence of Re and La, which is physical in nature. Equally, the difference of mental qualia between severe and mild suicidal ideation would be due to the difference between the neurobiological state of *A* and that of *A'*, which is biological in nature.

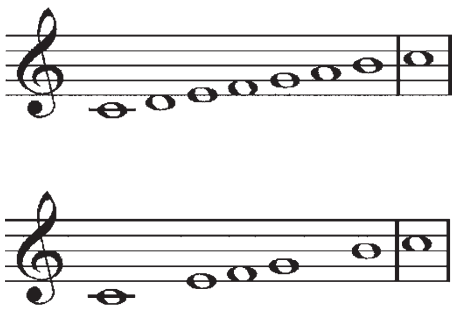

Fig. 12.1 The major and Okinawan scales

Fig. 12.2 The acoustic differences between the major and Okinawan scales

The ratio between the frequencies of all the notes of the major and Okinawan scales

The Major Scale							
Do	Re	Mi	Fa	So	La	Te	Do
1	9/8	5/4	4/3	3/2	5/3	15/8	2
Okinawan Scale							
Do		Mi	Fa	So		Te	Do
1		5/4	4/3	3/2		15/8	2

Conclusions

To summarize, musical properties have their own non-musical, physical bases, and likewise, mental properties have their own non-mental, biological bases. Music supervenes on the acoustic event, whereas the mental process supervenes on the neurobiological event. A scale in music has its own emotional atmosphere, while a mental process has its own emotional atmosphere. The difference in atmosphere between the two scales exists by virtue of the acoustic difference between the two scales, a difference that is physical in nature. Equally, the difference in qualia between the two mental processes would exist by virtue of the difference between the two neurobiological events, a difference which is likewise physical in nature.

These considerations should discourage one from coming to the conclusion that the concept of supervenience can illuminate the enigma of the mind-body relation. No one can contend that musical supervenience would elucidate the special fascination that a piece of music possesses for the listener. This is equally true for the mind-body supervenience. While the supervenience thesis can explain why we recognize a mental process as distinct from its biological base, it leaves unexplained why the relationship called supervenience exists in the first place. Even so, the supervenience thesis is useful to us, as it is a concrete natural relationship. The idea of musical supervenience contradicts the view that a piece of music is free-floating. Equally, the mind-body supervenience contends that the nature of mentality is anchored in the physical nature of biological processes. It is true that supervenience reveals little to us about what biological properties are relevant for mental attribution. However, a comparison between one mental state and another, followed by a comparison between their biological bases, respectively, would elucidate what biological properties are critical for mental processes. The presence or absence of Re and La is a critical point for the comparison between the major and Okinawan scales. Similarly, the presence or absence of particular biological properties would play a decisive role in the difference between the presence and absence of particular mental processes.

So far, the mysterious nature of the mind-body problem has been overemphasized. Certainly, it is mysterious. Nevertheless, the degree of mystery present in the

mind-body problem is, in fact, equal to that in the relationship between aesthetical properties and non-aesthetic properties. The relationship between the mental and the physical is as mysterious as the relationship between a piece of music and its subvenient bases, i.e. the vibration of microphysical properties.

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