# Introducing a Kantian interpretation of quantum physics

in accordance with Kant's Philosophy of Science
in the *Critique of the Power of Judgment*,
reinterpreted and reworked
with special attention to the supersensible realm

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# Abstract

In this thesis I confront the problem of indeterminism in quantum physics. The first pioneers accepted indeterminism as part of their Copenhagen interpretation and it was incorporated in Von Neumann's formulation (as the "projection postulate"). But how deep does this indeterminism go? With the arrival of quantum physics, the idea that the world is fundamentally deterministic has been shattered. Redhead's work showed that the experimental confirmation of the violation of Bell's inequality means that determinism has broken down; he even formulated a version of the Bell inequality that is not dependent on local hidden variables and showed that the violation thereof negates even what might be called "stochastic" determinism – at least in the framework of the Lorentzian space-time manifold (Redhead 1987:83, 103).

With the acceptance of non-determinism as part of our world, we are confronted with the question: How can the possibility of non-determinism be explained and how can it be reconciled with determinism in one coherent conceptualization of the world? I use the philosophy of science that Immanuel Kant developed in the *Critique of the Power of Judgment* to develop an answer to these questions. In this part of his philosophy of science Kant is concerned with the possibility and conceivability of a spontaneous (albeit effective) causality in nature's producing its products. Kant developed the idea of this causality in *analogy* to the achievement of human ends, conceptualizing it as a capacity that non-extended wholes and parts have to be realized as parts forming an aggregated whole in nature.

An important feature of my approach is that I develop a new interpretation of Kant's philosophy as presented in his well-known *Critique of Pure Reason.* In contrast with the two-object and two-aspect views in Kantian interpretation, I argue that the noumenal realm refers to an ontologically distinct realm outside nature, problematically assumed. This agrees with Kant's view in the *Critique of the Power of Judgment* where it is conceptualized as the substratum of nature and forms a central part of his philosophy of science. It is only when the noumenal (supersensible) realm is conceptualized in this manner that spontaneous causality becomes not only logically possible, but also conceivable within the framework of his philosophy.

In my Kantian interpretation of quantum physics his concept of nature is taken as referring to the "classical realm" (where the theories of relativity would apply). His non-extended wholes and parts, which belong to the supersensible realm, find application in superpositions of states, which I argue belong to an ontologically distinct realm – the pre-measurement "quantum realm". Since the classical and quantum realms are taken as ontologically distinct realms, there is no contradiction in ascribing two heterogeneous laws, namely of deterministic and spontaneous causality (which is manifest in the reduction of the wave packet), to these realms which are combined in one description in quantum mechanics. In my view spontaneous causality grounds a non-spatio-temporal potentiality which explains why superpositions of states have the ability to collapse to reduced states. I develop these ideas in the framework of the various interpretations of quantum mechanics.

# Content

# 1. General introduction to the thesis

## 1.1. Introduction

Immanuel Kant (1724-1804) is one of the great modern philosophers of science. In his famous *Critique of Pure Reason* (the first *Critique*; 1781, 1787) Kant developed a scientific epistemology that he used to produce a philosophy of science in his *Metaphysical Foundations of Natural Science* (1786). In this he laid the philosophical foundations for Newtonian science. Through the years his approach has been reworked and adapted in such a manner that it could ground all classical mathematical science, including the theories of relativity (Friedman 2001:31, 47).

In the second part of the first *Critique*, Kant engaged with the problem of freedom. In the third antinomy (conflict of laws) he showed how the transcendental idea of freedom, that is, absolute spontaneity, can be introduced without contradiction as a different kind of causality (this is sometimes called "freedom" although it is not the same as practical freedom; it is merely a precondition for practical freedom). He conceptualized this as a different kind of effective causality in opposition to deterministic causality.

In the *Critique of the Power of Judgment* (the third *Critique*, 1790) Kant developed this concept of causality further when he formulated another part of his philosophy of science. He now calls the spontaneous causality of the first *Critique* that is grounded in the transcendental idea of freedom, "causality of freedom" and the "concept of a causality through freedom" (5:195-6). He develops the idea further in the context of non-extended parts and wholes as a "spontaneity of a cause" (5:411), which is conceptualized in analogy with human ends. In this formulation Kant allowed for the possibility that some products in nature are not produced in accordance with mechanistic (deterministic) laws. In this thesis I show how these concepts can be fruitfully introduced in that domain of physics where determinism has broken down, namely in quantum physics.

The question of non-determinism in quantum physics goes back to the early pioneers; it is central to the Copenhagen interpretation. Bohr understood the observed indeterminism as involving spontaneity. This was formally introduced in the context of Von Neumann's formulation of quantum mechanics in terms of two conflicting maxims, namely the deterministic evolution of quantum states and the so-called reduction of the wave packet (called the "projection postulate") that introduces an indeterministic (spontaneous, according to Bohr) aspect into physics.

The question became even more accentuated in the context of Bell's inequality. Since the Aspect experiment confirmed the violation of Bell's inequality in quantum mechanics, the debate regarding non-determinism has intensified since determinism is assumed in this inequality as Redhead has demonstrated (Redhead 1987:102). The violation of Bell's inequality is therefore also a violation of determinism. Redhead has furthermore shown that the Bell inequality can be reformulated to show that the violation thereof negates even what might be called "stochastic" determinism, that is, that there are not even stochastic causal links between the particles in the two arms of the Aspect experiment (Redhead 1987:102).

There are various responses to the question of non-determinism in quantum physics. Some merely assert the fact of such non-determinism taken in the more positive sense as absolute spontaneity (Cartwright 1983); others have tried to adhere to a purely deterministic view (for example, Bohm's theory). In this case action-at-a-distance may be assumed (which contradicts special relativity) or even the idea of "many worlds". In this thesis I develop a Kantian solution to this problem in which determinism and non-determinism are reconciled. In this regard I understand non-determinism in

quantum physics in terms of spontaneity (in accordance with the Kantian concept of spontaneous causality or freedom). I argue that we have good reason to subscribe to an (Kantian) interpretation of quantum physics in which such freedom is conceivably part of our understanding of how the world is like.

In the same manner that Kant's philosophy answered the quest for the mathematical grounding of Newtonian physics, Bohr made use of it in his effort to formulate an adequate response to the new kind of observations found in quantum physics (Pringe 2007). Since that time various authors have developed Kantian approaches, epistemically grounding both quantum mechanics and quantum field theory (Bitbol 2007; Auyang 1995). Various methodological approaches have been developed, some of which focus on Kant's third *Critique* (Pringe 2007). In contrast, I follow an ontological approach. I am not so concerned with epistemological issues, but with absolute spontaneity (freedom) which Kant incorporates in his conception of "final causality" in the third *Critique*, which in my view describes quantum collapse.

My view is an *ontological* reading of Kant's philosophy which is then applied to quantum physics. I argue that *we have good reason to think* that the quantum and classical realms belong to different ontological modes of existence and that the non-determinism in quantum mechanics involves not merely the logical possibility of spontaneity, but that such a spontaneous causality (in accordance with the Kantian conception in this regard) becomes conceivable in our understanding of what the world is like. I argue that this spontaneous causality governs a non-spatio-temporal potentiality (as is conceptualized in the context of Kant's "final causality" in the third *Critique*), similar to Bohm's quantum potential. This potentiality allows non-extended wholes-and-parts in the supersensible realm to produce parts and wholes in nature. I apply this concept to quantum collapse which takes superpositions of states (wholes-and-parts) to reduced states. My view is not a dogmatic (realist) assertion, but merely a conceptual understanding that is in line with Kant's critical philosophy.

In my approach the mere logical possibility of freedom is contrasted with the conceivability thereof – by which I mean that I also engage with conditions for the possibility of freedom, which includes 1) a problematically assumed, ontologically distinct, mode of existence through which such freedom becomes possible (as the ruling principle of this mode of existence) and 2) that this realm has the ability to (absolutely spontaneously) produce outcomes in nature. I argue that this is the Kantian position (see chapter 2), although he does not formally introduce this as a "condition" in the context of his discussion of freedom in the first *Critique*. The conceivability of freedom also involves the construction of a conception of such spontaneous *potentiality* in the framework of the ontologically distinct supersensible realm in the third *Critique* (see chapter 3).

Within this context I introduce the questions that I engage with in this thesis: How is absolute spontaneity possible and how can it be accommodated in physics as part of our overall conception of the world? I use the philosophy of science that Kant developed in the third *Critique*, which involves exactly such spontaneity (freedom), to try and solve the problem.

### 1.2 Outline of the thesis

The problems with such an approach are two-fold. The first concerns Kant's conception of this other kind of non-deterministic causality and the other his conception of the noumenal realm. These are in fact interwoven problems since such a causality can only be conceivably introduced as something that can in principle really exist when the noumenal realm is taken as an ontologically distinct realm outside nature, that is, where the deterministic laws of nature do not apply (The Kantian conception of nature involves the totality of causal relations).

In the third *Critique* the noumenal realm is taken as the substratum of nature and plays a very important role in the philosophy of science that Kant developed in that *Critique*. In my interpretation, the Kantian concept of nature refers to the "classical world" (where the theories of relativity would apply), his concept of the noumenal realm as the substratum of nature finds confirmation in the pre-measurement "quantum world" and his concept of spontaneous potentiality as a causality finds its application in the reduction of the wave packet. This makes his philosophy of science in the third *Critique* applicable to the study of the above mentioned problems in quantum physics. I argue that Kant's metaphysical position as described above can be formulated as a working hypothesis which prescribes the characteristics that the quantum realm should have for it to be taken as conforming to this interpretation.

My application of Kant's philosophy of science requires that the Kantian concepts be understood in a specific manner, especially that the noumenal realm refers to an ontological distinct realm outside nature, problematically assumed. In this regard my interpretation stands in contrast with current interpretations (in both the two-object and two-aspect views – see chapter 2) which assume that the noumenal realm, especially in the first *Critique,* does *not* refer to an ontologically distinct realm *outside nature*. In my view the first *Critique* lays the foundations for both parts of Kant's philosophy of science as presented in the *Metaphysical Foundations* as well as the third *Critique*, and it would be very strange indeed if his view of the noumenal realm in the first *Critique* differs substantially from that in the third *Critique* where it is presented as the substratum of nature (and human nature).

To arrive at an interpretation of Kant's first *Critique* as well as that of his philosophy of science in the third *Critique* which allows for a sensible application to the problem of spontaneity in quantum physics, I present my view in three parts which also constitutes the three main chapters of the thesis:

1. I argue that the most viable interpretation of the noumenal realm in the first *Critique* (and therefore also in his critical philosophy in general) is to understand it as a realm outside Kant's conception of nature (governed by deterministic causality), regulated by the transcendental principle of freedom (as an absolute spontaneous, albeit, effective causality). In this manner this principle of freedom does not merely become logically possible; it becomes *conceivable* as something that could really exist if the world is perceived in accordance with Kantian philosophy. I present this reading as a third alternative in Kantian interpretation in contrast with the two-object and two-aspect views (which include about all streams of Kantian interpretation). I show that *Kant's* two-aspect and two-object views are reconciled in this manner.

2. I present a new reading of Kant's philosophy of science in the third *Critique* that is in agreement with my new reading of the first *Critique* (with the focus on the noumenal realm and other relevant concepts). I show that the conception of such a realm, now called the supersensible realm, is essential to the concepts that Kant develops in this part of his philosophy of science. I also show that Kant now argues for the *conceivability* of both such a realm and a different kind of causality, namely of "final" causes, which is named in *analogy* to the achievement of human ends. I argue that this causality involves a certain potentiality according to which non-extended wholes-and-parts (in the supersensible realm) can produce aggregated parts and wholes in nature and builds upon the transcendental idea of freedom introduced in the first *Critique*. This aspect of Kant's philosophy of science stands apart from that presented in the *Metaphysical Foundations of Natural Science* which is directed to the study of matter (grounded on the epistemology developed in the Analytic part of the first *Critique*).

3. I show that, although Kant himself did not foresee this possibility, his philosophy allows us to

engage with the noumenal realm empirically. This is possible when we rework it in such a manner that time is combined not with space, but with mathematical space (Kant calls such space-forms that are constructed through reason and applied to noumena, "ideal" space – see below), as is done in quantum mechanics. I argue that the pre-measurement quantum realm adheres to the three basic requirements that Kant has for the supersensible realm, namely that it is supersensible, that it is beyond space/time and that it is outside nature (where all interactions are governed by deterministic causality). As such the quantum realm can be conceived of as an ontologically distinct realm. The concept of absolute spontaneous causality can therefore be ascribed to that realm without contradiction and I argue that Kant's approach enable us to positively conceive how this is possible.

I take the reduction of the wave packet as adhering to this kind of causality, namely as a physical event that happens in various contexts, also outside measurement, for example during atomic decay which is the paradigmatic indeterminate process. In my Kantian interpretation of quantum physics I develop a unified conceptual framework in which spontaneous and deterministic causality are reconciled. When these two kinds of effective causality are regarded as heterogeneous laws that govern two ontologically distinct modes of existence, namely the quantum and classical modes, the well-known measurement problem in quantum physics (that involves the above mentioned conflict in laws) is also resolved. New light is also thrown on some interesting features in quantum mechanics, for example non-separability and non-locality.

In this manner three interpretations are developed, namely 1) a new interpretation of the first *Critique* (called the third alternative), 2) an interpretation of Kant's philosophy of science in the third *Critique* that is consistent with 1) and 3) a new Kantian interpretation of quantum physics. These interpretations are not independent of each other – together they constitute a consistent interpretation of the first and third *Critiques* (and the *Critique of Practical Reason*, although that is not included in the discussion) that is also consistent with contemporary science.

### 1.3 Methodology

In deciding on a methodology for my interpretation of Kantian philosophy, I considered what may be called the hermeneutic problem. This problem is that the overall interpretation of a text and the particular arguments are interwoven. *In all interpretation the particular arguments are important whereas for all arguments the overall interpretation is important.* The reason for this is that our understanding of philosophical works always involve certain assumptions underlying our premises that are not made explicit. There are so many strings of thought in the overall work (the horizon behind the work) that we can think of it as a thing in itself beyond the possibility of ever bringing those ideas in any objective sense into our premises and arguments. Kant explicitly acknowledged this problem when he argued that reason always has certain limits insofar as we as humans are sensibly and conceptually constrained. In Kant's formulation of the antinomies he shows that conflicting paradigms (even mechanism and freedom) that cannot be shown to be true in any final sense, may even under certain conditions both be true.

In this context I believe that a typical Kantian approach should not be to even try to establish final conclusions in this regard. It should rather acknowledge that the above-mentioned problem makes it impossible to arrive at final conclusions when trying to understand the works of philosophers. As such it is better to speak of interpretations: that we develop certain interpretations that are not truth statements. We can never do better than presenting various interpretations. This is especially relevant in the interpretation and understanding of Kant's philosophy.

In my reading I observed two strategies in dealing with the hermeneutic problem in the work of

historical philosophers and especially Kant. The first strategy is to try and reconstruct the author's arguments and in that manner to arrive at some conclusion that we may attribute to the author. In this case the project is often *implicitly* guided by a preconceived paradigmatic commitment to an overall interpretation of the work (say the two-object view) which is never made explicit. Although some seemingly final conclusions are sometimes arrived at, there cannot be any metaphysical commitment to truth because of the implicit assumptions. The other approach is to start with a broad interpretation (a contextualization) and to proceed within this context with particular reconstructed arguments. In this case the paradigmatic commitments are made *explicit* from the start. As such there are also no truth claims to be made. We can call this the analytic and continental approaches and in Kantian studies both are well presented in the literature (for the first, see Guyer 1987, Langton 1998, etc.; for the second, see Allison 2004, Allais 2004 etc.).

The hermeneutic problem is especially relevant to my own approach since I am not committed to any of the current paradigms in Kantian interpretation (namely the two-object and two-aspect views). I can therefore neither start with particular arguments (which always depend on some overall interpretation) nor work from within any accepted paradigm. The result is that readers who have different paradigmatic commitments (standing outside my newly introduced paradigm) might read the work in their own terms, understanding the terminology in their own way.

The problem is alleviated by the fact that my interpretation accepts the two-aspect view insofar as Kant's epistemology is concerned (i.e. in the Analytic part of the first *Critique*), but not insofar as Kant's views regarding freedom and the noumenal realm are concerned (i.e. in the Dialectic part; for which I hold a two-object view). This allows me to use a continental approach according to which I first provide a contextualization of Kant's overall program (i.e. give my own take on it) before proceeding with arguments regarding the details of Kant's concepts and their relation with each other.

We find the same problem in mathematical texts where mathematical formulations are sometimes thought of as giving precise descriptions of what happen in the same manner that precise formulations of arguments are often conceived of. This is an extensive problem and I am not going to discuss it in any detail. What is of importance, however, for my own approach, is that there are always various ways to understand the physics behind the equations (and even the equations themselves). This is why various interpretations of quantum physics have been developed.

In the chapter where I give my Kantian interpretation of quantum physics, I developed my ideas in a formal manner but have on purpose not included any equations – I have tried to present my understanding of the mathematics and the physics involved without taking the short route through mathematics where presenting equations is regarded as stating “obvious” truths or interpretations. Although mathematical expressions can provide logical (methodological) possibilities, the understanding of how this relates to what the world is like goes beyond that. In not including equations I try to facilitate the reader's engagement with my own paradigm of understanding quantum physics. Even in this case I, again, give a contextualization of my Kantian approach before commencing with the detailed discussion.

I follow the continental approach throughout (in all the main chapters), starting with contextualization before engaging with the details of Kant's position. I develop an interpretation of Kant's philosophy in the first *Critique*, of his philosophy of science in the third *Critique* and eventually produce a Kantian interpretation of quantum physics in which I use these interpretations. In the final instance I produce arguments for my position but I do not try to establish any final conclusions. I nevertheless hope that my arguments will be convincing and my interpretations

sophisticated enough to accommodate the many strings of Kantian thought into a unified perspective.

## 1.4 Conclusion

Kant's philosophy is not easy to engage with. The historical context in which he presented his major work played an important role in the formulation of the traditional two-object view in which Kant is read primarily as an idealist. This has changed over the last fifty years or so with the wide acceptance of the two-aspect view (see Gardner 1999). I believe that this has brought more balance to Kantian interpretation. The problem, is however, that Kant's conception of freedom is still understood for the most part in moral terms.

In this thesis I try to change that view and show that freedom constituted an essential part of Kant's scientific thought – both in the groundwork that he laid in the first *Critique* as well as in the third *Critique*. Once this is recognized, the way is prepared for the application of these Kantian concepts to contemporary scientific debate. There is no short route – the work presented here involves many detailed discussions of seemingly forgotten concepts. But I hope in the end it will be worth the effort of the reader.

# 2. Kant's conception of the noumenal realm in the *Critique of Pure Reason*: the third alternative

## 2.1. Introduction

Kant's conception of noumena and a noumenal realm figures prominently in the writings of his critical period and is interwoven in the arguments of all three *Critiques*. There can be no doubt that he regarded it as an important part of his philosophy. The problem is, however, that it became one of the most problematic aspects (one could even say the most problematic) of his philosophy.

Outside Kant's moral philosophy very little attention is given to the noumenal realm and there seems to be a consensus that we should rather forget that he gave such prominence to it in both the *Critique of Pure Reason* (the first *Critique*, except insofar as it relates to his moral conception), as well as the *Critique of the Power of Judgment* (the third *Critique*), where it forms part of his philosophy of science. Scientifically minded philosophers believe that some damage-control is needed to purify the non-moral aspects of Kant's philosophy from this relic of an ancient mode of thinking. They regard the noumenal realm as a "quasi-theological" realm (O'Shea 2010:525) which represents eighteenth century ideas which are "now thought to be nothing more than ghosts of earlier ways of thought" (Butts 1990:13).

The problem is magnified by the fact that there is no consensus in Kantian interpretation. Since interpretation in turn determines our understanding of noumena – for the simple reason that this concept is closely interwoven with Kant's wider philosophical thought – this has led to divergent ways in which it was/is understood. This interrelatedness in Kant's thought is visible in the close relation between Kant's concept of noumena and other concepts, like things in themselves and the transcendental object. Any study of noumena and a noumenal realm should therefore commence with the more basic question regarding the place that noumena occupy in Kant's overall program in the first *Critique* and its relation to these other concepts.

All scholarly views can broadly be allocated into two schools of Kantian interpretation, namely the two-object view and the two-aspect view. The "two-object" (or "two-world") view is the oldest and goes back to Christian Garve's first review of the first *Critique* in 1782 (Feder/Garve 2000). It understands noumena as referring to the everyday objects of our senses considered outside our cognition of them, i.e. the unknowable "real" things (in the world as it really is) which stand in contrast with the representations in our "mental realm". In recent times P. F. Strawson (1966) and Paul Guyer (1987) have been the best known proponents of this view. The most important criticism against this view is that it ascribes gross inconsistencies to Kant which are eliminated in the two-aspect view (Bird 2010a:2).

The two-aspect view goes back to Kuno Fischer in his debate with Adolf Trendelenburg in the 1860's (Bird 2010c:486-499). This is called the "two-aspect" (or "one world") view because *the same things* that we encounter in experience are taken from two different standpoints, namely as they appear to our senses, adhering to the epistemic conditions of cognition, and as we can think them beyond that as things in themselves. Some of these interpreters, like Henry Allison, view things in themselves (equated with noumena of which we can know nothing) in mere epistemic terms (Allison 2004). Others, like Karl Ameriks, hold that things in themselves could also have ontologically distinct (i.e. noumenal) intrinsic properties (Ameriks 1992; Langton 1998; Allais 2004). The problem with this view is that it is not able to account for the conceivability of freedom.

In my view, none of these views gives an interpretation of noumena which sufficiently accounts for the many strands of Kant's thinking. This poses the problem: Is the concept of noumena problematic because Kant held some (now) outdated ideas in this regard or is it because of the distortion in our interpretation of the Kantian view? I believe the second option is the case. I therefore propose a third alternative in our reading of Kant, namely that the noumenal realm is transcendent to our senses, not in the sense of being the "real" outside the confines of our senses, but in the sense of being outside the Kantian conception of "nature" and consisting of ontologically distinct entities (noumena). I show that in this interpretation *Kant's* two-aspect and two-object views (i.e. not the traditional two-object view) are not merely reconciled; it is integrated in a unified view in which the first captures his epistemology (in the Analytic part of the first *Critique*) in such a manner that it allows for the second which is necessary to establish the conceivability of freedom (in the Dialectic part). Although this alternative is implicitly (and sometimes explicitly; Guyer 1987:335) rejected in the above interpretations, I believe that this is in fact the alternative that not only most accurately captures Kant's thought, but also makes the most sense for the contemporary scientific mind.

To understand Kant's concept of noumena I first explore its place in Kant's overall program and its connection with other related concepts. I show that we can order Kant's program in the first *Critique* into three paradigmatic moves, which grounds the three basic aspects of his philosophy, namely his transcendental idealism, empirical realism (which together constitute his epistemology) and his conception of freedom. Since the first two moves are in agreement with the two-aspect view and do not contain anything new *per se* (except the manner of ordering them), I only discuss those concepts introduced in these moves which directly relate to Kant's concept of noumena.

The last Kantian move, which concerns his concept of freedom, is my primary concern. I take this move not merely as establishing the logical possibility of freedom, but as designed to establish the *conceivability* of freedom under certain (metaphysical) conditions which include a particular conception of noumena. It is within this framework that Kant's conception of noumena should be understood: it makes the transcendental idea of freedom (as well as practical freedom) conceivable. In my view the noumenal realm refers to an ontologically distinct metaphysical realm, *problematically assumed* (A255).

Although Kant does not explicate his idea of the noumenal realm in any detail in the first *Critique*, I argue that we have every reason to think that he adhered to the same conception of the noumenal realm throughout his critical period, but especially in the third *Critique.* In the third *Critique*, especially in the part called Critique of the Teleological Power of Judgment, where the noumenal realm forms part of Kant's philosophy of science, he conceptualizes it as the substratum of nature and human nature. *This means that Kant thought that this concept is consistent with science.*

### 2.2. Kant's overall program in the first *Critique*

In the first *Critique* Kant is concerned with the question: How is mathematical science (and mathematics) possible for humans with our discursive form of cognition i.e. that needs both sensibility (intuitions) and concepts of the understanding for cognition of objects? (Friedman 2001:10). In it he develops an epistemology in accordance with the conditions for and limitations of human knowledge. He establishes the limits of pure reason and undoes all "proud ontologies" (A247), but at the same time shows how certain ideas like freedom, which could conceivably be true, can be fruitfully introduced.

Within Kant's overall program, I distinguish three paradigmatic moves. Kant's first two moves are interwoven in the first part of the first *Critique*, namely in the Transcendental Analytic (using

arguments from the Transcendental Aesthetic and Logic). The third move is made in the Transcendental Dialectic. With each move another concept is introduced that has some bearing on our limits of knowledge, namely things in themselves, the transcendental object and noumena themselves, all of which are closely interconnected. The relation between these concepts is discussed in section 2.4 (on noumena).

2.2.1. The possibility and conditions of *a priori* cognition

The first move concerns Kant's transcendental idealism. Kant presents his project as an inquiry into the possibility of establishing something about objects *a priori before* they (as real objects) are given to us (Bxvii). According to Kant, it is not the objects which make representations possible, but representations which make objects possible – in the first case the relation would be empirical and not able to establish necessary and universally valid principles for mathematics and the natural sciences, in the second case "[although] the representation in itself... does not produce its object as far as its *existence* is concerned, the representation is still determinant of the object *a priori* if it is possible through it alone *to cognize something as an object*" (Kant's accentuation, A93/B125).

Central to the possibility of *a priori* cognition, is Kant's well-known Copernican turn (see Bxvii-xviii). The essence of this critical turn in Kant's philosophy is the acknowledgment that we as humans do not have access to objects of the senses, except through our human faculties. Objects are always objects "for us" (B138). In the same way that Copernicus incorporated the perspective (movement) of the observer in our understanding of the heavens, so Kant saw that we have no choice but to incorporate the human perspective in cognition in general. Our cognition of objects are dependent on our cognitive faculties – we do not have unconditioned access to the world.

Within such an anthropocentric model (Allison 2004:xvi), which would always be subjective, it is nonetheless possible, according to Kant, to obtain objective cognition when various epistemic conditions which are necessary, and presumably together sufficient for that, are adhered to (Allison 2004:12). Such conditions involve the human abilities which make cognition possible in the first place (Gardner 1999:83), namely the pure (*a priori*) forms of sensibility, namely space and time, the pure "form of sensibly intuiting" (i.e. the manner/form in which intuitions are given for synthesis with concepts; Allison 2004:15, 114) as well as the pure forms (concepts) of the understanding, all of which relate to objects completely *a priori* (A86/B118; A88-89/B120-122). The pure form of space provides the manifold (B154, B156, A157/B196) in which the "form of sensibly intuiting" is combined into a unity through apprehension (B129-131; note to A429/B457; Allison 2004:193). The formal conditions which make our experience of objects possible at the same time makes them into possible objects of experience.

This mind-dependence of appearances (the manner in which objects appear to the mind) constitutes Kant's philosophy as a form of "idealism" (Allais 2004:656). It differs from both Berkeley's "dogmatic" (or "material") idealism and Descartes' "skeptical" (or "empirical") idealism in that it is both "formal" and "critical". It is formal because it concerns the formal conditions (involving the "forms" of the mind) under which objects can be cognized and it is "critical" because it involves a reflection on the limits of discursive cognition (Allison 2010:112). Kant calls his philosophy "transcendental idealism". By "transcendental" Kant means that his idealism is concerned with the possibility of and conditions for (objective) experience, and as such with *a priori* cognition.

Kant's transcendental philosophy, however, does not only concern the *a priori* possibility and conditions of cognition; it is also occupied with the concepts of "objects in general" (A12) which refer to objects as we can conceptualize them in general, even beyond the restrictions of sensibility

(see A35/B52, A57/B81; A252 etc.). When we abstract the subjective constitution of the senses from these objects in general, we are left with "objects in themselves" of which we cannot know anything (they are beyond the reach of our senses). Kant writes: "What may be the case with objects in themselves and abstracted from all this receptivity of our sensibility remains entirely unknown to us" (A42). In this way the concept of things in themselves in contradistinction to things as they appear to our senses is introduced into Kant's philosophy (Bxxvi).

Kant's first move culminates with the formulation of four rules or "principles" of cognition, based on the four basic types of concepts/rules (called categories) of the understanding (quantity, quality, relation, modality). These principles are both *a priori* (valid before any actual experience) and "synthetic" since they involve human sensibility. They are *a priori* objectively valid, i.e. they constitute the real possibility of experience and are therefore valid for all possible objects of experience. As mere rules which regulate the real possibility of experience, these principles are, however, not sufficient to establish actual experience. Experience involves judgments of actual perceptions according to these principles.

2.2.2. The objective spatio-temporal world of empirical cognition

The second move concerns Kant's realism. Kant now establishes the necessary *a priori* (i.e. before experience) conditions for achieving actual empirical cognition (empirical truth) when objects are given in empirical intuition (perception). This move compliments the discussion of the *possibility* (*a priori* conditions) of experience with that of 1) the *actuality* of experience and 2) the *necessary* and objective world of experience (see below).

For experience to be actual, it must involve not merely establishing something about objects *a priori before* they (as real objects) are given to us (Bxvii), but also about the real objects of the senses (both inner and outer objects). Objects must not only conform to our cognition; cognition must also incorporate the real in objects. *A priori* cognition does not mean that no *a posteriori* data is involved (Bird 2010b:127). On the contrary, the judgment that a cognition is true or false must involve both *a priori* (transcendental) rules (only general rules can have necessary and strict universal application) as well as particulars (when pure apprehension is particularized in experience) which are brought under those rules. The undetermined (unconceptualized, i.e. not brought under rules) object of an empirical intuition is called "appearance" (A20/B34); the determined object is called phenomenon (A249-9/B305).

This mind-independence of appearances constitutes Kant's philosophy as a form "empiricism" (Allais 2004:656). Kant describes this aspect of his philosophy as "empirical realism". The term "empirical" refers to the givenness of objects; that outer objects are given from outside us in the senses (B166). The term "real" refers to their independent existence, which is not inferred, but directly perceived as "matter" in appearances: "[T]he transcendental idealist is an empirical realist, and grants to matter, as appearance, a reality which is not inferred, but is *immediately perceived*" (A372; my accentuation).Whereas the conception of objects, which precede perceptions, signify mere (though real) possibility, perceptions provide the material for these conceptions, and as such "is the sole characteristic of actuality" (B273).

2.2.2.1. Perception and the transcendental object

The manner in which real objects are given to us in perception involves an "effect" on the mind. Although this effect is in some sense "caused" by objects (our bodies are objects in a causal relation with other objects), this should not be confused with objects as the ground or "cause" (taken in the

weak sense, i.e. merely as something that is necessary for something else to happen) of appearances (Allison 2004:65). What does Kant mean by this ground? Kant's realism accepts that we are *directly aware* that *appearances* are not merely in the mind but involve independently existing objects outside the mind (A372/3). We are aware that appearances of objects relate to objects existing independently of us.

When we conceptualize appearances as phenomena, this necessarily includes in the concept the presupposition of such a ground for these phenomena (A252). Without such a *transcendental* ground, phenomena would not be possible for us. In this case the term "transcendental" does not refer merely to human conditions for the possibility of experience but to external conditions, i.e. that objects really exist independent of us. There must be real objects for us to have experience of them.

Kant now introduces the concept of the "transcendental object" as the ground of phenomena. Since this concept involves everyday objects to the extent that they exist beyond our perceptual reach, it stands in some relation with the concept of things in themselves (this relation is explored in more detail below). The transcendental object does not refer to any particular object; it is the completely undetermined thought, i.e. we do not even have a concept of it except merely that it is the object of sensible intuition in general (as a mere "nothing" for us), which is the same for all appearances (A251, A253). As belonging to the real world *before our cognition thereof*, it is "given in itself prior to all experience" (A495/B523).

Although the transcendental object, as ground of appearances, stands forever outside experience, the transcendental matter (and its form) belonging to the transcendental object can be brought to consciousness as the matter (and its real form) given in sensibility (see also Allison 2004:70; note 1). As such Kant speaks of "things themselves which appear" (A268/B324), i.e. which are brought into sensibility. Clearly the transcendental object, as the *mere intelligible ground* of appearances in general, is *merely something corresponding to "sensibility as a receptivity"* (A495), forever outside sensibility.

2.2.2.2. Experience of an objective world

At this point in the discussion we can focus in more detail on Kant's concept of judgment which constitutes an essential part of the second move. Kant distinguishes between understanding and the power of judgment: whereas the understanding is "the faculty of rules [concepts]", the power of judgment "is the faculty of subsuming under rules, i.e. of determining whether something stands under a given rule or not" (A133/B172). The understanding provides the rules/concepts, whereas judgment is the ability to subsume the particulars given in sensibility under those rules. For Kant determinate judgment is the ability to subsume particulars under rules (Guyer 2000:xxii).

How is judgment related to experience? In judgment the appearances of objects given in perception are brought under the rules for objects (principles of the understanding) made possible through the first move (in this way appearances are distinguished from mere "representations of apprehension"). Kant writes in this regard: "The appearance that is given to me, in spite of the fact that it is nothing more than a sum of the representations, is considered as their object, with which my concept, which I draw from the representations of apprehension, is to agree. One quickly sees that, since the agreement of cognition with the object is truth, only the formal conditions of empirical truth can be inquired after here, and *appearance, in contradistinction to the representations of apprehension*, can thereby only be represented as the object that is distinct from them if it stands under a rule that distinguishes it from every other apprehension, and makes one way of combining the manifold

necessary" (A191/B236; my accentuation). The judgment of truth/falsity involves determining the necessary manner in which the synthesis of the manifold of appearance (or: the manifold of perceptions as he says elsewhere; B219) is accomplished.

The necessary connection between perceptions allows for a definition of objects: "That in the appearance of which contains the condition of this necessary rule of apprehension, is the object" (A191/B236). This rule is provided by the third principle of cognition which governs the relations between existences *in time*, i.e. the Analogies of Experience. Objectivity in experience is achieved through the rules for perceptions (the analogies), which constrain our actual perceptions as Arthur Melnick (2010:179) writes: "[W]e can represent objectivity by rules (for perceptions) that constrain our actual perceptions. It is proper perceptions [constrained in this manner], that is, that constitute objectivity".

Whereas the first two principles, called "mathematical" principles, justify applying mathematics to appearances, that is, determining the extensive spatial and temporal magnitudes of relations between objects (or parts thereof) and the intensive magnitudes of matter in empirical objects (A165/B206, A179), the analogies (substance, causality, community) concern the "relation of existence" (B222), namely the persistence, succession and simultaneity of the real existing objects of experience. Although the mathematical principles are constitutive (i.e. involve numerical magnitudes) and the dynamic principles (the third and fourth) regulative principles (i.e. involving relations of existence) of the understanding, both enable us to make determinate judgments regarding the world of experience. In the case of the analogies, they enable us *to determine the necessity of the relations of existence*, that is, the objective spatio-temporal order of the world.

2.2.3. The conceivability of freedom

Kant's third move is made in the last part of the first *Critique* (in the Transcendental Dialectic, i.e. the Logic of Illusion). I understand this Kantian move as establishing the *conceivability of freedom*. Whereas the first two moves constitute a way of ordering Kant's epistemology (in accordance with the two-aspect view), this move presents a new reading of the Dialectic within the framework of his overall program. In my understanding Kant's goal with this last part of the first *Critique* is not only to establish the limits of pure reason and to undo all "proud ontologies" (A247); it is to show *how freedom can be saved even though pure reason is limited in its reach*.

In my reading Kant is not merely introducing the possibility of freedom as just another topic in the course of his discussion in the Dialectic. On the contrary, his overall aim is to argue that transcendental freedom is *conceivable* under certain (metaphysical) conditions which include a particular conception of noumena. *When we want to understand how noumena fit into Kant's overall program, we have to take this goal into account.* It is my opinion that only when we take the conceivability of freedom as the overall goal of Kant's third move, would our interpretation of the first *Critique* do justice to Kant's philosophy. In the same manner that the two-aspect view does away with various inconsistencies which the two-object view finds in Kant's philosophy (Bird 2010a:2), this understanding of Kant's third move does away with many of the remaining inconsistencies in the two-aspect view. After discussing Kant's conception of noumena in the next few sections, I discuss these different views (in section 2.5) and show why they do not correctly capture Kant's position.

Kant's arguments for the conceivability of freedom are indissolubly linked with his conception of noumena. Since all experience is governed by causality according to the second analogy, freedom is only conceivable if it can be ascribed to an intelligible (noumenal) world beyond the sensible world,

and if it can also operate as a cause for some phenomena in the world of experience. The only way in which freedom can be secured in Kant's critical discussion of the limits of cognition (established in the previous part of his work), is within the framework of the correct use of another human faculty, namely reason. Reason has the impulse to proceed beyond the sensible world. This, however, is a dangerous space where various illusions lurk and Kant discusses the possible pitfalls, but also shows how freedom can be fruitfully introduced as a transcendental idea of reason.

This move is of great importance for Kant since freedom plays a very important part in his philosophy. We can even say that his philosophy can be regarded as a philosophy of freedom. He says in the *Critique of Practical Reason* (the second *Critique*) that freedom is the foundation of his philosophy (5.3-4). In the first *Critique* he demonstrates its conceivability, in the second *Critique* he uses this as basis for his moral philosophy (speculative reason creates the space which is to be filled by practical reason; Bxxii; Allison 1990:243). In the *Critique of the Power of Judgment* (the third *Critique*) he engages with the problem regarding the gap between the realms of nature and freedom. For my purposes, this move is important since it is so closely linked to his conception of noumena and the noumenal world.

**2. 3. Proceeding beyond the limits of human cognition (introducing the noumenal realm)**

In the first part of the first *Critique* Kant is primarily concerned with the possibility and conditions of human cognition. In the Dialectic he proceeds with an investigation into the possibilities of achieving cognition beyond our sensible reach. He shows that since the cognition of objects beyond sensibility, i.e. of things as they are in themselves, is not possible, no ontology thereof can be established (A247). However, our natural questions regarding metaphysics can be put to good use in both scientific inquiry and morality (Guyer 2000:14).

Since our understanding is restricted by sensibility, and the principles of the understanding can be related only to objects of sensibility, this faculty cannot be used to explore the domain of things in themselves. For this another faculty is needed, namely the higher faculty of reason. Reason has the characteristic that, in its logical use, it seeks for a synthesized whole (A307/B364; A409/B436). For any conditioned it demands the unconditioned in the series of conditions (i.e. the whole). Reason therefore proceeds from the categories of the understanding (for those categories which allow such a synthesis) to an absolute whole, in which case these are called concepts of reason or "transcendental ideas" (A311/B368). Three kinds of such ideas are possible, namely ideas of rational psychology, rational cosmology and rational theology, generated according to the three kinds of rational inference (the relation of a property to the subject, to another property and to its ground; Guyer 2000:63; A334/B334).

The cosmological ideas are of special interest in our discussion since they are the only ones which presuppose an object (A479/B507). They are therefore of particular importance when we study the limits of cognition, which always require real objects. In this case the demands of reason for the unconditioned can only be satisfied under the following assumption: "when the conditioned is given, then so is the whole series of conditions subordinated one to another, which is itself unconditioned, also given" (A308/B365). Kant calls these unconditioned wholes "principles" (of reason), which are "a logical prescription in the ascent to ever higher conditions to approach completeness in them and thus to bring the highest possible unity of reason into cognition" (A309/B366). When the absolute whole is taken to be the sensible world as a whole, the various conditions thereof, as given by the applicable categories, can be synthesized in this manner.

Kant's philosophy suggests two competing strategies for thinking the unconditioned, namely

proceeding from the transcendental idealist and the empirical realism perspectives respectively. Reason in its transcendental use can think the unconditioned in a series of conditions regarding the sensible world (a first moment in time or a limit in space, that matter is composed of indivisible elements, etc.). This *conceptualized* unconditioned can, however, never be brought into experience (it is merely an idea) and assuming such a reality (i.e. that it can be given in sensibility) would be illusionist. Reason in its empirical use proceeds from empirical conditions to infinity taken as an unconditioned whole (there is no first beginning or limit to space, no simple substances of matter etc.). This infinite whole can also never as such be brought to experience (it would contain the empirical boundary with the void) and assuming such a reality (i.e. that it can be given in sensibility) would also be illusionist (Grier 2010:203; McLaughlin 1990:78).

In bringing these thesis and anti-thesis positions into conflict in the framework of the antinomies (a conflict of laws), Kant demonstrates the errors of the dogmatic rationalist and dogmatic empiricist positions (Allison 1990:13). When the principles of reason are used "constitutively" this would enable us to expand both the conceptual structure and the empirical conditions which apply to the sensible world (in objective cognition) beyond the boundaries of possible experience. The antinomies show that this cannot succeed. Kant, however, also introduces the "regulative" use of reason in which the unconditioned is given merely as a problem and where these principles guide scientific research towards an ever more complete understanding of objects, insofar as they may be empirically given (B537; B692; Cicovacki 2010:88).

These antinomial conflicts, furthermore, open new avenues for thinking. In this regard the difference between the "mathematical" and "dynamical" antinomies are important. Kant accentuated such a difference already when he introduced the categories and also later with the principles of the understanding. The primary difference is that the mathematical principles are concerned with the manner in which appearances must be given in space and time, whereas the dynamical principles concern the existence of appearances (Allison 2012:17). The two dynamical principles are concerned with the modes (third antinomy) and ground (fourth antinomy) of existence. The *thought* of the unconditioned in these cases suggests "absolute spontaneous" causality (the cosmological idea of freedom) and the existence of a necessary being. The *empirically* unconditioned would deny these.

The mathematical principles are merely concerned with accumulation or division within sensible conditions (within appearance), whereas the dynamical principles *in their consideration of existence alone* (i.e. no magnitudes of the series of conditions are considered; A536/B564) can easily be absolved from those conditions (the condition of appearances can be outside the series of appearances; A531-2/B559-560). As such, the transcendental and empirical use of reason (i.e. the thesis and anti-thesis positions) can be extended *to conceptualize* both the intelligible and sensible worlds, where the last is now taken not as an accumulative world-whole but as "nature".

Nature is comprised of the totality of casual relations which is called "mechanism". As such, mechanism stands in contrast with transcendental freedom. The "mechanism of nature" is only introduced in the second edition of the *Critique* in the context of the third antinomy (Bxxvii-xxx; A419/B447 note). It should be distinguished from "material mechanism" which is used in the technical sense to refer to causality in the science of mechanics (Allison 2012:202/3). Mechanism differs from Kant's concept of causality discussed in the second analogy in that it is a transcendental idea of reason which applies to nature as a whole (which is also only a concept), whereas causality is a rule of the understanding which applies to phenomena. Both are, however, deterministic concepts of causality.

Now in the dynamical antinomies the anti-thesis position *thinks* the unconditioned in the framework of sensible conditions whereas the thesis position does not merely think the unconditional, it also *thinks it outside sensible conditions in an intelligible world*. Instead of creating a conflict of reason, this represents a *real (logical) possibility*. The value of the dynamical antinomies, when viewed in this manner (with the thesis position taken outside possible sensible conditions), is that *existence in two different worlds can be brought into interaction with each other*, i.e. an intelligible cause can produce phenomenal effects or a necessary being can bring forth contingent existences.

Since the mode of existence in an intelligible world outside nature is not governed by mechanism we can without contradiction ascribe freedom to it. *As such freedom, as a different type of effective causality, namely of absolute spontaneity, becomes conceivable as a transcendental idea that belongs to that other mode of existence outside nature* (Kant views this as the only alternative kind of causality; A532/B560). Spontaneity as an effective cause of phenomena has no previous causal links in the structure of causal relations governed by the second analogy (in the world of phenomena); this is why it is viewed as beginning "a series of occurrences *entirely from itself*" (A534/B562).

### 2.4. Kant's conception of noumena

With this background, we can now depart from the two-aspect view. I now present an explication of Kant which builds on the two-aspect view (as presented in the previous sections), but which is nonetheless different from that found in other interpretations. *I now argue for a two-object view insofar as noumena are concerned*. As said before, I believe that we can only understand Kant's conception of noumena (intelligibilia) and a noumenal realm when we consider it within the framework of his conception of freedom. In fact, *Kant introduces the conception of noumena exactly because without it his conception of freedom is nothing but a vague possibility (as we find in the two-aspect view – see below), not necessarily something that can really exist in a conceivable manner.* Within the framework of Kant's conception of noumena, his transcendental conception of freedom becomes conceivable. Although we cannot prove the reality or even the possibility of freedom (A558/B586), we can think its possibility, and, *when using reason, argue its conceivability.*

We can even make a slightly stronger claim. Since we need freedom to assert personal responsibility (morality), and this only becomes possible through the transcendental idea of freedom, Kant believes that he has *good reason* to think that noumena are conceivable, even though we can never know that they really exist. Andrews Reath (2010:276) writes in this regard: "Kant thinks that we can make warranted assertions about noumena if we have grounds for thinking of entities that are governed by laws different in kind from the causal laws governing the occurrence of events in space and time. Such assertions would be a way of *conceiving* of such entities, but are not *knowledge* claims".

According to Kant, practical freedom, i.e. freedom associated with human action, is grounded on transcendental freedom: "*It is especially noteworthy that it is this transcendental idea of freedom on which the practical concept of freedom is grounded*, and the former constitutes the real moment of the difficulties of the latter, which have long surrounded the question of its possibility" (A534/B562, B461-2; my accentuation). Although the transcendental idea of freedom is necessary for the concept of practical freedom, only the latter regulates human action and morality; the first is a concept of speculative reason, not practical reason. We therefore find that Kant also discusses freedom in the human domain (from A546/B574 on) only *after* he shows how transcendental freedom is conceivable as a different kind of causality once the existence of noumena is assumed (A531/B559-A545/B573). It is also in the context of transcendental freedom that the realms of

nature and freedom are first introduced (A537/B565). Although Allison (1990:24) follows a mere epistemic (methodological) two-aspect approach, he also distinguishes in this regard between transcendental freedom as effective cause and the freedom associated with causal agents.

Viewed from this perspective, we can say that Kant formulates his conception of noumena at the end of the Analytic, in a section called "On the ground of the distinction of all objects in general into *phenomena* and *noumena*", with his discussion of transcendental freedom in the antinomies in mind. Kant's most important statement in this regard is: "For if appearances are things in themselves, then freedom cannot be saved" (A537/B565). Kant says that for (transcendental) freedom to be conceivable, we need to go beyond appearances, which are governed by causality, to things in themselves. What does Kant mean by "things in themselves" in this regard? Throughout the first *Critique* Kant often mentions that this concept refers to things considered outside the conditions in sensibility. But this is quite a broad conception (as I will now show), which includes various considerations of things in different contexts.

2.4.1. Noumena in the negative sense

When speaking about things in themselves *in the context of freedom* (although Kant often does not make this explicit) Kant has something specific in mind, namely noumena, taken in the negative sense. In the second edition of the first *Critique* he introduces noumena in the negative sense, which should be distinguished from noumena in the positive sense (B308-9). What are noumena in the negative sense? By this expression Kant means that *we cannot positively cognize noumena* in the sense of knowing something about them (for this the concept of the object must be synthesized with some intuition thereof as explained in the first part of the first *Critique*) (B309-11). But since we do not have any sensible intuition of noumenal objects (they are pure objects of understanding), we cannot cognize them.

Although noumena in the negative sense are not objects of *our* sensible intuition, *they could very well be objects of another kind of intuition* (B308). Although Kant in general refers to intellectual intuitions in this regard, according to which some intellect (albeit not ours) can capture things as they are in themselves, this is not necessarily the case here – he could just refer to such a possibility without any specifics (see note 2 for another possibility). Kant mentions that we cannot assert that no such intuition exists (A255/B311). The possible existence of objects as noumena can therefore never be excluded. As such, they would be entities of another kind of intuition, but outside our sensible reach. *Although outside our sensibility, they would, nonetheless, be real objects of the world*. Kant's conception of noumena in the negative sense captures this possibility, although only *problematically* (i.e. the concept contains no contradiction).

Kant writes: "[T]here may even be beings of understanding to which our sensible faculty of intuition has no relation at all, our concepts of understanding, as mere forms of thought for our sensible intuition, do not reach these in the least; thus that which we call noumenon must be understood to be such only in a *negative* sense... The concept of a *noumenon*, i.e. of a thing that is not to be thought of as an object of the senses but rather as a thing in itself (solely through a pure understanding), is not at all contradictory; for one cannot assert of sensibility that it is the only possible kind of intuition... In the end, however, we have no insight into the possibility of such noumena, and the domain outside the sphere of appearances is empty (for us), i.e. we have an understanding that extends farther than sensibility *problematically*, but no intuition, indeed not even the concept of a possible intuition, through which objects outside the field of sensibility could be given" (B309-11).

At this point of the discussion *it is important to distinguish between the positive content of the conception of noumena and noumena in the positive sense* (a difference which is ignored, for example, by Allison 2004:63). Noumena in the positive sense must be "grounded" on some intuition (B308-9). Alternatively they can, according to Kant's explication in the second *Critique,* be grounded in our practical use of reason which is not our concern here (Allison 1990:242). The positive conception of noumena, on the other hand, is not grounded on any intuition; it is merely a concept with reference to a possible existing object which can be an object for another kind of intuition than our own.

The positive content of the *concept* of noumena (i.e. not noumena in the positive sense) is determined from the third antinomy. We have seen that the only manner in which the thesis and antithesis positions can be reconciled, and the conceivability of transcendental freedom established, is when such freedom transcends not only sensibility (and the second analogy), *but is also assigned to the realm outside nature (and mechanism)*. As such transcendental freedom is ascribed to *noumena, which would belong to another mode of existence outside nature* where mechanism does not apply, and which is only accessible to another kind of intuition than our own. This antinomy is after all concerned with (modes of) existence. Paul Guyer is certainly right when he writes: "their affirmation [i.e. of the two sides of the dynamic antinomies] is taken to refer to what might exist in a noumenal or supersensible world of things in themselves" (Guyer 2000:17).

Such an existence would not merely be outside the conditions of sensibility; it would really be outside space and time. The reason for this is immediately clear: according to the Kantian conception of noumena they could only exist outside the conception of nature (and mechanism) and as such they would forever be outside the reach of our sensibility which is restricted to the objects of nature. *Only objects in nature can become objects of sensibility* and as such be perceived with our forms of sensibility, namely space and time. The reason for this is that objects outside nature would not stand in a community with us in accordance with the third analogy since they do not belong to the causal structure of our world. We cannot become aware of them. They therefore cannot be perceived with our kind of sensibility in space and time.

As a mode of existence outside space and time, this would encompass a realm that we can merely think and as such it would be ontologically distinct from our sensible world. Already in the first *Critique* Kant mentions the distinction between these *conceptualized* worlds: "The division of objects into phenomena and noumena, and of the world into a world of sense and a world of understanding, can therefore not be permitted at all *in the positive sense*, although concepts certainly permit a division into sensible and intelligible ones" (B312: the words accentuated are added in the second edition; noumena in the positive sense are not allowed). He later spells out that this involves existence outside time (and space) when he says: "this acting subject, in its intelligible character [i.e. noumenal ground], would not stand under any conditions of time... insofar as it is a noumenon, nothing happens, thus no alteration requiring a dynamic time-determination is demanded, and hence no connection with appearances as causes is encountered in its actions" (A540-1/B568-9).

Of special importance to my interpretation is *the fact that Kant regards noumena as real entities* which are ontologically different from the objects of the senses. This is why Kant contrasts the two kinds of objects with each other and refers to noumena as "other objects" than those given in the senses: "[I]f we call certain objects, as appearances, beings of sense (*phenomena*), because we distinguish the way in which we intuit them from their constitution in itself, then it already follows from our concept that to these we as it were oppose, as *objects thought merely through the understanding*, either *other objects* conceived in accordance with the latter constitution, even

though we do not intuit it in them, or else *other possible things*, which are not objects of our senses at all, and call these beings of the understanding (*noumena*)" (B306; my accentuation, except for "phenomena" and "noumena"). Kant here distinguishes between two types of noumena, namely those *objects* which can be included in the framework of things as they are in themselves and those which have no relation to the objects of the senses whatsoever (things like angels).

At this point my interpretation shows some agreement with the two-object view which also takes Kant's conception of noumena as referring to ontologically distinct objects seriously. The difference, however, is that they view things in themselves as equivalent to noumena, whereas I interpret Kant's concept of things in themselves as being wider than noumena (see below) – although he admittedly sometimes speaks as if they are the same. In the two-object view the everyday objects outside our sensible reach, i.e. as they are "really" in themselves, are taken to be the same as noumena. I disagree. I mentioned in my discussion of Kant's second move that the real outside our senses are fully given in empirical apprehension. When I discuss the two-object view below I show that such a concept of noumena cannot make freedom possible, nor conceivable.

We can now say that Kant confirms a positive conception of noumena, which refer to real but ontologically distinct objects, which can only be taken in the negative sense as *problematically assumed*. This conception is more substantial than merely considering objects outside the conditions of sensibility; it includes objects of the understanding which can be given in some intuition, although not a sensible one (A255; B311). As such, noumena as objects of our thoughts, can constitute a different mode of existence than that given in sensibility, although we cannot cognize them because of our particular form of sensibility (A253). Kant construes noumena and the noumenal realm in these terms to make the transcendental idea of freedom conceivable. *Without such a noumenal ground for the phenomenal effects of spontaneous causality, conceptualized in this manner, the transcendental idea of freedom (albeit possible) would not necessarily be conceivable.*

2.4.2. The difference between noumena and the transcendental object

We can now further delineate Kant's conception of noumena (henceforth taken in the negative sense). Although things in themselves encompasses the transcendental object (A268/B324 etc.), this is not what Kant means by noumena (contra what is often accepted to be the case). The difference is simple: noumena are objects of understanding conceptualized in a positive manner whereas the transcendental object is merely the empty thought that real objects of sensibility underlie appearances (see discussion in section 2.2.2.1.). The concept of noumena is introduced to make the idea of freedom conceivable; the concept of the transcendental object is introduced to enforce Kant's philosophy as an empirical "realism" (as I showed in section 2.2.2). These moves are clearly distinct in Kant's overall program.

*Kant actually accentuates the point that the transcendental object is not a noumenon:* "The object to which I relate appearance in general is the transcendental object, i.e. the entirely undetermined thought of something in general. This cannot be called the noumenon; for I do not know anything about what it is in itself, and have no concept of it except merely that of the object of a sensible intuition in general, which is therefore the same for all appearances" (A253). Allison (2004:59) takes this as a reference to noumena in the positive sense (i.e. that noumena in the negative sense can still be equated with the transcendental object), but there is no reason to think so – we find this distinction between the transcendental object and noumena also elsewhere in the first *Critique* (see below). Although it is true (as Kant mentions) that we can conceive of a conceptual non-sensible representation of the transcendental object (i.e. all concepts assume some intellectual representation of objects), and therefore in some very weak sense can consider it a noumenon, this representation

remains absolutely empty for us, we cannot even form a definite concept of what it is. As such it is not a noumenon as Kant conceptualizes it (A251; A289/B345).

We can articulate the difference between noumena in the negative sense and the transcendental object by referring to two places where Kant discusses both of these together in the same passage. The first of these is in the first edition (A251-252) where Kant, in his discussion of the ground of appearances, first mentions the transcendental object, but then adds that one *can add* the concept of noumena in this regard: "But the cause on account of which, *not yet satisfied through the substratum of sensibility, one must add noumena* that only the pure understanding can think to the *phenomena*, rests solely on this [i.e. namely, that sensibility and its field, i.e. that of appearances, are themselves limited by the understanding]" (A252; my accentuation except for the words "noumena" and "phenomena").

The other passage appears in both editions of the first *Critique* (A539-40/B567-8). Here, again, Kant discusses the transcendental ground of appearances. First he says that we can include both the transcendental ground as well as spontaneous causality in the framework of the transcendental object (i.e. when we take this as the transcendental ground in general). Then he is more explicit and mentions that the noumenal ground (or: intelligible character) of phenomena (which as such would be outcomes of spontaneous causality and be part of the observable empirical character), is different from the transcendental ground embodied in the transcendental object.

Kant writes: "For since these appearances, because they are not things in themselves, must be grounded in a transcendental object determining them as mere representations, nothing hinders us from ascribing to this transcendental object, apart from the property through which it appears [i.e. as the mere ground of appearance], also another *causality* that is not appearance, even though its *effect* is encountered in appearance (A539/B567). And: "This intelligible character [which he explicitly says is a noumenon in the next paragraph; A541/B569] could of course, never be known immediately, because we cannot perceive anything except insofar as it appears, but it would have to be thought in conformity with the empirical character, *just as* in general we must ground appearances in thought through a transcendental object, even though we know nothing about it as it is in itself" (A540/B568; my accentuation).

The difference between the transcendental object (as the mere conceptual ground of appearances of objects of the senses) and noumena in the negative sense is substantial. The transcendental object is the transcendental ground for the appearances of sensible objects; noumena are the ground for spontaneous causality with its effects in the phenomenal realm. In the first case Kant speaks of "things themselves which appear" (A268/B324); in the second he says that only the "effects [of the intelligible cause] appear" (A537/B565). The transcendental object contains matter in the transcendental sense (the transcendental ground of empirical matter); whereas noumena do not contain any such matter (A357). The first is a mere general concept without any content, whereas the second is a concept which includes particular characteristics through which transcendental freedom becomes conceivable. The first embodies merely the thought of something outside the conditions of sensibility; the second is often asserted to be outside space and time, yes, outside nature.

It can, in fact, be shown that the transcendental object cannot be the same as noumena. The transcendental object is the ground of those appearances which "appear" in the normal progress of experience, i.e. in accordance with empirical laws (A495/B523). This is why Kant includes even the "real things of past time" in the transcendental object – they belong to possible perceptions as part of a regressive series ("under the guidance of history or in the footsteps of cause and effect")

(A495/B523). *The transcendental object therefore grounds those appearances which stand under the analogies (causality)*; which we *think* as belonging to nature and the mechanistic laws which govern nature. Although we do not actively restrict the transcendental object to be the ground of the objects of nature (then it would be a positive conception), it is nevertheless true that the transcendental object is the ground of those objects that belong within the concept of nature.

Noumena, on the other hand, belong to the realm outside nature where the rules ascribed to nature (mechanism) do not apply. As such, they are governed by another law, namely the law of spontaneity (transcendental freedom). In this *essential aspect noumena (and therefore noumena as such) can never be given in sensibility – only the effects thereof which appear can be so given*. They stand forever apart from sensibility (objects have to be objects of nature to be given *as such* in sensibility): this means that noumena belongs to a supersensible realm beyond nature. There is therefore a gap between noumena (outside nature) and appearances (even though noumena can be the effective cause behind certain appearances).

We can put it differently: it is not merely that noumena are governed by a different law (spontaneity); noumena can also never be part of the community of objects in accordance with the third analogy. Objects have to be in causal relation with each other to be part of the community of objects which at any time coexist. As Kant says: "[T]he light, which plays between our eye and the celestial bodies, produces a... community between us and them and thereby shows us that they coexist" (A213/B260). We cannot even become aware of the coexistence of noumena because their mode of existence does not stand in a community with our mode of existence. As such noumena are supersensible and forever outside the possible reach of our type of sensibility. Whereas we are directly aware that appearances of the objects of the senses are real and as such are grounded by the transcendental object (although we cannot know anything thereof; see section 2.2.2.1.), we cannot even become aware of noumena at all.

From this it follows that noumena are not the "ground" of appearances in the same sense as is the transcendental object; although they "would have to be thought in conformity with the empirical character, *just as* in general we must ground appearances in thought through a transcendental object" (A540/B568; my accentuation). Instead noumena are the conceivable spontaneous cause of certain appearances as Kant says: "Of it [a noumenon] one could say quite correctly that it begins its effects in the sensible world **from itself**, without its action beginning **in it** itself [i.e. the effect does not originate within the framework of the world of sense as a new beginning in time]" (A541/B569; Kant's accentuation). Since noumena cannot be the direct ground of appearances they cannot be the transcendental object. When Kant generalizes the transcendental object to include noumena (A539/B567), this is clearly a different concept which refers merely to "anything" that in any sense stands behind appearances. But even in this case, the concepts are clearly not the same.

At this point in the discussion it becomes clear why my interpretation of noumena as real objects (problematically assumed) is consistent with a two-aspect view. As mentioned in my discussion of Kant's second move, the concept of the transcendental object arises in the framework of his empirical realism when we view the objects of the senses from two viewpoints, namely within and outside epistemic conditions (Allison 2004:12). In accepting this I agree with the two-aspect view. When I, however, differentiates between the transcendental object and noumena, ascribing *the transcendental object to nature and noumena to the realm outside nature*, I depart from that view. In my view it is exactly this difference that allows the necessary space to accommodate transcendental freedom as the principle governing that realm. The problem with the two-aspect view is that the transcendental object and noumena are collapsed into one conception (as is also done in the two-object view), in which case it is difficult to see how freedom can be saved (see below).

2.4.3. Epistemic intelligibilia

We have now seen that the concept of noumena belongs to the space between noumena in the positive sense (too strong a concept) and the transcendental object (too weak a concept). We can, however, delineate the conception of noumena even more precisely by considering things as they are in themselves in more detail. Although things in themselves are forever outside *the possibility* of experience, this can be taken in various possible senses, for example, as discussed above, as the transcendental ground of ordinary objects in their existence outside the conditions of experience (i.e. the transcendental object). This is, however, not what Kant means by noumena.

Things in themselves can also be outside the possibility of experience in two other senses as determined by the third antinomy: in their constitution as belonging to the totality of causal relations in nature (mechanism) and as being outside nature in the realm of freedom (A533/B561). As mentioned before (section 2.4.1), Kant extends the transcendental and empirical use of reason in the thesis and anti-thesis positions of the third antinomy to the intelligible and sensible worlds, where the last is taken as "nature". As such the unconditioned can be ascribed either to nature or the realm of freedom, but always outside the possibility of our cognition of it, not even in the progress of experience (A483/B512, A493/B521).

In the anti-thesis position the unconditioned incorporates the absolute totality of all causal interactions in nature (mechanism), *which we think to be real*, but which can also never be brought as such into experience (i.e. as an infinite magnitude of causal relations; only finite magnitudes can be given in our cognition; B383). This absolute totality of causal relations is only accessible to a God's eye view. Although Kant never develops the idea of the unconditioned in the framework of nature any further in the first *Critique*, it is in my opinion possible that he may have included this within the framework of the "something actual" in things in themselves (i.e. that we can think that such an absolute totality of causal relations really exists) which he mentioned in the preface to the second edition (Bxx). As such he says that the unconditioned can be present in things in themselves: "the *unconditioned* must not be present in things insofar as we are acquainted with them (insofar as they are given to us), but rather in things insofar as we are not acquainted with them, as things in themselves" (Bxxi; my accentuation). *The unconditioned is present in things as they are in themselves*, outside our cognition of them.

The relations of ordinary objects of experience, insofar as they are given as appearances in sensibility, adheres to the principle of causality, but insofar as they (as objects of our thoughts) belong to nature, they are governed by the general mechanical laws of nature. As such, the relations of appearances *are thought to be* part of the unconditioned totality of causal relations (mechanism) in the framework of nature which includes an aspect which stands forever outside sensible conditions, i.e. which belongs to things as they are in themselves. In this case we form a positive conception of something real in the framework of things in themselves which goes beyond the empty concept of the transcendental object, which also has reference to objects of the senses in their existence outside our sensibility in nature.

These unknowable aspects in things in themselves stand *within the framework of the concept of nature* (I am only considering the anti-thesis position). As such it *does not involve another mode of existence than that governed by mechanism.* This means that it involves no more than an epistemic aspect of things in themselves (an ontologically different aspect would require a different mode of existence). The interesting thing about such aspects of things is that, since they cannot appear in sensibility, they can also not be presented in space and time which are the conditions of sensibility

(being outside space and time is often taken to imply an ontological difference, but this is not the case with the Kantian conception).

Although these unknowable aspects remind of Kant's conception of noumena as being outside space and time, Kant never relates this to noumena. The reason is simple: For Kant the anti-thesis position (in which this possibility appears) involves one mode of existence (the concept of nature) whereas the thesis-position allows for another mode of existence (i.e. noumena) outside nature. Although Kant merely mentions this unknowable aspect of things in themselves (i.e. the unconditioned therein) in the first *Critique* (as discussed above), it nonetheless forms part of his philosophy. We can therefore include such genuinely unknowable aspects in a positive conception of the objects of nature outside our perception of them. I call such a conception of objects in themselves *epistemic intelligibilia*. Although Allais (2004) also thinks that Kant allows for something genuinely unknown in the framework of the causal structure of nature (and shows how we can sensibly conceive that), she does not relate it to the unconditioned in Kant's philosophy and also does not present it as a clearly delineated formal aspect within the framework of the concept of things in themselves (see below).

This is, however, not what Kant means by noumena in his discussion of the third antinomy. Working from the thesis-position, Kant assigns noumena to a transcendent intelligible world *outside nature* which in the mathematical antinomies were left empty (a mere void outside the world-whole). *Noumena are placed outside nature and as such they do not fall under the conditions that regulate phenomena, namely space and time, as well as the laws of nature in accordance with mechanism*. The reason why noumena and the noumenal world are outside space and time is that they belong to *a totally different mode of existence* outside nature. As such, a different ontology belongs to that world. Only when noumena are conceptualized in these terms would transcendental freedom become realistically conceivable and can we think that totally different laws govern the noumenal world, namely that of freedom. This is why Kant can distinguish the two worlds as that of nature and freedom (A541/B569 etc.).

Even if it were possible, for argument's sake, that the whole of nature "be revealed to us", and that we would therefore somehow gain knowledge of epistemic intelligibilia, for which a faculty of cognition different "in degree" from ours would be needed, i.e. to cognize the infinite totality of causal relations in nature (the unconditioned), it would still not be possible to know anything about the realm outside nature, for which a faculty different "in intuition *and kind*" would be needed. In his discussion of these things, Kant writes: "[F]or they [who think we can know the inner in things] would have us to be able to cognize things, thus intuit them, even without senses, consequently they would have it that we have a faculty of cognition *entirely distinct from the human not merely in degree but even in intuition and kind*... Observation and analysis of the appearances penetrate into what is inner in nature, and one cannot know how far this will go in time [in the progress of experience]. Those transcendental questions, however, *that go beyond nature*, we will never be able to answer, even if all of nature is revealed to us..." (A279/B334; my accentuation).

2.4.4. The two-fold nature of things in themselves

I have now distinguished between three concepts within the broader concept of things as they are considered in themselves, namely the transcendental object, epistemic intelligibilia and noumena. Since *epistemic intelligibilia* is merely a positive conception of the transcendental ground of objects which are thought to belong to nature, it collapses into the transcendental object when the concept is taken as empty since that concept also concerns the objects of nature (but only without any positive content) *This means that things in themselves have a two-fold structure consisting of epistemic*

*intelligibilia and noumena as positive conceptions which belong to the realm of nature and the realm of freedom respectively.* Both epistemic intelligibilia and noumena can conceivably include genuinely unknowable aspects of objects, outside time and space. Epistemic intelligibilia (and the transcendental object) would belong to an intelligible realm (a mere intelligible realm in the case of the transcendental object) which has only epistemological significance. Noumena, on the other hand, which belong to a noumenal realm, *also have ontological significance*.

Since Kant never develops the concept of epistemic intelligibilia as such in the first *Critique*, we can simplify matters by collapsing it into the transcendental object. The two-fold structure of things in themselves would then include the transcendental object and noumena. This two-fold structure is observable, for example, when Kant says that the "intelligible character [i.e. noumenon] could of course, never be known immediately... but it would have to be thought in conformity with the empirical character, *just as* in general we must ground appearances in thought through a transcendental object" (A540/B568; my accentuation). This two-fold structure goes far beyond Kant's *concept* of things in themselves; it permeates Kant's philosophy and captures the exposition of his epistemology in the Transcendental Analytic as well as his metaphysics (especially regarding the conceivability of freedom) in the Transcendental Dialectic. Although Kant often refers to things in themselves within the context of any one of these aspects, his general position includes both.

Although the concept of things in themselves *in a general sense*, therefore, refers to things outside the conditions of sensibility, *in a more specific sense it involves a two-fold structure* as the ground of appearances, namely the mere transcendental ground (the transcendental object) of ordinary objects, as well as the noumenal ground, which includes objects of the understanding existing outside nature that can serve as the spontaneous cause of appearances (both of these can in fact be included in general in the wider concept of a "transcendental ground", A539/B567).

This two-fold structure in the concept of things in themselves which characterizes my interpretation can be further illuminated through Kant's conception of the object. The Kantian conception of the object involves the unity of the synthesis of all appearances in accordance with the concept of an object in which they are necessarily connected (see section 2.2.2.2; A108). Although Kant sometimes uses the concept of an appearance to refer to an object as given in intuition (A109), he also uses this concept to refer to the various representations of such an object which are synthesized together under the concept of an object (A108). In the second sense, appearances can have two origins: they can be the mere appearances of the everyday objects of cognition or they can be appearances *caused* by noumena.

In the first case they are "representations, which in turn have their object, which therefore cannot be further intuited by us, and that may therefore be called the non-empirical, i.e. transcendental object = X" (A109). In the second case they are the effects originating with the intelligible character (noumenal ground) of an object of sense, i.e. of a noumenon, which "begins its effects in the sensible world [as appearances] from itself, without its action beginning in itself [i.e. outside nature and therefore space/time]" (A538/B566 – A541/B569).

Such appearances (i.e. according to the second case), which would be part of the empirical character of an object (i.e. taken together with other appearances as belonging to the same empirical object), would be caused by noumena situated outside nature and therefore outside space and time. We therefore find that *two kinds of appearances can be ascribed to objects*, namely those which are directly perceived appearances of the everyday objects of the senses, and those which are caused by noumena, which *are not objects that appear but merely objects of the understanding, of which only the effects (of this spontaneous causality) appear.*

In this interpretation I accept that objects have various layers of appearance that are discovered in the progress of science which could include appearances of both kinds. As such it is possible that their different origin would be reflected in their properties, which would presumably in some manner be distinguishable from each other. All properties of objects are predicates, that is, conceptualized appearances, of objects (B149, A250; Guyer 1987:125, 163). The properties would therefore merely reflect the kinds of appearances. As such the properties associated with those appearances that are the effects of noumena which exist outside nature (space/time) would reflect this ontologically distinct noumenal ground. Since their objects (behind the appearances) are very different from the normal objects of the senses, this difference would be reflected in these properties (Kant never mentions this but it follows from my analysis). If this is so, this difference can be discovered in the progress of experiment which would present at least indirect evidence for the existence of the noumenal realm. Since this discussion took us beyond Kant's own conceptualization, I will not pursue it further here.

2.4.5. The noumenal realm as substratum of nature

The conception of the noumenal realm which I presented above can be taken to be the substratum of nature as Kant says: "I distinguish the substratum (the thing itself) from that which merely depends on it" (A400). Although Kant does not develop this idea any further in the first *Critique*, he does so in the second *Critique* and, especially, in the third *Critique*. Since Kant views the noumenal realm already in the first *Critique* as having a possible existence outside nature, but at the same time as having effects within the sphere of nature, it seems quite possible that he viewed that realm already in the first *Critique* as the substratum of nature.

As I discussed above (section 2.4.2.), Kant's conception of noumena involves that we allow for the existence of two ontologically different types of objects, namely those of the senses and those that we can merely think to exist (noumena; A250; A253). As belonging to the noumenal realm, noumena are not merely ordinary things considered as they are in themselves outside the conditions of sensibility; they can also involve another mode of existence which includes an ontologically different type of entities which can never become objects of the senses; they would be objects for another form of intuition than our own. Although we cannot confirm (know) that such entities exist, we can problematically allow for their existence since there is nothing contradictory in thinking them.

At this point it is important to remember that Kant's conception of noumena is modeled on Leibniz's monads, the fundamental building blocks of the world – going beyond the physical monads or elementary parts of matter of Kant's earlier days, to conceptualize noumena as non-material entities (Cicovacki 2010:85; Friedman 2010:243). In a very enlightening passage in the *Metaphysical Foundations of Natural Science*, written during the height of Kant's critical period (1786), Kant gives a charitable interpretation of Leibniz which is in agreement with his own view (he repeats this interpretation in *On a Discovery* (1790) where he identifies Leibniz's monads with his noumena; this differs from his interpretation of Leibniz in the Amphiboly in the first *Critique*; Langton 1998:198):

"[Monadology] is rather an intrinsically correct *Platonic* concept of the world devised by Leibniz, insofar as it is considered, not at all as the object of the senses, but as a thing in itself, and is merely an object of the understanding, which, however, does indeed underlie the appearance of the senses. Now the composite of things in themselves must certainly consist of the simple, for the parts must here be given prior to all composition. But the composite in the appearance does not consist of the

simple, because in the appearance, which can never be given otherwise than as composed (extended), the parts can only be given through division, and thus not prior to the composite, but only in it.

Therefore, Leibniz's idea, so far as I comprehend it, was not to explicate space through the order of simple beings next to one another, but was rather to set this order alongside space as corresponding to it, but as belonging to a mere intelligible world (unknown to us). Thus he asserts nothing but what has been shown elsewhere [i.e. in Kant's own writings]: namely, that space, together with the matter of which it is the form, does not contain the world of things in themselves, but only their appearance, and is itself only the form of our outer sensible intuition" (4:507-8).

From this quotation it is clear that Kant, during his critical period, regarded the noumenal realm as an ontologically distinct mode of existence, which forms the substratum of nature as a whole. As such, this substratum is viewed in a certain sense as the fundamental level of existence. Its basic (albeit non-extensive) building blocks, namely non-material simples, can on their turn belong to composites in the noumenal realm itself. Although this view about the noumenal realm is never explicitly spelled out in any detail in the first *Critique*, everything that Kant says in that *Critique* is in accordance with such a view.

It is possible that Kant had these "simple beings" in mind when he wrote the following (see section 2.4.2.): "[T]here may even be beings of understanding to which our sensible faculty of intuition has no relation at all" (B309; also B306). In his own copy of the first edition of the first *Critique* he actually made a note at the beginning of the chapter on phenomena and noumena in general, where he wrote: "Noumena: beings that themselves have understanding" (Kant 1998:339), which was part of the general concept of Leibniz's monads. This does not mean that this was Kant's own view (or considered opinion) regarding noumena (although Kant does in fact think that the soul, or thinking I, is intrinsically similar to noumena; A360), but confirms that his idea of noumena was derived from monads and that Kant's "beings of the understanding" (B306/B309) have a distant relation to monads *as existing outside space/time*.

According to the quotation from the *Metaphysical Foundations* given above, Kant believed that Leibniz was right to not ascribe space to the realm of simple beings, but "rather to set this order alongside space as corresponding to it". This implies that, although that realm is not in space, it would have some structure "corresponding" to space. Kant seems to have the same idea in the first *Critique* when he allows that we ascribe "ideal space" to things in themselves *through reason*: "Our expositions accordingly teach the reality (i.e. objective validity) of space... but at the same time the ideality of space in regard to things when they are considered in themselves *through reason*" (A28/B44; my accentuation). Thereafter Kant also mentions the "transcendental ideality" of space which refers to the mind-dependency of space as condition for the possibility of all experience.

This passage shows that Kant allows us to ascribe some ideal space-structure which we can construct through reason to "things in themselves". The difference between space and ideal space would be that the first is an ability for and condition of experience whereas the second is merely some conceptual space (or: space-time or space/time) structure or manifold which we can think through reason. We can *think* of ideal space as the space-structure/manifold which reflects the form of objects/entities as they are in themselves (even without trying to construct ideal space in practice) in the same way that empirical space reflects the real form of appearances (A431/B459; see note 1) to which Kant also refers in the above quotation: "space, together with the matter of which it is the form".

Ideal space can obviously refer to any spatial concept that we can construct through reason. In accordance with the two-fold structure of things in themselves, we can apply such mathematical (geometrical) structures both to the everyday objects (as they "really" are) outside our cognition of them as well as to the noumenal world outside nature and outside space/time (Kant, however, never makes this explicit). Ideal space can refer to some geometrical form (i.e. conception) that is applied to ordinary space (B147; see also A29, A57/B81; see note 1) or some abstract mathematical form that has reference to our conception of noumena. Since noumena cannot be presented in space/time, we would not be able to imagine (visualize) such mathematical space/time (or: space-time) forms (this takes us beyond the mathematics of Kant's time but is consistent with his position). (I have not included Kant's ideas about ideal space in the *Opus postumum* because that falls outside his critical period).

At this point I am in a position to make a proposal as to the origin of Kant's two-fold structure of the concept of things in themselves, which includes both the transcendental object and noumena. The concept of the transcendental object is a direct result of Kant's Copernican turn. When we view objects from two perspectives, as they are given in appearances and as they are outside that, the concept of things as they are in themselves as the transcendental object is necessarily introduced. But this concept only applies to everyday objects of the senses. The concept of noumena, on the other hand, is introduced into the concept of things in themselves along a different track: to allow for the conceivability of freedom. Here Kant uses the age-old distinction between phenomena and intelligibilia (or phenomenal and intelligible realms) going back to Plato, but reworked by Leibniz into the appearances of the senses and monads. Since the phenomenal and intelligible realms stand apart from each other, the last is a suitable candidate for Kant's realm of freedom. As is the case with the transcendental object, this conception of noumena as belonging to a realm of freedom, is original to Kant's philosophy.

Although Kant focuses on the limits of cognition in the first *Critique* and makes the important point that we can never gain access to the noumenal realm because of the restrictions to our kind of sensibility, I have argued (I hope convincingly) that he allows us to think its existence, *as well as the existence of entities particular to it, although only problematically*. Kant's arguments regarding the conceivability of freedom lead to this conceptualization of the noumenal realm.

### 2.5. The third alternative in the interpretation of Kant's philosophy

With this background in mind, we can now reconsider the well-known views regarding the interpretation of Kant's philosophy. I am not going to discuss them in detail; I am merely going to focus on the fundamental assumptions underlying these views. In my opinion the main problem in Kantian interpretation is his broad conception of things in themselves, which can refer to or include the transcendental object, epistemic intelligibilia as well as noumena (see section 2.4.3. above). The different views take different conceptions of things in themselves as point of departure. When these conceptions are considered in the light of my discussion above, the correctness or not of these views becomes obvious.

1. The two-object (two-world) view accepts that things in themselves refer to ordinary objects as they "really" exist outside our sensible (mental) reach. As such these are taken as the transcendental ground of appearances (i.e. transcendental object). When things in themselves are then taken as noumena (according to Kant's statement that noumena are things in themselves; B310), the transcendental object is effectively equated with the concept of noumena.

In this view Kant's statements that noumena are outside space and time are taken seriously (Guyer

1987:333), which is taken to mean that noumena are ontologically distinct from appearances. From this it follows that the transcendental object (equated with noumena) gains an ontological status. The result is that Kant is taken to say that the everyday objects of cognition, viewed outside the confines of the mind, are in fact ontologically distinct objects (outside space and time) from the appearances of objects in the mind which are presented within the sensible forms of space and time (Guyer 1987:335). In this way two types of objects are ascribed to two different worlds, namely that of our mind and that outside our mind in the "real" world (This can be done in a variety of ways, but I will not discuss it further since it has no bearing on my main argument; for a discussion, see Allais 2004:657).

The most important error underlying this view is that the transcendental object is effectively equated with noumena. Kant *explicitly* says that this is not how he understands these concepts (see section 2.4.2.). Furthermore, an ontological value is ascribed to the transcendental object, which in fact has no value at all (it is merely an empty concept). The result is the very unintuitive claim that the everyday objects and events of our senses, considered outside our mind, are really outside space and time. Although such objects exist independently of our space/time intuitions of them, the real magnitudes and relations between those objects (i.e. the real order in the world) are in fact reflected in empirical space (see note 1; A431/B459). It is therefore not sensible to say that ordinary objects are outside space/time and to ascribe freedom to them.

The most problematic aspect of this view is that our cognition of the world is considered *only in mind-dependent (idealist) terms*, leaving the "real" world outside our senses uncognizable (Strawson 1966:16; Ward 2006:16). The "real" world, which is considered mind-independent and outside our consciousness, is said to affect us through the "raw data of sensibility". This form of idealism, which comes down to "the mind making nature", or that "the mind actually imposes its rules on an otherwise formless reality" (Guyer 1987:61), does not take Kant's second move (his empirical realism) sufficiently into account. Although it is a well-established reading of Kant, it is nonetheless distinctly unKantian (Bird 2010a:6).

I have shown that Kant's second move takes as point of departure the fact that in perception we become aware that the world has its own order over and above the manner in which the mind orders the world; the second move is exactly to establish the *objective reality* of the spatio-temporal world of empirical cognition. The two-object view effectively misses this paradigmatic Kantian move in his philosophy and collapses Kant's empirical world of apprehension into a world-in-itself (noumenal world) outside our senses. The manner in which the two-object view has neglected or misunderstood this important Kantian move has been discussed in detail elsewhere (Allais 2004).

2. The epistemic two-aspect (one-world) view also takes things in themselves as the transcendental ground of appearances, now considered as outside the conditions of sensibility. When things in themselves are then taken as noumena, the concept of the transcendental object is again equated with the concept of noumena (see for example, Allison 2004:59). This view considers noumena to be merely outside the conditions of space and time. As such this view reduces the difference between ordinary objects considered as appearances and as things in themselves, to a mere epistemic difference ("two ways of considering things"; Allison 2004:16). In this manner all "metaphysical claims" are removed and a mere methodological approach is followed.

The most important error underlying this view is again that the transcendental object is equated with noumena. Now a mere epistemic value is ascribed to the transcendental object, which as mentioned before, should have no value at all (it is merely an empty concept), and with it, to the concept of noumena which is now also considered as a mere empty concept. This ascription of value is

grounded on the false assumption that a positive conception of noumena is also a conception of noumena in the positive sense (see section 2.4.1; Allison 2004:63). In doing so, Kant's elaborate positive conception of noumena which serves an important goal, namely to make the conception of transcendental freedom conceivable, is undone.

Although this view appreciates the importance of Kant's first two moves, it effectively misses the essence of his third move which is to establish the conceivability of freedom. When Kant's noumenal world is collapsed into the mere transcendental ground of phenomena, it becomes difficult to see how freedom can "be saved" as something that can conceivably be assumed. Without noumena, conceptualized as situated outside nature and therefore outside space/time (not merely the conditions of space and time) and the mechanical laws of nature, Kant's conception of transcendental freedom loses its conceivability. The result is that Kant's concept of freedom is reduced to a mere vague possibility (which is then considered to be the only viable alternative to the unacceptable assertion of the reality of freedom; Allison 2012:112).

3. The last view that I consider is the noumenal properties two-aspect (one world) view which appreciates the fact that things in themselves have a broad meaning which could include both epistemic and ontological aspects (where ontological is taken to mean not only outside the conditions of sensibility, but really "outside space/time"). This view takes things in themselves as including something more than the mere transcendental ground of appearances; it can also include distinct noumenal "properties". In this regard Ameriks (1992:334) writes that Kant held that "there are objects which in themselves have genuine ultimate properties that do not conform to those [sensible] conditions". In doing so, this view takes the best from the epistemic two-aspect view and adds what they take as an ontological aspect to it.

Kant is, however, making a stronger claim than merely that some intrinsic properties of objects can be beyond sensible reach (i.e. that the labels "phenomena" and" noumena" refer merely to different classes of properties; Langton 1998:13). Although the idea of complementing the phenomenal properties of things with distinct "intrinsic" properties (or: complementing relational properties with intrinsic properties; Langton 1998) captures something of Kant's ontological thrust, it does not serve the purpose that Kant has in mind with his conception of noumena, namely to make freedom conceivable. Although we can complement phenomenal properties, which are conceptualized appearances of objects, with *unknowable properties which would be mere intelligible representations, as long as such representations are ascribed to the objects of nature, freedom cannot be saved and this view would not capture Kant's reason for introducing noumena in the first Critique.*

All sensible or intelligible properties must obviously be ascribed to some object, which can either be an object for the senses, i.e. belong to the mode of existence that we associate with nature or noumena, which belong to another mode of existence that we associate with the realm of freedom (these are mutually exclusive for Kant). Since this view only recognizes noumenal properties, but not noumena as entities of a different kind, the "intrinsic" properties can only be that of the objects of the senses. One can understand this to mean that such properties belong within the framework of an object's causal powers, although as "something genuinely unknown" (Allais 2004:678). As such they would belong to things considered as they are in themselves as epistemic intelligibilia.

Although such intrinsic properties can in some sense be outside space and time, they nonetheless belong to nature. The mode of existence to which the objects of nature belong, however, does not allow for the conceivability or *even the possibility of freedom* (the solution to the third antinomy requires that such existence must be outside nature and its laws of mechanism; see section 2.4.1.).

*As long as we stay with the transcendental object or epistemic intelligibilia we cannot accommodate the Kantian conception of freedom*.

But is it not possible to think that objects of the senses could in themselves have "intrinsic properties" which stand outside the causal structure of nature? This is what Langton (1998) proposes. She relates these properties to monads in accordance with Kant's charitable interpretation of Leibniz and says they "cannot be given, as they are in themselves, to creatures whose sensibility is passive" (Langton 1998:202; see section 2.4.5.). Although we can certainly view such properties as "intrinsic" properties of objects of the senses in the sense that they belong to the substratum of such objects, *they can only be real if they at the same time belong to something which exists in that substratum (see above: they must belong to some object or entity)*. How can we have "intrinsic" properties if nothing exists in that realm outside nature and how can something exist if it would not be some type of entity like monads or noumena? And when we allow for such entities we have a two-object view.

4. My view is a coherent interpretation of Kant's philosophy which does away with all the major inconsistencies ascribed to him. Although my own view can be regarded as considering things from a two-fold standpoint (as Kant says, Bxix note), namely as things given as appearances in experience and as things in themselves of which we can only have ideas of pure reason, it is also a two-world (two-object) view (as Kant also accentuates) in that noumena, properly understood, can involve ontologically distinct entities in such a realm. I show that there is no conflict between these two perspectives. The two-aspect and two-object perspectives are reconciled in one view when the broad conceptualization of things in themselves, as including the transcendental object, epistemic intelligibilia as well as noumena (properly conceptualized), is taken into account. This obviously does not include any discussion of the practical standpoint, which Kant develops to some extent in the first *Critique* as well as the second *Critique*.

My view allows for both the conception of an epistemic intelligible realm as well as an ontologically distinct noumenal realm (properly speaking). As such my view captures the complexity of Kantian philosophy without the reductive moves which characterize the other views. All the other views, in some way or another, neglect some aspect of Kant's three paradigmatic moves. It is only when we understand all three moves in sufficient detail and see how the two lines of Kant's thought, namely the transcendental and empirical, within both the framework of our discursive understanding as well as reason, are interwoven to form a sophisticated whole, that we are in a position to correctly interpret him. Only then can the conceivability of freedom be sufficiently established.

Freedom is only conceivable when we do not merely allow that objects can have properties outside space and time. For Kant being outside space means that we cannot visualize such appearances in any space-form. Being outside time can be taken as "timeless", meaning that they do not change with time (adhering to our conception of time), or as a-temporal, meaning that they are not in our time. A mere negative statement about objects or properties (i.e. that they are outside space/time) does not say how freedom would be conceivable. For that we need some positive statement (as Kant does), namely that freedom is conceivable if something, i.e. *noumena, exists outside nature* (i.e. outside mechanism, which belongs to the concept of nature) and *therefore* also outside space and time. A distinct noumenal ontology would necessarily be accompanied by a corresponding (ideal) space/time conception which can be thought through reason (A28/B44; see section 2.4.5.).

Although Kant never discusses ideal space in any detail in the first *Critique*, a possible answer as to how we should conceive of it suggests itself in the framework of his critical philosophy, namely that

ideal space should be regarded in exactly the same manner as empirical space, i.e. as the structural form of objects or entities (see note 1). As such we do not need any particular conception of ideal space; we can merely say that ideal space would reflect the form of the entities belonging to the noumenal realm. One can then say that *that realm is outside space/time because the structure of its entities is such that it cannot be brought into space/time (only its effects can); it adheres to another space-time form which is inaccessible to our sensibility. Although we cannot say that freedom rather than causality would necessarily belong to such a realm (we cannot prove even the possibility of transcendental freedom* – A558/B586) *it is surely conceivable that different rules would apply in such a realm.* An important outcome of this interpretation is that the traditional problem of the "timeless self" is resolved, i.e. the self is not merely outside space/time, it belongs to a different space-time manifold (as such we can easily conceptualize it).

Regarding Kant's noumenal realm, I can summarize Kant's idea thereof as follows. Kant conceptualizes that realm in a positive sense as filling the void outside nature in such a manner that it underlies (or grounds) nature. He thinks that the freedom that we ascribe to ourselves as rational and moral agents can only realistically be assumed to be actual (even if we cannot prove it) if there is a supersensible realm in which transcendental freedom, which underlies practical freedom and makes it possible, has its ground. The reason for assuming such a realm, outside space and time, is that freedom cannot be ascribed to the world of objects in space and time, where causality rules according to the second analogy (or by extension to nature, where mechanism rules). At the same time such spontaneous causality must have effects in the phenomenal world, when actions are taken in this world. Regarding the interaction between these realms of nature and freedom, Kant returns to that in the third *Critique*.

The Kantian view involves a positive metaphysics of the noumenal realm which is ultimately based on (and argued from) human freedom of choice. Although it shows that transcendental freedom, which for Kant underlies practical freedom, is conceivable, it does not prove even the possibility of such freedom. To show this, some type of empirical proof would be needed, at least of the existence of the noumenal realm. Kant, however, excluded that possibility for the simple reason that noumena are only accessible to an intuition other than our own.

### 2.6. Conclusion

In the reconsideration of Kant's noumenal realm, I have taken the path that has until now been implicitly or explicitly rejected in all interpretations, namely that we can understand Kant's noumenal realm, as presented in the *Critique of Pure Reason,* as an ontologically distinct realm, different from nature. It is not only in Kant's moral philosophy or his theory of taste or teleology that the noumenal realm is taken as the substratum of nature; it is also the best way to understand the first *Critique*. As such, this constitutes a third alternative in interpreting Kant. This is an alternative in which both Kant's views, namely that his philosophy allows us to take two viewpoints on things, but also considering them in the context of two worlds (and therefore as "two objects"), are reconciled. I believe that the view presented above, does justice to Kant's philosophy and is closer to his own position than any of the other views.

I structure Kant's program in the first *Critique* into three moves. When we fail to understand the full implications of any of these moves, we end up with inconsistencies in our interpretation of Kant's philosophy. The first two moves show how *a priori* synthetic judgments of objects are possible and save objective principles in mathematics and the natural sciences. The third move shows how freedom is conceivable and saves morality. The importance of the third move, however, goes beyond morality. Kant uses the outcome of this move in the *Critique of the Power of Judgment* as

part of his philosophy of science. In all of this Kant's conception of the noumenal realm as a substratum of nature plays a central part.

Kant rejects any possibility of knowledge regarding the noumenal realm, and with it all efforts to establish a "proud ontology", but at the same time he has a positive inclination towards metaphysics as long as it is used in a legitimate manner. One can even say that his positive conception of the noumenal realm constitutes exactly such a critical metaphysics. Kant cannot see any problem in establishing such a metaphysics on reasonable grounds, as long as it is problematically assumed.

Although the conceptual structures which are developed in the sciences can serve as regulative ideas guiding research in the progress of experience (and experiment), the noumenal realm as such cannot in Kant's view ever be empirically tested accordingly. Only practical reason can provide the grounds for the metaphysics of the noumenal realm. In the third *Critique*, however, Kant introduces new tools through which new avenues are opened. The question is: How much further can that bring us? This is the topic of the next chapter.

**Note 1: Kantian space**

As is the case with other aspects of Kant's epistemology, space can be determined both *a priori* and *a posteriori*. When space is determined *a priori*, some geometrical form (i.e. conception) is constructed in space: "Through determination of the former [i.e. sensible intuition] we can acquire *a priori* cognitions of objects (in mathematics [i.e. geometry]), but only as far as their form is concerned, as appearances; whether or not there can be things that must be intuited in this form is still left unsettled" (B147; see also A29, A57/B81; here "appearances" refer to imagined geometrical objects in inner sense). When space is determined *a posteriori*, objects determine the form of empirical space: "if it [i.e. space] is restricted solely to objects of the senses, then it is called empirical" (A57/B81; see also A377).

Since space (as an ability and sensible condition for experience) is "nothing other than *merely the form of all appearances* of outer sense" (A27/B43, my accentuation), empirical space is just the *particular form* which is exhibited in the extensive magnitudes and relations between the various parts of objects given in any particular appearance. In this case Kant says that space is "*the form of appearances themselves*... Thus *things, as appearances, do determine space*, i.e. among all its possible predicates (magnitude and relation) they make it the case that this or that one belongs to reality" (A431/B459, my accentuation). Clearly Kant differentiates between space as the "mere form of appearances" and (empirical) space as the "form of appearances themselves", which is *a posteriori* determined by objects: "things, as appearances, do determine space". Real objects determine the real form of empirical space.

When some empirical space form is brought under a (geometrical) concept of space, the objective validity of space can be established: "Our expositions accordingly teach the reality (i.e. objective validity) of space in regard to everything that can come before us externally as an object... We therefore assert the empirical reality of space (with respect to all possible outer experience), though to be sure at the same time its transcendental ideality, i.e. that it is nothing as soon as we leave out the condition of the possibility of experience" (A28/B44). Such concepts of space can include *a priori* synthetic geometric determinations of space (B41, A57/B81, A165/B206) which are applied (in judgment) to the empirical form of space given through objects (see the mathematical principles).

**Note 2: Another kind of intuition?**

When we want to inquire about the possibility of another kind of intuition, we should probably focus on inner experience. Kant distinguishes (at least) two kinds of inner experience, namely a very basic kind where I have the mere awareness of my own existence (in apperception; even before being aware of my identity as the same self) and another kind where I am conscious of my own representations (as well as the representation of myself; B159) in inner sense, which is "a sensory consciousness of the contents of thought" (Allison 2004:277). The first kind merely involves an indeterminate (non-conceptualized) sensible intuition in time (B423, note); the second kind involves sensible intuitions both in time and space in the sense that the imagination is involved in ordering representations in inner sense at least conceptually in a line (continuous in time; B156, B292).

Insofar as the first kind of experience is concerned, Kant says that a mere indeterminate intuition in time is necessary to provide the material for thinking, for the act "I think" to take place. The "I exist" is contained within this "I think" (B423, note). The problem, however, is that time does not have its own manifold (B154-156; B197). So, how is the matter for this intuition provided if it cannot be presented in some manifold? We can say that the inner self as noumenon produces effects in sensible intuition even when the space manifold is not involved. As such sensible intuitions are taken up in time even without any manifold involved (although it would be necessary for presentation in inner sense).

There is, however, another possibility. We can allow that time be combined with another manifold than space, say the manifold of ideal space associated with the inner self as noumenon. If we have such a noumenal awareness, we would be able to become aware of this noumenon when this manifold (given with its own kind of intuition) is combined with time. In this case we are noumenally aware of it in time. In this manner the gap between the noumenal and phenomenal realms is bridged by combining time not with objects in space, but with the entities that exist in the noumenal mode of existence which have their own ideal space-time manifold (A57/B81). This could provide the bare feeling of existence that Kant refers to in the *Prolegomena to any Future Metaphysics:* "the *feeling* of an existence without the slightest concept" (Proleg 334n). Although this short exposition does not prove the existence of such an intuition, it does show in what sense we can possibly conceived of it.

# 3. The noumenal realm in Kant's philosophy of science

## 3.1. Introduction

The noumenal realm plays an important role in Kant's philosophy. Kant introduces it as a central aspect of his critical philosophy in the *Critique of Pure Reason* (the first *Critique*; first edition 1781, second edition 1787) and makes extensive use of it in his moral philosophy in the *Critique of Practical Reason* (1788; the second *Critique*) and elsewhere. It also features prominently in his philosophy of science as presented in the *Critique of the Power of Judgment* (1790; the third *Critique*). This last aspect is not that well known, and due to the close association of the noumenal realm with Kant's moral philosophy, interpreters often tie it exclusively with that aspect of his philosophy. Scientifically minded contemporary interpreters who engage on a more substantial level with the third *Critique*, typically try to minimize the role of the noumenal realm in this regard (mostly due to those associations).

Kant's philosophy of science is for the most part appreciated for its important contribution in laying the philosophical foundations for Newtonian science. Kant's epistemology, as presented in the first *Critique,* explained how actual mathematical physics, and especially Newton's mathematical physics, is possible in the first place (Friedman 2001:10). He used the conceptual framework developed in the first *Critique* as basis for the formulation of his philosophy of science in the *Metaphysical Foundations of Natural Science* (1786). In more recent times modified versions of Kantian scientific epistemology have been developed in which his *a priori* constitutive principles have been reworked into dynamic and relativized principles consistent with contemporary scientific theory (Friedman 2001:31, 47; Bitbol 2007:240/1). It is generally accepted that the noumenal realm has no place in this part of Kant's philosophy of science.

This, however, is not the full extent of Kant's philosophy of science. In the third *Critique*, and more especially in the introductions (both the published and unpublished versions) as well as the second part called Critique of the Teleological Power of Judgment, Kant is concerned with more general questions in science (again building on the foundations laid in the first *Critique*, especially the Transcendental Dialectic). In this regard interpreters accentuate concept formulation and hypothesis development in empirical research (McLaughlin 1990:128) as well as the problem concerning underdetermination in scientific theories (Allison 2012:210; 5:180). The third *Critique* has also been understood as having special application to the life sciences (although Kant's main concern therein is with biology) – and that it holds out the possibility that both the physical and life sciences can be comprehended in a common meta-framework (Friedman 2001:126).

The third *Critique* is primarily concerned with purposiveness (teleology) in science. In this regard Kant is not arguing for the traditional teleologies (and thus for old Aristotelian science; Guyer 2010:433). He argues that, at a basic level, purposiveness has a necessary place in science. Scientists have no choice but to accept the general purposiveness of nature as a *heuristic* principle (5:411), namely that nature (and its products) is treated *as if* it is designed even though only mechanistic *explanations* would eventually be available (5:413). All general laws of nature, which purport to describe the whole of nature as an ordered system (in contrast to mere empirical laws which describe particular phenomena), are grounded in this principle of purposiveness. As such this principle guides science as a research programme.

One of the most important questions with which I am concerned in this chapter is: How does the noumenal realm fit into Kant's teleological approach? Scientifically inclined authors do not think it is important for Kant's main argument. They view the above-mentioned concept of purposiveness

(and the other related concepts) as the full extent of Kant's contribution in the third *Critique.* For them purposiveness is merely a scientific guideline which does not imply that any product of nature could in fact be produced in accordance with a teleological principle (see Butts 1990; Ginsborg 2010 etc.). Since the noumenal realm is not important to this aspect of Kant's theory, they can effectively discard it. Since they think that the noumenal realm is a remnant of outdated modes of thinking, they try to remove it from this part of Kant's philosophy of science (or at least minimize its role; O'Shea 2010:525; Butts 1990:13).

There is, however, another sensible way to interpret Kant's teleology that does not reject the supersensible realm out of hand. In this case the general transcendental principle of purposiveness is understood not merely as allowing for the conceptualization of nature as ordered; it also allows that two seemingly opposing principles, namely mechanism and teleology, could both be involved in producing the products of nature. In this case these principles are taken as deterministic and non-deterministic causes; in the framework of the antinomy introduced in this part of the third *Critique*, Kant shows that both can logically *be true* even though this can never be empirically confirmed. Allison (1012:205), who is known for his methodological approach which strips Kant's work of all metaphysics, accommodates both these principles as logical possibilities. As such the supersensible realm does not play a significant role in his analysis.

In my interpretation I take a stronger view. I argue that the Kantian concept of teleology takes the concept of freedom that Kant develops in the first *Critique* as basis. This does not merely involve Kant's concept of practical freedom which serves as *analogy* in his conceptualization of the teleological principle as a "final" causality – that is, that Kant views this kind of causality in analogy to human achievement of goals. In my view Kant's remarks concerning freedom in the third *Critique* should not be regarded exclusively in such practical terms as is often thought to be the case (McLaughlin 1990; Guyer 2010). I argue that Kant actually takes the transcendental idea of freedom, or absolute spontaneous causality, as point of departure in his conceptualization of final causes. The difference with the first *Critique* is that Kant now applies this concept to non-extended wholes and parts in their role in producing the products of nature. To my knowledge no other interpreter mentions this concept of freedom in the context of the third *Critique*, which is, in my opinion, important to Kant's overall argument concerning final causes.

I argue that Kant is not merely arguing for the logical possibility of final causes in opposition to mechanism; he is arguing that such causes can conceivably exist in the supersensible ground of nature. Kant thinks that the manner in which he conceptualizes final causality in the framework of his overall philosophy makes it conceivable that such a causality could in fact exist as an effective cause alongside mechanism in producing the products of nature. This is why the supersensible realm plays such a significant role in the scientific part of the third *Critique*: it is only outside nature that such a "spontaneity of a cause" (5:411) can be conceived of. Kant's concept of final causality and the supersensible realm goes hand in hand – the one makes the other into a real possibility as well as conceivable, i.e. in thinking about how the world really is.

The main thrust of Kant's philosophy of science in the third *Critique* is that both determinism and freedom (absolute spontaneity) are allowed a role in the production of the products of nature. Kant argues in this regard "for extending natural science in accordance with another principle, namely that of final causes, yet without harm to the mechanism of nature" (5:379). Kant effectively uses the concepts that he developed in the Dialectic part of the first *Critique* (in the discussions following the third antinomy) and apply it to the study of nature in the third *Critique*.

After a general introduction to the concepts that stand at the basis of Kant's philosophy of science in

the third *Critique*, I present the arguments for my own interpretation. I show how closely the third *Critique* aligns with the first one, but also the significant moves beyond that. If Kant is successful in his approach it may be possible to apply his concepts to that area of science where both determinism and non-determinism (spontaneity) has to be accounted for, namely quantum physics.

### 3.2. The purposiveness of nature as transcendental principle

As is the case in the other *Critiques*, Kant engages with a particular problem in the third *Critique*. Whereas the problem of the first *Critique* was: How is mathematical science (and mathematics) possible for humans with our discursive form of understanding?, the problem discussed in the third *Critique* is: How do we proceed with research into nature and its multiplicity of forms given the rationally constrained nature of our (human) understanding? According to Kant our discursive understanding has certain fundamental limitations in its cognitive reach which force us to consider strategies in dealing with it. The Kantian answer situates, and tries to solve this problem, within the framework of his transcendental philosophy.

Kant refers to the rationally constrained nature of our understanding as a "contingency in the constitution of our understanding" (5:406). This contingency is found in the relation between the particular and the universal. Allison says it well: "The basic problem, which is central to the third *Critique* as a whole, is that the universal principles underdetermine the particulars falling under them" (Allison 2012:210).

In both introductions Kant discusses this contingency in the relation between particular empirical laws and general (universal) laws that we ascribe to nature as a whole (20:203). Although all particular experiences which are interconnected in accordance with the principles of the understanding, could be further interconnected in accordance with empirical laws in which nature is taken as an "aggregate", there would always be a contingency according to which this field of objective cognition falls short of the universal laws (lawfulness) which reason ascribes to nature when taken as a totality, as a unified "system" (20: 209). This problem was already discussed in the first *Critique*, where Kant mentions that the unity of reason presupposes an idea, namely that of the systematic "whole" for the aggregate of particular cognitions. Since this whole cannot be given in sensibility, such a universal can only be problematically assumed as an idea (or general law) for the purposes of systematization. Kant calls this a "regulative principle" (A646-7/B674-5; B708).

In the framework of the third *Critique* Kant allows that this contingency between the particular and universal could even be more substantial than that assumed in the first *Critique.* We must also allow for the possibility that our understanding would not necessarily grasp the universal (Allison 2012:171). This possibility arises in the case where we assume that nature could have a supersensible ground. When such a supersensible ground is assumed, the universal could even be "beyond the sphere of the insights into nature that are possible for us" (20:218; see also 5:170). In that case some laws, as empirical, "may indeed be contingent in accordance with the insight of our understanding" (5:180; see also 5:183-4). The assumed unity of empirical laws (i.e. the universal) would not be fathomable by us (although it is thinkable); it would be beyond our cognition and only available to another (non-human) understanding.

When the problem is stated in this way, it is immediately clear that this is actually a problem for the faculty of the power of judgment which subsumes particulars under universals. In the first *Critique*, the function of the power of judgment is to determine whether given particulars fall under the rules (concepts/universals) given by the understanding. But how do we judge particulars when the universals are not given (as discussed above)? Kant's answer is to distinguish two kinds of

judgment, namely "determinate" judgment (the kind specified in the first *Critique*) and "reflective" judgment. Reflective judgment is the ability to subsume a *given particular under a rule that is not given*, i.e the rule under which the particulars may be subsumed must be sought for. In this case an *a priori* principle is required for the power of judgment according to which such universals can be found (in the case of determinate judgment such a rule for the given rules would be on pain of an infinite regress), which necessitates a critique of its own for this faculty of the mind (i.e. the third *Critique*; Allison 2010:240).

Kant identifies the transcendental principle which guides the reflective power of judgment (both in aesthetic and teleological judgment) as the purposiveness of nature which he describes as "the lawfulness of the contingency as such" (20:217). This principle basically says that we have to take nature heuristically *as if* it is designed for the purposes of the scientific study of nature (i.e. for us), even though we recognize that the objectivity of such a cognizable order is contingent (5:185). In contrast with determinate judgment, there is no objectivity nor can any be claimed for this kind of judgment (due to the contingency in the relation between the particulars and the universals). There is an explicit acknowledgment of the subjective, reflective (self-referential) character of this principle of judgment which does not prescribe rules to nature but merely to itself. Kant calls this the "heautonomy" of the power of judgment (20:225; 5:185).

The reason why we must take purposiveness as a (subjective) universal and necessary (i.e. transcendental) principle guiding empirical research, is that without it no "thorough interconnection of empirical cognition into a whole of [i.e. unified] experience" is possible (5:184). Kant says further: "[W]ithout presupposing this [principle], we would have no order of nature in accordance with empirical laws, hence no guideline for an experience of this in all its multiplicity and for research into it" (5:185). Transcendental principles always ground *the possibility of a unified experience a priori.*

Allison writes that in the deduction in the published introduction Kant establishes "the subjective necessity of presupposing the purposiveness of nature in the process of empirical inquiry. In other words, the claim is not that nature is purposive, i.e. that we have some sort of *a priori* guarantee that it is ordered in a manner commensurate with our cognitive capacities; nor even is it that we must believe it to be purposive in this sense (which is basically Hume's position). The claim is rather that we are rationally constrained to approach nature as if it were so ordered" (Allison 2010:186). Butts describes this approach as follows: "Determinate judgments are either true or false of objects of possible experience. Reflective judgments, based as they are on subjective maxims, are neither true nor false, not even probable or improbable; they are rather rational *estimates* of the way nature operates" (Butts 1990:4).

The purposiveness of nature which Kant introduces in the third *Critique* as a regulative principle for the reflective power of judgment is much broader than the purposiveness (systematicity) of nature that he introduces in the first *Critique* as a regulative principle for the hypothetical use of reason (Allison 2010:171). Whereas the concept of systematicity merely involves the mechanism of nature (the totality of all causal laws) which allows the understanding to think it as a whole (as the condition for determining the place of all the parts in the whole; A646/B674), the concept of purposiveness goes further and also includes the concept of freedom in its range (it accommodates the supersensible substratum of nature) resulting in the whole (lawfulness) being potentially beyond the grasp of our understanding.

Such purposiveness, as the *a priori* principle of the power of judgment, also functions as a mediating concept between the concepts of nature and freedom because in Kant's system the faculty

of judgment stands between the understanding (the systematic unity of concepts of the understanding produces the concept of nature) and reason (which produces the idea of freedom) (Allison 2012:217; Guyer 2000:xxii-xxiii). Kant writes in this regard: "Now this transcendental concept [of purposiveness] is neither a concept of nature nor of the concept of freedom, since it attributes nothing at all to the object (of nature), but rather only represents the unique way in which we must proceed in reflection on the objects of nature with the aim of a thorough interconnected experience" (5:184). As such the principle of purposiveness does not merely assume that nature is ordered (i.e. take it as if it is designed); it is also a principle "for the possibility [of the products] of nature" (5:186). Since it accommodates the supersensible substratum of nature, it allows that the ground for the possibility of the products of nature may lay therein.

### 3.3. The internal purposiveness of nature

Kant's transcendental principle of purposiveness does not only have reference to nature as a whole, but also to the individual *products* of nature. Kant calls this the "technique" of nature, i.e. that nature is "purposive in its products" (20:249). In this way Kant accentuated the idea that the products of nature are judged as if they are produced by the technical skills of some artist in accordance with some design (plan). Such reflective judgments, which are neither theoretical nor practical, "do not determine anything about the constitution of the object nor the way in which to produce it" (20:201).

According to Kant there are two ways in which the products of nature can be so considered, which occupy the two parts of the third *Critique*. When the form of things are judged as purposive (in intuition prior to any concept of the faculties of cognition) for our feelings of pleasure (and displeasure) it is called the "formal" technique of nature. In this case a judgment of taste (called an aesthetic judgment) is made on mere subjective grounds and considers the relationship between the object and the human subject. When things are judged as purposive in accordance with concepts (of objects and their possibility) it is called the "real" technique of nature. In this case a logical (i.e. cognitive although still reflective) judgment (called a teleological judgment) is made on objective grounds, through the understanding and reason, which considers the relationship which is supposed to subsist in the object of cognition (5:193).

In teleological judgments nature and the products of nature are considered as a system (or systems) of purposive relations (McLaughlin 1990:51). As such this kind of judgment considers the "objective" and "material" (i.e. not merely mathematical) purposiveness of things and their possibility *in terms of relations of cause and effect.* Kant writes: "Experience leads our power of judgment to the concept of an end in nature only if there is a relation of cause and effect to be judged which we can understand as lawful only insofar as we find ourselves capable of subsuming the idea of the effect under the causality of its cause as the underlying condition of the possibility of the former" (5:367).

Two such judgments are possible, namely when relative (extrinsic) or internal (intrinsic) purposiveness is considered. In the case of relative purposiveness, which explores the existence of one thing for the sake of another (or the existence of one part for another within the framework of a product of nature), things are explained according to mechanical laws (McLaughlin 1990:43). In the case of intrinsic purposiveness a thing's internal possibility for the production of its outer form is considered (in analogy to production by the causality of a concept).

### 3.3.1. The teleological principle

In this way Kant introduces two regulative principles according to which natural products could be considered in reflective judgment in accordance with its own rule (i.e. the transcendental principle of purposiveness), namely mechanism and teleology. When causal relations of such products in general are considered in mechanistic terms the first principle is used. When we cannot explain something in those terms we can consider it in accordance with the teleological principle. In fact, the same product could be considered in accordance with both these principles (When the parts are considered as an aggregate whole, Kant also uses the term mechanism, although then it would be a constitutive concept; 20:218).

The relation between this teleological principle and the transcendental principle is complex (Allison 1990:214). Some authors regard the teleological principle (just as a transcendental principle) *merely in methodological terms* as a heuristic device guiding scientific research. They argue that, although the products of nature can be considered as if they are produced in accordance with the teleological principle, they are nevertheless still produced according to some form of mechanism. In this way the supersensible realm (and with it all reference to freedom as absolute spontaneity) is removed from Kant's philosophy of science. Ginsborg (2010:465), for example, views these two principles as "two different, although related, senses of mechanical explanation". Butts (1990:5) writes: "The conclusion is that a deep teleological principle operates as an *a priori* presupposition of *any* scientific inquiry. Teleology subordinates mechanism, *while at the same time vindicating its employment*".

In my view this is not Kant's position. I believe and will now argue (in the following sections) that with the teleological principle, which concerns intrinsic purposiveness, *Kant introduces the possibility that there could be aspects of some products of nature which are not produced in accordance with deterministic causality at all.* He allows for the possibility of another kind of causality, namely that of final causes, which builds upon the causality according to freedom which was first introduced in the first *Critique*. In this regard Kant grounds the condition for the possibility of the products of nature in the supersensible realm.

Although this kind of causality is not empirically accessible according to Kant, it is nonetheless non-contradictory, (logically) possible and the broader framework in which he embedded it suggests that he is in fact arguing for the *conceivability* of the existence of such a kind of causality. In this regard my view is stronger than the methodological approach taken by Allison (1012:205) who accepts the logical possibility of another kind of causality; I argue for an ontological reading of the third *Critique* within the framework of Kant's critical philosophy in which such spontaneous causality can be conceived of as something that really exist.

### 3.3.2. The possibility of things in themselves

When the products of nature are considered as systems (and not merely as aggregates), we can consider both the relative purposiveness of its material parts (governed by the principle of mechanism), as well as its intrinsic purposiveness which involves *the possibility which the products have in themselves* to produce such product systems (governed by the principle of teleology). At this stage of the discussion I tentatively propose that Kant's distinction between the two kinds of purposiveness reflects (or builds on) the two ways of considering objects discussed in the first *Critique*, namely regarding their external relations as well as their intrinsic nature, i.e. as they are *in themselves* (Langton 1998:19). The difference is that now we are not merely considering everyday objects, but rather the (production of the) products of nature and their internal parts in this manner.

This reading is supported by the manner in which Kant seems to understand intrinsic purposiveness, namely that it is the intrinsic ability that a product of nature has in itself, i.e. as a thing in itself, to produce its form. We find that the concept of intrinsic purposiveness (and the teleological principle belonging to it) is consistently related to the possibility that products of nature have *in themselves* to produce their forms, in contradistinction with the mere representation of the forms of such products (and the relation of the parts to each other). In this regard Kant, for instance, says in his discussion of teleological judgment in the unpublished introduction that its concept of purposiveness (which seems to include both kinds of purposiveness) is designated "not merely for the manner of representation, but for *the possibility of the things themselves*" (20:234; my accentuation).

There are also other textual support that intrinsic purposiveness involves *the possibility which the products have in themselves* to produce such product systems. In the published introduction Kant mentions that for objects given in experience, (intrinsic) purposiveness involves "a correspondence of its form with *the possibility of the thing itself*, in accordance with a concept of it which precedes and contains the ground of its form" (5:193; my accentuation). Here he accentuates the relation between the form of a product of nature and the possibility that it contains *in itself*. In the rest of the third *Critique* Kant sometimes refers to products of nature judged "in itself and its internal [i.e. intrinsic] possibility" (5:373-4) which again seems to suggest that the intrinsic purposiveness refers to this intrinsic possibility that the products of nature have when considered *in themselves*.

What does Kant mean by "the possibility of the things themselves"? At the most basic level this would refer to the idea developed in the first *Critique* that things in themselves (as noumena) could have a certain causal relation with phenomena (as the absolute spontaneous cause thereof). This does not refer to things in themselves as the mere transcendental ground of objects, i.e. when we merely consider the real ground of everyday objects that are given as phenomena in perception (A253; see 2.4.3. above). It rather refers to things in themselves (things themselves) *considered only as noumena*, i.e. objects of our understanding which could exist *outside nature* although for another kind of intuition (than ours), to which the transcendental idea of freedom, also called "absolute spontaneity", could be ascribed without contradiction (since mechanism belongs only to nature; see the third antinomy). I presented this way of understanding the concept of noumena in the first *Critique* as a third alternative in Kantian interpretation (in the previous chapter).

*The ground for this kind of (spontaneous) causality lies in the noumenal realm, although its effects are produced in the phenomenal realm.* According to Kant there are only two kinds of causality, namely deterministic causality (in accordance with the second analogy; called mechanism when nature as a whole is considered) and absolute spontaneous causality in accordance with the transcendental idea of freedom (A532/B560; see 2.4.1.). The ability that things have in themselves to eventually produce their phenomenal form would involve both these causal concepts, but especially that of absolute spontaneous causality according to which the ground for the phenomenal effects is situated in the thing as it is in itself, *which Kant equates with the supersensible (5:175).* According to Kant the idea of the supersensible "underlies the possibility of all those objects of experience" (5:175).

### 3.3.3. The concept of a causality through freedom

Although freedom is at first introduced as a moral concept in the third *Critique* (5:172), and some interpreters understand it throughout the *Critique* in that way (McLaughlin 1990:118; Guyer 2010:433), Kant does eventually distinguish between freedom as moral concept of practical reason and as a formal concept of *pure* reason (i.e. transcendental freedom; see note to 5:196) in the last

section of the published introduction after his discussion of teleological judgment (these two kinds of freedom are, however, closely interwoven in his discussion). This distinction goes back to the first *Critique* where he said that practical freedom is grounded on the transcendental idea of freedom (A534/B562). He now calls the spontaneous causality that is grounded in the transcendental idea of freedom "causality of freedom" and the "concept of a causality through freedom" (5:195-6). He argues that this kind of causality can be included in a teleological principle under the reflective power of judgment.

Kant writes that the idea that the supersensible can have consequences (effects) in the realm of nature is *already* (before its use in the practical concept of freedom) included in the concept of a causality though freedom: "But although the determining grounds of causality in accordance with the concept of freedom (and the practical rules that it contains) are not found in nature, and the sensible cannot determine the supersensible in the subject, nevertheless *the converse is possible* (not in regard to the cognition of nature, of course, but in regard to the consequences of the former on the latter) and *is already contained in the concept of a causality through freedom*, whose **effect** in accordance with its formal laws is to take place in the world, although the word **cause**, when used of the supersensible, signifies only the **ground** for *determining the causality of natural things to an effect* that is in accord with their own natural laws but yet at the same time is also in unison with the formal principle of the laws of reason, the possibility of which cannot of course be understood, although the objection that there is an alleged contradiction in it can be adequately refuted" (5:196; my italics).

This reference to freedom in the introduction suggests that the possibility (and conceivability) of a causality though freedom (as an idea of reason) is important for Kant's overall argument regarding the teleological principle since it allows for the possibility that such causality could be real and that all products of nature are therefore not necessarily produced in accordance with deterministic causality (mechanism). Although Kant admits that the existence of the supersensible and its accompanying kind of causality though freedom cannot be proved, the concept thereof is non-contradictory and it can be incorporated in a principle of reflective judgment: "The power of judgment, through its *a priori* principle of judging nature in accordance with possible particular laws for it, provides for its supersensible substratum (in us as well as outside us) determinability [i.e. that it can determine outcomes as phenomena] through the intellectual faculty [i.e. we can think it]" (5:196).

*At this point we have reason to think that the teleological principle is not merely a methodological device which guides us in our search for mechanical causes (although it surely does); it also allows for the real possibility that another kind of causality than the deterministic sort, namely that of absolute spontaneity (freedom), could in fact contribute to the form of the products of nature*. In this regard the possible relation between things in nature and the supersensible realm, which could contain the ground for the possibility of the forms of nature which would be realized (at least in part) though spontaneous causality, should be considered.

When Kant introduced the teleological principle in the preface to the first edition of the third *Critique*, he already emphasizes that this involves the relation between the things of nature (regarding their form) and the supersensible realm (which contains the possibility for the expression of its form). He writes: "[I]n the case of the logical judgment of nature, where experience imposes on things a conformity to law that the understanding's general concept of the sensible is not sufficient to understand or explain, where the power of judgment can derive from itself a principle [i.e. the teleological principle] for *the relation of the thing in nature to the uncognizable supersensible* but can only use it with respect to itself for the cognition of nature" (5:170; my

accentuation).

3.3.4. Two cohering principles

Although absolute spontaneous causality is of great importance to Kant's argument, he does not think that it could alone (i.e. without deterministic causality) accounts for the forms of the products of nature. In this regard he mentions that *the coherence of the effects of these two kinds of causality in one product of nature* does not contain a contradiction. He discusses this "alleged contradiction" in more detail in an accompanying note (5:196) where he says that it refers to *two kinds of appearances cohering in the same subject*, namely that of nature as appearance as well as the effects of the causality of freedom as appearances in the sensible world. In this regard his reference is to the first *Critique* where he already argued that both kinds of causality could without contradiction be accommodated in the framework of the empirical character (both of causes and causal agents; Allison 1990:24; see section 2.4.4 for a discussion). The fact that there is no contradiction in this regard is important for Kant's later argument that both mechanism and teleology (and therefore both relative and intrinsic purposiveness) could cohere in nature and its products.

After Kant dissolved the antinomy of teleological judgment in the Dialectic part of the third *Critique* (this is the seventh antinomy in total) he shows how these two principles can cohere through the supersensible. In that instance he again refers to both mechanism and "the spontaneity of a cause", which would be "another kind of causality", and "without which no ground of those forms [i.e. of the products of nature] would be given" (5:411). Of special importance is the name that he uses for this other kind of causality, which without any doubt refers to the causality of absolute spontaneity.

I have now argued that the two kinds of causality which Kant originally introduced after the dissolution of the third antinomy in the first *Critique*, is again used in the third *Critique* as the basic building blocks for his principles of mechanism and teleology. As such, there can also be no doubt that the idea of the supersensible is central to Kant's concept of teleology and that this principle allows for a real alternative to mechanism according to which the products of nature are produced. As such, these products contain in themselves, i.e. in their supersensible ground, the possibility for the realization of its material forms. *When we remove the supersensible realm from this part of Kant's philosophy of science, we lose all prospect that another kind of causality could really exist* – even though it would be beyond our sensible reach.

**3.4. The concept of natural purpose (end)**

In the Analytic part of the Critique of the Teleological Power of Judgment Kant introduces a concept in accordance with intrinsic purposiveness (and the teleological principle), which is suitable for application to biological structures, namely that of natural purpose. This is not a constitutive concept through which we can achieve objective cognition; it is merely a regulative concept for reflective judgment (in accordance with the transcendental principle of purposiveness). This is also not an empirical concept, taken from experience. It is, rather, an analytically acquired concept with application to organisms insofar as they are conceived by us as natural purposes (McLaughlin 1990:46; see 5:376).

The concept of natural purpose does not only involve the internal possibility that things have in themselves to produce their external form; it also says *how that could conceivably be realized*. In this regard Kant introduces the relation between the "whole" and the "parts" as well as the particular causal relation which governs them. There are two conceivable ways in which this could

be possible (according to Kant), namely through "mechanism of nature", when the material whole is explained by the causal relation between the component parts (the parts determine the whole), and through a "natural purpose", when the idea of the whole serves as ground and condition for the parts and their internal arrangement (the whole determines the parts) (Allison 2012:203; McLaughlin 1990:129). Kant writes already in the unpublished introduction: "[T]he whole should be the cause of the possibility of the causality of the parts, rather [than in the case of physical-mechanical causes] the latter must be given first in order for the possibility of the whole to be comprehended from it" (20:236).

The main difference between the transcendental ideas of mechanism and freedom introduced in the third antinomy and the corresponding ideas of mechanism and natural purpose in the third *Critique*, is that the two last mentioned ideas do not merely involve two different kinds of causal relation (deterministic and non-deterministic), it also describes those in the framework of a whole-part relation (which can be ascribed to the products of nature). In this extended sense the "mechanism of nature" cannot be equated with the mechanism introduced in the first *Critique* (Allison 2012:204), just as the concept of natural purpose cannot be equated with the concept of absolute spontaneous causality which Kant again introduces in the introduction to the third *Critique*, although it includes those concepts (see below).

In the third *Critique* the idea of the "whole", which contains the ground and possibility for the production of the products of nature (of the material whole with its parts), effectively supplants the concept of noumena that Kant used in the first *Critique*, that is, "objects of the understanding" existing outside nature which is introduced merely problematically, i.e. non-contradictory, and would only be accessible for another kind of intuition. As I argued in my interpretation of the first *Critique* (presented as a third alternative viewpoint), when noumena are conceptualized in this way, they could contain the ground and possibility for absolute spontaneous causality which could produce effects in nature. One can say that the whole-part relation introduces a more complex concept of noumena.

3.4.1. Final causes

According to Kant the concept of natural purpose means that we take things as the "cause and effect of itself", i.e. in the production of material wholes. The Kantian concept involves the production of things in accordance with its own internal possibility (although Kant mentions the reproduction of things when he provisionally presented the concept (5:371), he does not engage with that in any detail). Kant distinguishes three aspects that determine the concept, which have some distant relation to the three properties of reproduction that he observed in organisms (powers of growth, reproduction and self-repair; Guyer 2010:433; McLaughlin 1990:49).

A body would be a natural purpose "in itself and in accordance with its internal possibility", when the following apply (5:373): 1. The parts of a natural purpose, as far as their presence and their form (properties) are concerned, are only possible through their relation to the whole. The whole (which for us can only be an idea) serves as the ground for all the parts in their relation to each other and the material whole. 2. The parts reciprocally produce each other as far as their form and their combination is concerned (see also 5:408). They produce the material whole out of their own causality. 3. Each part is conceived as if it exists only through all the others, as existing for the sake of each other and on account of the whole. A product of nature which adheres to these rules would be an "organized and self-organized being" (5:373).

In the framework of this conception of a natural purpose, Kant introduces a new concept of

causality, namely of "final causes", according to which such beings are both the cause and effect of themselves (the parts are mutually the cause and effect of each other in the production of the material whole). In this case the causal relation is not that of a series of causes and effects, with each cause having an effect (called "effective" causes; not even when such causality is taken as reciprocal causality in the context of "community" as in the third analogy). Such a series would be "descending", i.e. it moves from the condition to the conditioned. Kant contrasts it with an "ascending" series which moves from the conditioned to the condition (McLaughlin 1990:86). With final causes, however, as a concept of reason (as such it is an "ideal" cause; we can think it, but cannot understand it), when considered as a series, a mutual dependency between ascending and descending series occurs such that each cause is also an effect. "[T]he thing which is on the one hand designated as an effect nevertheless derives, in ascent, the name of a cause of the same thing of which it is the effect" (5:373). This is not the causality that we find in the context of nature.

Although this kind of causality (final causes) can be logically conceptualized without contradiction (5:371), and can be used as such in our conceptualization of a natural purpose, it *cannot be part of nature*, which Kant understands in terms of deterministic causality (mechanism). When we allow that the unity of the forms of nature is produced in accordance with a rule (as an ordered outcome), and not merely "contingently" in accordance with mechanism, then such an *a priori* principle *would be outside the concept of nature*: "[W]ithout the help of a special kind of causality, namely that of ends (nexus finalis), this [order in nature] is all in the highest degree contingent, i.e. that nature, considered as mere mechanism, could have formed in a thousand different ways without hitting precisely upon the unity in accordance with such a rule, and that it is therefore *only outside the concept of nature*, not within it, that one could have even the least ground *a priori* for hoping to find such a principle" (5:360, my accentuation; see also 5:371).

Within nature everything is regulated by the concept of mechanism (deterministic causality), which means that it is only outside nature, in the supersensible substratum of nature, that we can have the least possibility of another kind of causality, namely in accordance with final causes (that have ordered outcomes). Kant makes it clear that this kind of causality could only be possible in the context of the supersensible realm "[W]e have related such an effect [in the products of nature] in the whole to a supersensible determining ground beyond the blind mechanism of nature" (5:377).

3.4.2. The productive capacity (potentiality) of a natural purpose

*Kant's concept of final causes provides a process (as a manner in which it could be achieved) according to which the intrinsic possibility of natural products could be realized in nature* – in a manner not possible through the mechanism of nature. We can, however, only *realistically conceive* of a final cause if its ground, from which it begins its work, lies in the supersensible realm outside nature. As such, the concept of final causes involves a "productive capacity" (5:370, 379) which the products of nature have in themselves to produce their material forms. Kant writes: "[W]e have discovered in nature a *capacity* for bringing forth products that can only be conceived of by us in accordance with the concept of final causes... [The idea of which], as far as its ground is concerned, leads us *beyond the sensible world*" (5:381; my accentuation). Kant also calls it a "productive cause" (5:421).

This "productive" capacity or potentiality that natural products have in themselves to produce their material forms is clearly based on the more basic concept of absolute spontaneity. In both cases the ground for this kind of causality lies in the supersensible realm, while its effects are produced in the phenomenal world. In the first case it is grounded in noumena; in the second it is grounded in "wholes" (which is just another way to think of noumena), on which the possibility of the parts, as

far as both their constitution and their combination are concerned, depends (5:408). Whereas absolute spontaneity is a cause grounded in noumena in the noumenal realm with its effects in nature, productive capacity (potentiality) through final causes is a similar kind of cause grounded in the whole (of which we can merely form an idea) in the supersensible substratum of nature from with its material form in nature is produced.

Kant relates absolute spontaneity and productive capacity (potentiality) in different ways to a series of events. Absolute spontaneity as a cause of phenomena is viewed as beginning "a series of occurrences *entirely from itself*" (A534/B562). Productive capacity also involves such a series which begin from itself (i.e. from a whole), but it is not merely producing effects; it involves a whole and its parts which are realized through the mutual dependency between ascending and descending series according to which each cause is also an effect, producing material wholes in nature. *We can say that the idea of absolute spontaneity of the first Critique is expanded with the idea of productive capacity (potentiality) through final causes (or: a productive cause) in the third Critique which makes it more suitable for application to the products of nature.* Kant even refers to this last cause as "the spontaneity of a cause" (5:411), a name which is clearly borrowed from absolute spontaneity.

In both *Critiques* Kant mentions that these are the only two kinds of causalities possible. These are clearly the same kinds of causality that Kant introduced in the first *Critique* (Butts 1990:5) although the concepts of both mechanism and spontaneous causality have been expanded to include the whole-parts relation to make them suitable for application to the products of nature. In including these concepts within the broader framework of Kant's philosophy, especially when noumena or the whole-parts relation is considered, the second kind of causality is not only non-contradictory, *it is also conceivable that it could in fact exist.*

In the final instance Kant also contrasts these kinds of causality in terms of "forces", namely the "moving force" in accordance with mechanism which is explained in terms of the fundamental "forces of matter" (the forces of attraction and repulsion discussed in *Metaphysical Foundations of Natural Science*; Ginsborg 2010:458; Langton 1998) and the "formative force" in accordance with teleology which we can think of in terms of final causes. Kant writes: "An organized being is thus not a mere machine, for that has only a motive power, while the organized being possesses in itself a formative power, and indeed *one that it communicates to the matter, which does not have it (it organizes the latter)*: thus it has *a self-propagating formative power*, which cannot be explained through the capacity of movement alone" (5:374; my accentuation).

In Kant's conception, matter is the lowest level of nature, as an aggregate of numerous substances external to one another, with its forces governed by mechanical laws (5:420-1). According to Kant a natural purpose, on the other hand, has a formative power (force) which is not a force of nature (i.e. of attraction or repulsion), but which is "self-propagating" (i.e. in accordance with absolute spontaneity) and can be "communicated" to matter and in that way organizes matter. The seat of this formative power is in self-organizing beings *as they are in themselves outside nature, in the supersensible substratum of nature*. The whole-part relation that Kant has in mind, which grounds the formative process of a natural purpose, is therefore not referring to extended parts and wholes, but to non-extended wholes-and-parts (they are not in nature and therefore also not extended in our space/time). Kant, however, never spells out how these non-extended wholes-and-parts are related to the material parts and wholes produced in nature.

My analysis is in agreement with Kant's sympathetic reading of Leibniz in accordance with his own view, according to which non-material monads are viewed in similar terms to noumena (This

follows because Kant's conception of noumena is modeled on Leibniz's monads; Cicovacki 2010:85; Friedman 2010:243). In this regard Kant mentions that composites of things in themselves could be composed of simples which seems to be the same idea that he develops in more detail in the third *Critique*, namely of non-extended wholes-and-parts. He writes in *Metaphysical Foundations of Natural Science:*

"[Monadology] is rather an intrinsically correct *Platonic* concept of the world devised by Leibniz, insofar as it is considered, not at all as the object of the senses, but as a thing in itself, and is merely an object of the understanding, which, however, does indeed underlie the appearance of the senses. Now *the composite of things in themselves must certainly consist of the simple, for the parts must here be given prior to all composition*. But the composite in the appearance does not consist of the simple, because in the appearance, which can never be given otherwise than as composed (extended), the parts can only be given through division, and thus not prior to the composite, but only in it.

Therefore, Leibniz's idea, so far as I comprehend it, was not to explicate space through the order of simple beings next to one another, but was rather to set this order alongside space as corresponding to it, but as belonging to a mere intelligible world (unknown to us). Thus he asserts nothing but what has been shown elsewhere [i.e. in Kant's own writings]: namely, that *space, together with the matter of which it is the form, does not contain the world of things in themselves*, but only their appearance, and is itself only the form of our outer sensible intuition" (4:507-8; my accentuation).

When we read the third *Critique* in this light, it follows that the wholes which Kant introduces in this *Critique* are the above-mentioned "composite of things in themselves" consisting of parts, which would be simples, that is, elementary non-extended entities. These would exist in the supersensible realm outside nature. When Kant says that another kind of causality applies to these wholes-and-parts, namely of final causes, according to which the parts are the cause and effect of each other, this implies that they are interconnected (coupled) in a manner that we do not find with extended (material) parts (which is why I talk about "wholes-and-parts"). It also means that their effects (realization of themselves?) in the phenomenal realm would be governed by that rule, i.e. that each outcome would be produced in such a manner that it is the cause and effect of the other outcomes. The outcomes would be spontaneously produced from the co-operation of the elementary non-extended parts (without any preceding deterministic causal structure). On the whole, all the parts *together* would have the self-propagating potentiality in themselves to produce the product in co-operation with the material parts and mechanical forces of nature.

At this point I can say the following: Kant assumes a two-level world-system – involving the supersensible substratum of nature as well as nature. We can distinguish between the wholes-and-parts that things have in themselves, i.e. as non-extended entities, and the related material parts and wholes in nature. The first kind (of wholes-and-parts) involves an absolute spontaneous causality and on the whole a formative power (a potentiality) that we do not find in nature, where all interaction happens in accordance with mechanical laws. As such the first kind has a determining impact on the material form of the products of nature.

According to Kant both kinds of causality could possibly belong to the products of nature: "It might always be possible that in, e.g., an animal body, many parts could be conceived as consequences of merely mechanical laws (such as skin, hair, and bones). Yet, the cause that provides the appropriate material, modifies it, forms it, and deposits it in its appropriate place must always be judged teleologically, so that everything in it must be considered as organized, and everything is also, in a certain relation to the thing itself, an organ in turn" (5:377). The aggregated parts can account for

mechanical changes (according to deterministic laws); the non-extended wholes-and-parts "provides" and "deposit" material (matter) in its appropriate place in the framework of the material whole.

### 3.4.3. The restricted nature of our understanding

With the introduction of the concept of natural purpose Kant faced a problem, namely how to think of this kind of causality within the framework of the science of his day. On the one hand, it is not like any kind of causality that he knew (they obviously knew only deterministic causality). On the other hand it shows some distant analogy with causality through ends. Already in the published introduction, Kant mentioned that we can think of the possibility of the products of nature *in analogy* to human action, namely that some phenomenal outcomes (actions) have their ground in the supersensible realm (through which practical freedom becomes possible). He writes: "[T]he latter [the supersensible] should have an influence on the former [the sensible], namely the concept of freedom should make the end that is imposed by its laws real in the sensible world; and nature must consequently also be able to be conceived in such a way that the lawfulness of its form is at least in agreement with the possibility of ends that are to be realized in it in accordance with the laws of freedom" (5:176).

Natural purpose, however, is "entirely distinct from practical purposiveness (of human art as well as morals)" and does not involve any intentionality (5:181; 20:237). We can, nonetheless, think of "natural purpose" in analogy with human purpose (which is also where the name originates), where an idea, representation or concept of the result can be viewed as the "cause" of it (McLaughlin 1990:38), or as Kant defines it, "[T]he concept of an object insofar as it at the same time contains the ground of the reality of this object is called an end" (5:181). In various passages Kant accentuates that the concept of a "natural end" is merely conceived *in analogy* with human agency, especially in artistic production, without trying to explain it in this manner (5:181, 360-1 etc.).

Although Kant formulated his concept of natural purpose in analogy with human purpose, he acknowledged that this is not really satisfactory: "Strictly speaking, the organization of nature is therefore not analogous with any causality we know... inner natural perfection, as is possessed by those things are possible only as natural ends and hence organized beings, is not thinkable and explicable in accordance with any analogy to any physical, i.e. natural capacity that is known to us; indeed, since we ourselves belong to nature in the widest sense, it is not thinkable and explicable even through an exact analogy with human art" (5:375)

The main problem with the concept of a natural purpose is that the whole which underlies the production of the material parts and form of natural products (viewed as natural purposes), is ascribed to the supersensible realm. The representation of such a whole which precedes the possibility of the parts could be nothing more than an idea for us (20:236; 5:381). According to Kant, our understanding is constrained due to the contingency of its constitution (see section 3.2.) and can therefore not grasp this kind of non-extended whole, which is prior to and conditioning its parts and their internal arrangement; it cannot *represent* the whole as the ground for the possibility of the parts. Our discursive, "image-dependent", understanding, tries to form a representation of such a whole, which is not possible; we can only grasp *material* wholes as aggregates of its parts (5:408; Allison 2012:211).

Kant accentuates this problem by introducing another kind of (non-human) understanding, which he calls an "intuitive intellect" which is not constrained in this manner (doing so does not contain any contradiction). This understanding is not restricted to the use of general concepts, called "analytic

universals" (with their contingent relation with particulars). It can grasp the "synthetic universal", i.e. the (non-extended) whole could as such be given as an intelligible representation to its intuition (there is no contingency between this universal and particulars). As Allison says, "a supersensible ground would be accessible only to an intuitive intellect" (Allison 2012:213).

Kant thinks that such an intellect, and the kind of intuition associated with it, also shows how the supersensible realm itself could be possible: "[S]ince it is still at least possible to consider the material world as a mere appearance, and to conceive of something as a thing in itself (which is not an appearance) as substratum, and to correlate with this a corresponding intellectual intuition (even if it is not ours), there would then be a supersensible ground for nature, although it is unknowable to us, to which we ourselves belong" (5:409). When such a supersensible substratum is assumed, the design which is expressed in the products of nature, could be present in that realm (Guyer 2010:435). In this regard Kant also allows that such an intellect, now taken as God, could have intentionally produced such designs in the supersensible substratum of nature which find their materialization in the products of nature (5:425-6).

### 3.5. The importance of the supersensible realm

I have now argued that the supersensible realm is of crucial importance in Kant's philosophy of science as presented in the third *Critique*. We cannot eliminate this from Kant's philosophy of science without seriously damaging his arguments for the concept of natural purpose, which he applies to organisms through reflective judgment. Without the supersensible realm there cannot be any kind of non-deterministic causality and therefore nothing but deterministic causality. Such a realm is necessary for any concept which involves absolute spontaneous causality (the transcendental idea of freedom) in any manner, namely natural purpose which involves the self-propagating formative power or potentiality (productive capacity) that things in themselves have as non-extended composite wholes to produce their material forms.

#### 3.5.1. Unifying the principles

The introduction of such a new kind of non-deterministic causality at the same time introduces the problem of its coherence with mechanism. According to Kant this kind of causality as well as its co-existence with mechanism is only possible through the presupposition of the existence of a supersensible realm. Kant formulates this problem as an antinomy (a conflict of laws) in which the two kinds of causality, namely mechanism and final causes, are presented as equally necessary, but conflicting, alternative maxims (Allison 1012:205). Although all generation of material things must be judged as possible through mechanistic laws, some products of nature (organisms according to Kant) cannot be judged as such and require an entirely different law of causality, namely that of final causes (5:386).

As principles for the reflective power of judgment, these principles are not assertions but rather guidelines (they cannot be more than this due to the contingency in the constitution of our understanding). When they are dogmatically asserted (which happens when the principle of reflecting judgment is confused with the determining power of judgment; 5:389) an antinomy ensues. When they are, however, recognized as mere regulative principles of the reflective power of judgment, the conflict disappears because both can be possible although we can gain no insight into the way this happens (5:415).

I have argued above that Kant does not merely argue for the logical possibility, but also for the real conceivability of both these principles (that they can really exist). This is why he now proceeds to

argue that it is conceivable that *both principles could cohere in nature*, which would only be possible if they can be united in one principle. This is where the supersensible realm is of central importance in Kant's argument – just as was the case when he argued for the conceivability of the transcendental idea of freedom in the first *Critique*. The unifiability of the *two ways of representing* the possibility of nature "may well lie in the supersensible principle of nature (outside as well as inside us)" (5:429). In the same manner that the effects of both mechanism and transcendental freedom (or: the causality though freedom) can cohere in the same subject (as was shown in the first *Critique* and which Kant mentions in the published introduction of the third *Critique*; 5:196), the outcomes of mechanism and teleology can cohere.

Central to Kant's argument that these heterogeneous principles and their corresponding kinds of representation can cohere in the same product of nature, is the idea that the outcomes of mechanism merely involve nature, whereas the outcomes of teleology have their ground in the supersensible realm. Kant writes: "[I]t is just as necessary to conceive of a kind of causality for it [i.e. the products of nature] that is not, unlike the mechanism of natural causes, found in nature, since to the receptivity various and different forms than those of which matter is capable in accordance with that mechanism there must still be added the spontaneity of a cause (which thus cannot be matter) without which no ground of those forms could be given" (5:411). We can therefore think without contradiction, according to Kant, that both kinds of causality could produce their outcomes in nature when the ground of the "spontaneity of a cause" is taken to be outside nature (to be possible at all). According to Kant it is entirely undetermined how much each of these kinds of causality contributes to the products of nature (5:415).

In the final instance (and this is my essential claim) Kant explicitly states that causality according to final causes *could describe a real non-deterministic causality* and that its unification with mechanism is objectively possible. He views this as the outcome of his arguments in the Critique of the Teleological Power of Judgment: "for at least the possibility that both [mechanism and teleology] may be objectively unifiable in one principle (since they concern appearances that presuppose a supersensible ground) is secured" (5:413). As such Kant asserts in concluding his arguments, not only that we can conceptualize the "possibility" of the products of nature in accordance with two seemingly opposing principles, namely mechanism and teleology (final causality), but also that both of these *can be real* although this can never be empirically confirmed. Kant's conception of final causality shows *how* this could be possible within the conceptual framework of his philosophy when applied to the study of nature. The only reason why Kant thinks that this cannot be empirically explored, is that we as humans do not have the kind of intuition that would be necessary to confirm it (5:416).

According to Kant the two principles of mechanism and teleology (final causes), insofar as these have reference to really existing causes, could be combined in a single research program *only if we allow for the existence of a supersensible realm*. Since Kant thinks that there is no manner in which the existence of final causes could be empirically confirmed, this aspect of his philosophy of science could be regarded as critical metaphysics. Although no dogmatic metaphysics is intended, it is nonetheless a metaphysics. Even so, if there is a manner in which the Kantian concepts can be taken as relevant to contemporary physics, his general conception can serve as a theoretical framework (hypothesis) in which both determinism and spontaneous causality (and the two kinds of outcomes associated with them) can be reconciled in a single research program. As such one would have to say in what sense this spontaneous causality find its application in scientific context as well as how the supersensible realm, which serves as ground for such causality, could be accounted for.

### 3.5.2. The implications of Kant's third *Critique*

Kant thought that his concept of final causes is applicable both to the study of the products of nature as well as nature itself (5:381, 388, 409 etc.). According to Kant we can think that the "maternal womb of the earth" had an original purposiveness without which the "possibility of the purposive form of the animal and vegetable kingdoms cannot be conceived at all" (5:420). He proposed a theory of evolution according to which one species could have evolved though adaptation into another. The alterations which species could undergo and then successfully pass on, can be judged as "purposive potentialities" which were originally present in the fundamental constitution of the species (5:419-20; Butts 1990:7).

As such we can think that the design for all life on earth is present in the supersensible realm and unfolds through time. The various "wholes" ("designs" of animals and plants) evolved out of each other, from the most simple to the most complex, until the human noumenon (the noumenal self) became possible (5:435). In this case the transcendental idea of freedom makes practical freedom possible. At this point the noumenal realm which forms the substratum of nature both outside and inside us (5:429) becomes part of Kant's moral philosophy.

Since Darwin's theory of evolution, which proposed a purely mechanistic process of evolution, all teleological explanation has fallen out of favour in the scientific community. But Kant's approach is only teleological in name, not in substance. And can we assert that the products of nature are only possible in accordance with mechanism? Would that not be a dogmatic assertion of the kind that Kant warned against in the framework of his seventh antinomy? In Kant's critical philosophy this door must *remain* open – and he gave us the concepts that he thought could establish at least the conceivability of an alternative kind of causality (a non-determinate causality) than mechanism through which we can think that nature has the inbuilt potentiality to produce her products.

Kant had correctly foreseen, in spite of the modernist impulse in that direction, that everything in our world cannot be explained merely in deterministic terms. With the arrival of quantum physics the supremacy of determinism has indeed been fundamentally challenged. In this regard it is especially the reduction of the wave packet (mathematically expressed as the "projection postulate") that is taken as spontaneous, for example, in Niels Bohr's Copenhagen interpretation. Some authors have even proposed that the reduction of the wave packet be viewed in causal terms (Cartwright 1983:182; 1989:249; Bartels 1999:S170; Pringe 2007). As such, it makes the ordered (statistical) outcomes that are observed in quantum physics possible.

We may ask: Is it possible that Kant's philosophy of science as presented in the third *Critique* can be reinterpreted and reformulated in such a manner that it has relevance to these issues? When we take the Kantian conception of "nature" as referring to the "classical world" (where the space-time theories of relativity apply), his supersensible substratum of nature as referring to the pre-measurement "quantum world" and understand the reduction of the wave packet in some way in terms of the spontaneous causality (potentiality) that Kant argued for, such a reinterpreted Kantian philosophy of science may be relevant and could even contribute to contemporary physics debate. In such an interpretation it may make sense to furthermore consider superpositions of states, which is closely tied with the reduction of the wave packet, in terms of Kantian non-extended wholes-and-parts. In multi-particle systems such superpositions do in fact combine elementary particles into more comprehensive non-extended "wholes". Establishing a sophisticated interpretation, however, would require an in-depth and systematic study to determine whether the quantum realm adheres to the basic characteristics that Kant ascribes to that realm.

The discovery that our world is not governed solely by deterministic causality has not only led to a breakdown in the classical worldview; some philosophers of science even take this as a significant challenge to the unified picture of an ordered world (Van Fraassen 2008:278-80; Cartwright 1999:32). Friedman (2001:121) mentions the "difficulties in unifying or synthesizing the conceptual framework of quantum mechanics with those of our best contemporary space-time theories (both the special and the general theories of relativity)". He bemoans the fact that the quantum revolution has not invoked "ongoing traditions of meta-scientific reflection" like those on absolute versus relative motion and the foundations of geometry (Kant's philosophy was important in these reflections) that played a major role in Einstein's thinking when he formulated his theories.

Maybe Kant's approach in the third *Critique* can help us out in providing a unified conceptual framework in which determinism and non-determinism can be reconciled in quantum physics – in a similar manner that the other branch of his philosophy of science stimulated scientific reflection and theorization until the formulation of Einstein's theories. As discussed above, in Kant's philosophy of science in the third *Critique*, he provides clues as to how two conflicting principles, namely mechanism and final causality, or determinism and absolute spontaneity, could cohere in the same research program. If we explore the interpretation mentioned above in which the reduction of the wave packet is taken as the kind of effective causality that Kant conceptualized as final causes, there is at least the possibility that not only the classical and quantum pictures of the world, but also determinism and non-determinism, can be reconciled in one conceptual framework in (a reinterpreted) Kantian philosophy.

When we return to biology, we can now ask whether Kant's ideas have any relevance for today. If we allow for the application of his ideas in the framework of quantum physics as mentioned above, this may indeed be the case. Not only is quantum decoherence used to study of the interaction between quantum and classical systems; quantum physics plays a central role in the new field of quantum biology. According to decoherence models in quantum physics, quantum information is shared with the surroundings. Michel Bitbol writes: "[There is a] growing consensus, derived from decoherence, that a material body at our scale should *itself* be construed as an emergent *appearance* out of some sort of dispositional background" (Bitbol 2007:263). This implies that spontaneous causality (if we regard reduction in such terms) underlies these emerging processes in biology very much in the manner that Kant proposed. In fact, the writers of *Life on the Edge: The Coming of Age of Quantum Biology* (2014) suggests that quantum processes may play a role in genetic mutations – implying that a mechanistic approach to evolution may not be sufficient.

Although physicists and biologists may not (yet) think of a higher level of quantum complexity which involves the kind of potentialities that Kant had in mind (which could be regarded as "plans/designs") that become manifest in the material forms of the products of nature through this kind of causality (in collaboration with mechanism), it is surely possible that future research could find this. According to Kant we can think that such "designs" would evolve from basic to more complex forms.

### 3.6. Conclusion

In this chapter I focus on Kant's philosophy of science as presented in the third *Critique.* In my view we should not try to cast Kant's teleological approach merely in methodological terms in the sense that nature should be regarded as if "designed" in all scientific research. I argued that Kant had more in mind. Kant's teleology allows for the possibility that another kind of causality than the deterministic sort may be at work in nature, namely that of final ends. He held the opinion that we

have no choice but to regard at least some products of nature in such terms.

I show that Kant did not merely argue for the logical possibility of such a non-deterministic kind of causality; he also argued for its conceivability as a real effective causality operative in nature. In his view both teleology (final causes) and mechanism may be objectively "unifiable in one principle" (5:413). That principle is the supersensible. As such final causes can only *be conceived of as really existing* (as a conceptualized potentiality) if the existence of the supersensible realm is assumed. And this is the key question: Can we today consider this as a realistic proposal? In my view it may be possible to consider the quantum realm as the confirmation of the supersensible realm. Although I have not presented any detailed arguments in this regard, it would certainly be of great consequence for both our understanding of Kantian philosophy as well as the natural sciences (both physics and biology) and the life sciences if this estimation holds.

Although we can interpret Kant's position merely as a critical metaphysics, it seems possible that his conceptualization could also be taken as a theoretical framework (or hypothesis) through which determinism and spontaneity could be reconciled in a single research program. In that case one would have to show how the Kantian concepts find application in contemporary physics. We can explore this possibility further, which would be the topic of the next chapter.

# 4. A new Kantian interpretation of quantum physics

## 4.1. Introduction

A century after the paradigm shift introduced by quantum physics, physicists and philosophers of science are still struggling to come to terms with the implications of the theory. An important challenge is to understand and explain how determinism and non-determinism can be reconciled in one description of the world.

In the quantum picture of the world both our conception of objects in space-time as well as deterministic causality as governing all reality are challenged. In general, the breakdown in the picture of space-time as a Lorentzian manifold is typically associated with regions where quantum effects become dominant (Earman 1986:188). The Aspect experiment also confirmed the violation of the Bell inequality which assumes determinism as Redhead has shown (Redhead 1987:89). Redhead has also shown that the Bell inequality can be reformulated in such a manner that the violation thereof even negates what might be called "stochastic" determinism, that is, that the probabilities for possible values to occur are also not determined – at least in the framework of the Lorentzian space-time manifold (Redhead 1987:83, 102/3).

It is sometimes thought that Immanuel Kant's philosophy of science played an important role in establishing the supremacy of the deterministic picture of the world. Kant's epistemology, as presented in the *Critique of Pure Reason* (the first *Critique*, 1781, 1787), played an important role in establishing the philosophical foundations of mathematical physics (especially Newton's mathematical physics; Friedman 2001:10). According to Kant, experience (and experimental knowledge) is only possible within the framework of space and time, with all matter in space/time governed by deterministic causality in accordance with his second analogy.

Van Fraassen (2008) mentions that this Kantian grounding of science in time became a criterion of completeness, i.e. that any complete description of reality would be deterministic. He writes: "As Kant saw it, the very coherence of experience requires that it takes a form of experiencing ourselves as living in a spatio-temporally definite causal order. The context in which physics was changing around 1900 thus included a strong conviction, inherited from classical physics and modern philosophy, that all phenomena in nature derive from an underlying deterministic physics. Determinism has become a criterion of completeness: any apparent gap in determinism so far is filled with statistical laws, but the statistical probabilities can only be a measure of ignorance" (Van Fraassen 2008:279).

Although one could acknowledge that physicists and philosophers of science interpreted the Kantian epistemology in support of a deterministic picture of the world, this, however, is not the Kantian position. Already in the second part of the first *Critique*, Kant used the third antinomy (conflict of laws) to argue that his epistemology does not present us with a complete picture of the world! He argues that we can logically as well as conceivably (within the framework of his philosophy – see my arguments in the previous chapters) allow for another mode of existence outside nature.

Kant conceptualized "nature" as that mode of existence governed in totality by deterministic causality (or just "causality") – one can take it as the "classical world" (where the space-time theories of relativity apply; see note 3). In the context of this discussion I take "deterministic causality" as applying only within the framework of proper (Lorentzian) space-time. The other mode of existence, in contrast, would be governed by a different principle, namely that of

spontaneity or freedom.

Kant calls this other mode of existence the "noumenal" or supersensible realm because we cannot, according to him, gain any experiential (or experimental) access to it; we are merely able to think about it with our understanding ("nous" in Greek). Although the conception of the noumenal realm has traditionally been equated with Kant's moral philosophy, this, again, is not the Kantian position. Already in the first *Critique*, Kant introduces this other mode of existence to allow for another kind of effective causality, namely absolute spontaneous causality, which, although it produces effects in nature (which is why it is called a "causality"), begins "a series of occurrences *entirely from itself*" (A534/B562) without any previous causal links in any structure of causal relations. Although Kant uses this concept of causality to argue for practical freedom, it is in itself not a practical (or moral) concept.

The noumenal (or supersensible) realm as well as spontaneous causality play an important role in the philosophy of science that Kant developed in the *Critique of the Power of Judgment* (the third *Critique*) which complements that presented in the *Metaphysical Foundations of Natural Science* (1786). This work provides a conceptual framework to study those appearances in nature which do not seem to conform to the deterministic (mechanistic) picture of the world. In Kant's view non-deterministic causality (absolute spontaneity) can be accommodated when it is assumed that it does not have its origin in nature, but in the supersensible substratum of nature. I argue in this chapter that we can identify the pre-measurement "quantum world" with this realm.

What would a Kantian interpretation of quantum physics consists of? As Healey says, "An interpretation of quantum mechanics is an account of what the world is like if that theory is true. To be convincing, the interpretation should explain how the observations we take to support quantum mechanics in fact do so, given that the world is the way that interpretation say it is" (Healey 2009:272). I argue that the Kantian approach can be reworked in such a manner that it accounts for both the classical as well as the quantum pictures of the world, not only insofar as the observations are concerned but also in understanding how they are possible. More importantly, it also allows for a unified conceptual framework in which both determinism (deterministic causality) and spontaneity (non-determinism) are reconciled.

As a first step I show that superpositions of states should be regarded as another mode of existence, i.e. that the "quantum mode of existence" belongs to a different ontology and is not merely some feature of nature. Superpositions of states conform to the Kantian conditions for a supersensible ontology: their amplitudes are irreducibly complex and as such supersensible, they are not in proper space-time (instead an abstract mathematical space-form (in quantum mechanics) or "primitive" space-time manifold (in quantum field theory) is introduced) and are outside nature (in their non-extended wholes-and-parts relation).

As a different mode of existence this realm may be governed by a different principle than deterministic causality. Following Kant, I ascribe absolute spontaneity (which underlies a potentiality to actualize) to this realm. In my view this spontaneity is manifest in the framework of the reduction of the wave packet that is associated with superpositions of states which take them to their individual components and the accompanying measurable outcomes. I view reduction in accordance with this principle as spontaneous ("absolutely spontaneous" in the case of quantum fields) and discontinuous. In my view this spontaneous potentiality becomes *conceivable* (instead of a mere logical possibility) once the quantum realm is taken as a different ontological mode of existence.

In my view the Kantian conception of the supersensible realm is to be identified with the quantum realm *in the context of quantum fields*. *In quantum mechanics the situation is more complex*. The reason for this is that the general description that we find in quantum fields is constrained in a certain manner; in the Schrödinger description the quantum mode of existence is constrained in time (see the discussion below). In quantum mechanics space and time are decoupled (when taken in special relativity terms) and time is coupled with another kind of mathematical space (Hilbert space) which I take to in some manner represent the "quantum space" that corresponds with the quantum mode of existence. Although the quantum mode of existence is constrained within a temporal ordering in quantum mechanics, it is nonetheless present.

Although Kant did not foresee the possibility that time can be coupled with another mode of existence (i.e. to which can be ascribed some ideal "space" that agrees with its structural form – see section 2.4.5), this possibility is easily accommodated in his critical philosophy. This makes his conceptual framework applicable to quantum mechanics. I show that in this manner both the classical and quantum descriptions in quantum mechanics can be accommodated within the Kantian framework of nature and the supersensible realm (outside nature) respectively.

My interpretation explains many of the interesting features of quantum mechanics, like non-separability and non-locality. I look into the extent that these features involve moving beyond proper space-time. These features are also closely connected with the Aspect experiment and the question of non-determinism in quantum physics. I discuss the manner in which the various interpretations of quantum physics account for (or try to overcome) non-determinism. In the final instance I argue that, although the classical picture of the world can be successfully described within the context of Lorentzian space-time and deterministic causality (i.e. in terms of Einstein's theories of relativity), the quantum picture requires the conception of quantum entities as non-extended wholes-and-parts (superimposed states) that are connected outside proper space-time where another kind of causality (grounded in absolute spontaneity) governs the potentiality that these have to be realized in space-time.

In the same way that Kant's epistemology laid the philosophical foundation for classical mathematical science; his philosophy of science in the third *Critique* could now be viewed as laying the foundation for a viable interpretation of quantum physics which does not merely bring the classical and quantum pictures into one conceptual perspective, but which also reconcile the two heterogeneous laws governing the two different modes of existence, namely of determinism and absolute spontaneity, in a conceivable manner in a united conceptual framework. In my view the two descriptions involve two different modes of existence governed by these two heterogeneous laws – *both of which* should also be reconciled (if not united) in any viable interpretation.

### 4.2. Reworking the Kantian approach

There are various interpretations of Kant's epistemology. I follow the two-aspect view according to which objects may be viewed from two standpoints, namely as they appear to our senses and as we can think them as they are in themselves. I showed in chapter 2 that things in themselves may include noumena, taken *as objects* existing outside nature (perceivable only to another kind of intuition than the sensible one; this is the essence of my third alternative interpretation). Although the possible existence of such noumena in *an ontologically distinct noumenal realm* is first introduced in the first *Critique*, it is only in the third *Critique* that it becomes part of Kant's philosophy of science (see chapters 2 and 3).

The goal that Kant set out in constructing his epistemology was to establish "objective" cognition

through which the necessary and universally valid principles for mathematics and the natural sciences could be established (A93/B125). In his view our discursive intellect necessitates that the appearances that are given in perception be brought under the principles of the understanding for us to make truth judgments.

Although his epistemology is only applicable to our mode of existence, it is not restricted by the crudeness of our human sensibility. Kant allowed that our conceptual formulations can in the progress of experience (and experiment) be applied to "possible" perceptions "in accordance with the laws of the empirical progression", i.e. "in the footsteps of cause and effect" (A493/B521; A495/B523). Kant has no problem that we can "observe" very small objects; he even mentions the existence of the magnetic field force ("magnetic matter") in this regard (A226/B273). As long as a detailed causal structure can be established, scientists can apply some conceptual structure to appearances given in experiment.

In this regard it is presupposed that both our measuring instruments and the appearances that we measure belong to the same mode of existence (both of which can be given in perception), which Kant conceptualized as "nature". As such they share the same space-time structure that belongs to this mode of existence and stand (in accordance with the Kant's third analogy) in a "community" of relations with each other that are governed (in accordance with Kant's second analogy) by deterministic causality (just as we stand in such a relation with the objects of experience).

In the second part of the first *Critique*, Kant used the third antinomy to argue that another mode of existence (than nature) is not merely logically possible, but can be conceptually conceived of within his critical philosophy (see section 2.4). This is the "noumenal" or "supersensible" realm. The mode of existence which constitutes this realm does not stand in any "community" with nature; it is outside nature (taken as the totality of causal relations). Since human sensibility cannot reach outside nature and we do not (according to Kant) have an intuition which allows any experience of such a mode of existence (5:416), it is called a "supersensible" realm. This is the first characteristic of the noumenal realm that is confirmed in the quantum mode of existence (see below).

The supersensible mode of existence is also outside proper space and time. According to Kant we have two forms of sensibility in which intuitions are given, namely space and time. These provide us with the ability to perceive objects in space and time (A27/B43) and such perception (empirical intuitions) would constitute empirical space (A57/B81, A377, A431/B459; see note 1). Although the supersensible realm is not in space and time, we can accept that its ontologically different structure would be reflected in something similar to and corresponding with our space-time but which is not accessible to our forms of sensibility (see discussion in section 2.4.5). We can, therefore, in the same manner that we construct *a priori* geometrical space-time forms (taken from a contemporary perspective) which apply to our mode of existence, also construct abstract mathematical space-time forms (that we cannot visualize, otherwise it would be in our mode of existence) which would correspond to the supersensible mode of existence.

When we find that the pre-measurement quantum mode is not in proper space-time, but that we can nonetheless ascribe some abstract mathematical space-time manifold to it (see below, in quantum field theory), I take this as the second characteristic of the noumenal realm confirmed in the quantum realm. Since this space-time manifold reflects a different ontological structure (in the Kantian conception according to which structural relations reflect ontology) that stands in no community with our mode of existence (see section 2.4.5, note 1), I take this as implying that the quantum realm conforms to an ontologically different mode of existence. As such we can, without contradiction, allow that it is governed by a different rule than deterministic causality which

becomes conceivable in the framework of such a supersensible realm. Absolute spontaneity may be such a rule. Whereas nature is governed by deterministic causality, the quantum realm may be governed by spontaneity.

Which objects belong to the supersensible mode of existence? I previously (in chapter 2) showed that Kant distinguishes between the objects that we may encounter in experience and those that we can merely think of as existing outside nature. In the first *Critique* Kant calls this last kind "objects of understanding" or noumena. In the third *Critique* he develops a more sophisticated view based on arguments that such entities can produce not merely outcomes, but ordered arrangements of outcomes, within the framework of nature. As such he cast that mode of existence in terms of "wholes and parts".

In contradistinction with material wholes which are explained by the causal relation between the component parts (the parts determine the whole), Kant conceptualizes the idea of non-extended wholes and parts (existing in the supersensible realm outside space and time) according to which such wholes (and their parts) serve as ground and condition for the material parts and their internal arrangement (the whole determines the parts, see section 3.4; Allison 2012:203; McLaughlin 1990:129). In this case the non-extended wholes and parts are connected outside nature in such a manner that the parts are mutually the cause and effect of each other in the production of the parts that form the material whole. I argue below that the quantum mode of existence can also be characterized in these terms when superpositions of states are regarded as non-extended wholes-and-parts which produce a particular arrangement of outcomes where the states (parts) mutually produce "each other" (even non-locally) in multi-particle systems.

Kant casts these wholes-and-parts in the framework of a concept of causality, according to which such non-extended wholes and parts, which exist outside nature in the supersensible substratum of nature, would produce its effects within the framework of nature. He calls this "final causality" in analogy to the accomplishment of human ends. This kind of causality is viewed as a kind of capacity (potentiality) to produce certain outcomes in nature. In this regard this ideal causality (which we can merely think of) is grounded on the concept of spontaneous causality which can without contradiction be ascribed to the noumenal realm as was first discussed in the first *Critique* (see chapter 3). The concept of final causality is therefore also called a "spontaneity of a cause" in the third *Critique* (5:411). This is not merely a logical possibility; it is conceptualized as something that may conceivably really exist in the context of the supersensible realm. In my interpretation of quantum physics the reduction of the wave packet is understood in accordance with this kind of causality.

In this manner two kinds of appearance are possible in the framework of nature, originating from the objects of nature and noumena respectively, and produced in accordance with these two heterogeneous principles (deterministic and absolute spontaneous causality). The first is merely those appearances that belong to the causal structures of nature (which stand under the principles of the understanding); the second is grounded in the supersensible realm but produced in nature. These correspond with the two kinds of appearances that we observe in experiment, namely those in accordance with deterministic causality (even when regarded in stochastic terms) and those which result from the reduction of the wave packet. When we regard the reduction of the wave packet as an event in accordance with spontaneous causality, then these appearances reflect the Kantian distinction.

In total we can distinguish five essential characteristics of the supersensible realm in contradistinction with nature, namely that it is 1) supersensible, 2) outside space-time, 3) noumenal

entities are conceptualized as non-extended wholes-and-parts existing *outside nature*, 4) two heterogeneous principles govern the two modes of existence 5) two kinds of appearances can be discerned accordingly. The first three characteristics distinguish it as another mode of existence, i.e. as belonging to another ontology, the fourth involves the basic principle associated with that mode of existence. I will now show that these characteristics are confirmed in the quantum realm when we take superpositions of states as the supersensible mode of existence.

There is, however, an important manner in which I rework the Kantian program. Kant never envisioned the possibility that time could be combined, not with space, but with that "ideal" space which reflects the structural form of the supersensible mode of existence. There is no reason why time cannot also be logically and conceivably combined with the supersensible mode of existence – which would then be partially constrained in time. I argue that this is what we find in quantum mechanics where the superposition of states are described in Hilbert space, with the quantum system constrained in time. The result of this reworking of the Kantian system is that we can gain partial access to the supersensible realm – something that Kant did not think possible. One can even argue that this change makes another kind of intuition possible that Kant did not foresee, which would enable us to have some kind of experience of the supersensible realm (see note 2).

### 4.3. The quantum realm is supersensible

The one feature that uniquely characterizes all quantum systems is "superposition of states". This is something that we do not find in any classical system. What is a superposition of states? Albert writes: "Electrons seem to have modes of being, or modes of moving, available to them which is quite unlike what we know how to think about. The name of that new mode (which is just a name for something we don't understand) is *superposition*" (Albert 1992:11). In quantum physics the various possible states of physical systems (i.e. physical objects or collections of objects), which are mathematically expressed as "state vectors" (or wave functions), are entangled in such a manner that they cannot be individually distinguished without some loss in information. This entanglement of states is called "superposition of states" and the possibility of superimposing two states to form another is reflected in quantum mechanics by the possibility of adding or subtracting two such vectors (Albert 1992:30).

All physical systems have both intrinsic properties like mass and charge (which determine the kind of object) as well as variable or state-dependent properties (like position, momentum, spin, velocity, energy), which are called "observables" in quantum physics. They are represented by operators on the state space (the state space includes all the possible states of the system). Such representations would describe the physical system in terms of some property, for example the position or momentum representation. Various representations of the same physical situation is possible which is invariant among transformations between such representations (Healey 2009:xvi).

There is a fundamental difference between quantum and classical properties, which is also reflected in their mathematical formalization (Cartwright 1999:217). Even though the quantum properties of the system are called "observables" and they (in the relevant cases) assign a discrete spectrum of possible eigenvalues to the superimposed states in reference to probable outcomes, neither the superpositions of states nor their properties are in fact observable in experiment. As Van Fraassen says, quantum properties are merely a "theoretically described" reality which can never be given in experiment (Van Fraassen 2008:299). Quantum systems *as such* have no eigenvalues; they only have amplitudes. To realize some eigenvalue, another condition is required, namely classical realization (Auyang 1995:79) when the reduction of the wave packet produces a reduced state associated with an eigenvalue (taken on the individual level).

The reason why quantum properties cannot be given in experiment, is that the amplitudes associated with them are complex quantities while our instruments can only measure real numbers. Whereas some complex quantities can be decomposed into real and imaginary parts, which could be separately represented by real numbers, this is not the case with these quantum values. They are "irreducibly complex", they cannot be decomposed into real and imaginary parts (they have no real parts) (Auyang 1995:73).

Auyang (1995), who discusses this aspect of quantum physics in some detail, regards such irreducibility complex values as outside the possibility of human perception. In this regard she formulates a criterion which serves to decide what falls within the bounds of our form of perception, namely that we must be able to map object structures into a real number system or its direct products (which is possible, for example, when a complex number is decomposable into real and imaginary parts). Her arguments in this regard is that perception involves the ability to visualize which is not possible with regard to irreducibly complex numbers.

This irreducible complexity of the quantum states (superposition of states) and their amplitudes, as well as the amplitudes of the quantum properties, implies that *they are beyond our ability of representation in perception*. They can therefore never be empirically given in experiment (which is always representable in perception). Auyang writes in this regard: "In stipulating that quantities admissible as measured results [i.e. eigenvalues] must be real numbers, quantum theories make explicit a general limit to human empirical capabilities. The general form of our sensible capacity is representability by real numbers... Eigenvalues are numerical and fall within the bounds of our form of perception, whereas quantum amplitudes do not" (Auyang 1995:72; 81). The reduction of the wave packet takes the system from such irreducibly complex amplitudes to eigenstates which are associated with measurable real eigenvalues.

Although the superpositions of states and their accompanying quantum properties cannot be empirically given in experiment, they do exist in reality since they can be physically manipulated with observable effects. One can say, as Auyang does, that they are "kickable". This means that the quantum state (and its properties) is "a genuine feature of reality" (Cartwright 1999:232). But since no direct measurement of quantum quantities is possible, this mode of existence is clearly not the classical one. We can therefore think that superpositions of states embody another mode of existence than the classical one, a mode which is beyond the reach of our human sensibility and is as such supersensible.

The unmeasurable ("supersensible") aspect of entities in the pre-measurement quantum mode represents a change in ontology that is widely recognized. This is especially problematic in the case of entities which constitute quantum fields where field theorists have no clear idea as to what new ontology should replace the classical one (Bartels 1999). Healey writes in this regard: "[Whereas there is a problem with] quantum particle theories insofar as they leave it quite unclear what properties the particles have and when they have them, the problem becomes much worse in quantum field theory. For a quantum field theory removes even the basic particle ontology, while leaving it quite unclear what is to replace it" (Healey 2009:221).

### 4.4 The quantum realm is not in space-time

Another important feature of quantum physics, is that the space-time manifold associated with quantum states is distinctly different from the space-time that we know. In quantum physics abstract mathematical space-time (or: space) replaces proper space-time. Before discussing this in the

framework of Auyang's interpretation of quantum field theory, which in my opinion closely agrees with the Kantian position, I first focus on the restricted case where the pre-measurement quantum mode is constrained in time, namely quantum mechanics.

In contrast with the classical picture where particles can be described in terms of both time and space, in quantum mechanics the entities (in superpositions of states) could be described in time but not in space. They are described as mathematical objects (represented by state vectors or wave functions) in a mathematical space, called a Hilbert space (which is also the state space). The problem is to understand this space which is clearly not the kind of space associated with classical particles. Earman expresses this frustration vividly when he says that the path of the physical system is located in a Hilbert space, "which resides in Plato's heaven or wherever it is that Hilbert spaces reside" (Earman. 1986:203).

### 4.4.1 Hilbert space

The main problem is that in quantum physics the Hilbert spaces are complex vector spaces (Cartwright 1999:217). Although there have been efforts to describe quantum mechanics in a real Hilbert space (as was done independently by Mackey and Stueckelberg), these formulations merely make the complex nature of Hilbert space implicit, it does not remove it (Auyang 1995:74). The reason why the complex nature of Hilbert spaces is important, is that it reflects something about the nature of the quantum entities associated with that space-form if we interpret state spaces as reflecting the kind of the entities to which it belongs (as Auyang 1995:65 argues). As such we can take the Hilbert space as reflecting the ontology of the quantum state which has irreducibly complex amplitudes (in line with the Kantian view that space reflects ontology) and can regard it as *in some manner* reflecting the "quantum space" associated with quantum entities.

*In this reading the complex nature of Hilbert spaces is merely a mathematical expression of the fact that quantum states with their complex amplitudes cannot be represented in our space.* When entities cannot be represented in space they are not visualizable since this involves our ability to spatialize. In the Kantian approach, the representability of objects in space is closely associated with human perception which involves the ability to visualize objects in space (time is visualized as a line). For Kant this presents the limits of both human sensibility and understanding.

When entities cannot be visualized (i.e. their object structure cannot be mapped into a real number system – Auyang 1995:72), and therefore cannot be presented in space, *they belong to a different mode of existence than that which is accessible in sensibility*. They are supersensible (see the previous section) and outside space and as such they are difficult to understand.

Although the quantum state as it is in itself cannot be presented in space, some appearance thereof in terms of observable properties is nonetheless possible. Mathematically this is described by the representations of the quantum state (through linear operators on the Hilbert space) insofar as these involve a prescription of the eigenstates associated with the property as well as their eigenvalues and the probability of these appearing in observation. When we conceive of the quantum state merely in terms of its possible outcomes, we can say that it occupies some "probability" space; this, however, does not describe the quantum mode of existence but merely its appearance (in the classical mode of existence) in experiment. In this manner the position representation would describe the space-time points (regions) where the particle(s) could be found in measurement. In reference to this actualization in space-time, Bitbol (2007:258) says: "[In quantum physics] the objectified structures are state vectors or wave functions in a Hilbert space, and the situated appearances are experimental events occurring in ordinary space-time".

What is strange about quantum mechanics, is that although the quantum state is not in space, it is nonetheless evolving in time. In the move from classical to quantum mechanics, the new description entails the combining of time with mathematical space (i.e. Hilbert space) instead of the coordinates of ordinary space as before. In this regard space and time are not merely independent (as in Newtonian physics); they are decoupled when viewed in terms of special relativity and time is then coupled with that space associated with quantum states. The only relation between time and ordinary space that is retained, is the position representation which tells us what possible position values the system may have upon measurement (time is a parameter while position is an observable).

The time framework in the quantum mechanical description is taken from the Hamiltonian formulation which is incorporated in the Schrödinger equation. One can view the Schrödinger equation as extending the classical time framework into quantum physics. As such the most important contribution of the time framework is that it allows the quantum system to evolve continuously in time which in turn allows for the deterministic propagation of causes in this framework. The time parameter therefore allows the introduction of classical characteristics to the quantum system: the time *evolution* of the superposition of states is governed by deterministic laws which subject the state vector to given forces and constraints in a manner similar to classical equations of motion (Albert 1992:34).

We can read the time parameter as placing a (classical) constraint on the quantum mode (which is then in some manner constrained to be in time but not in space). The dynamic evolution of the quantum system, which is made possible through the time framework, constrains the superposition of states to evolve in a certain manner in time. In the quantum fields description (see below), the quantum system is not constrained in this manner. In placing this constraint (through the introduction of the time framework) on the quantum system, classical characteristics are effectively included with the quantum mode in one description. The classical characteristics are manifest in the deterministic evolution in time of the superposition of states which belong to the quantum mode of existence.

This strange combination of classical characteristics with the quantum mode of existence in one system is reflected in the way in which quantum particles differ from their classical counterparts. They are not situated in space-time like classical particles; they do, however, retain some definite classical characteristics (deterministic evolution) due to their continuous time evolution which disappears in the quantum fields description. When compared with the quantum fields description, on the other hand, where quantum entities have no classical particle characteristics at all, we can view the ascription of such semi-classical characteristics to those entities in the quantum mechanical description as a constraint on their ontology, i.e. they are constrained to evolve in a certain manner in time in the Schrödinger description. Quantum mechanics describes an in-between world where the classical and quantum modes of existence meet.

### 4.4.2 Space-time in quantum field theory

When we move from quantum mechanics to quantum field theory, the space-time manifold that belongs to special relativity is reintroduced (now both time and space are parameters). But what does it mean? As in all these matters, this depends on our interpretation thereof. In this regard I found Auyang's (1995) formulation and interpretation of quantum field theory (which is grounded on a Kantian approach) of special relevance to the present discussion.

Auyang first distinguishes free *matter fields* as idealized components of interaction fields, i.e. interaction is neglected (she later reintroduces it; Auyang 1995:129, 158). She then takes the idealized free local fields as representing the basic quantum entities in such fields (which are analyzable into local fields and their interactions; Auyang 1995:129, 158). As such these local fields correspond with the state vectors in the quantum mechanical description; the coupling between them corresponds with the introduction of superpositions (Teller 1995:104) which was previously described in terms of adding and subtracting vectors (in the vector formulation). The entities in the quantum fields are conceptualized as existing (with identities) before any definite descriptions of their qualities (properties) through (so-called "creation" and "annihilation") operators on their state space are introduced (similar to such descriptions of quantum states in quantum mechanics; Auyang 1995:170-2).

The entities that Auyang is concerned with are the "basic entities or individuals of the physical world" which are "extensionless in all four dimensions" (they have no space or time parts) even though they could be indexed in the framework of a "primitive" space-time manifold M (Auyang 1995:123, 129). These include elementary entities like electrons, but not field quanta. She calls these entities "events" to express the fact that their *indexing* in M involves both space *and time* (as such they have *the potentiality* to be realized in space-time). These "events" should not be confused with what is normally understood by events in space-time. (If Auyang's Kantian approach is not taken into consideration, it is difficult to understand her view; see Bartels 1999, Healey 2009:202).

In the same manner that the association of quantum states in quantum mechanics with a mathematical space (Hilbert space) reflect their quantum ontology, the entities in quantum fields are associated with a primitive space-time manifold that reflects their ontology (in the quantum mode of existence) before any definite qualities are expressed in ordinary space-time (Auyang 1995:183). According to Auyang, the primitive space-time manifold M is not something existing apart from the quantum entities; it reflects the structure of the real world of quantum entities (events). She writes: "Space-time is a structural property of the fields [i.e. field entities], not the other way round. This agrees with the common sense notion that the basic ontology is a thing, not a spatial region" (Auyang 1995:150).

The spatio-temporal structure M, in it's "coordinate-free [i.e. representation free] form, contains no explicit relations. It lacks notions such as contiguity, orientation, distance, extension, and all metric notions" (Auyang 1995:134). It is four dimensional and sets of four indexes are required to coordinate it. Insofar as time is concerned, M is "too primitive to confer special meaning on the time dimension... M is not in time; it is all time. More correctly, *it is the condition for the possibility of introducing the time parameter and the notion of being 'in time'*... [it] is independent of temporal concepts. It contains the time dimension as one aspect and makes possible the introduction of the time parameter, but *is itself beyond time and change*" (Auyang 1995:170; my accentuation). Only once events are actualized in some manner, are they represented mathematically as timelike or spacelike curves which are generated by mapping some part of a real number system onto the manifold M (Auyang 1995:171). This introduces constraints on the quantum mode; the quantum mechanical description involves such constrained conditions.

There are two aspects of Auyang's notion of "events" in M that are of importance to the present discussion, namely that these entities are conceptualized as existing beyond our representation of them and that (as such) their mode of existence is not in proper space-time; they are, however, "free to choose their own convention in expressing definite qualities" (Auyang 1995:183). This corresponds with the manner in which quantum states in quantum mechanics are conceptualized as existing in a Hilbert space beyond any representation of them (which characterizes their properties).

I take this description of quantum fields, instead of the quantum mechanical one, as the more suitable description of my conception of a "quantum mode of existence" since no classical constraints are placed on it. For me the quantum mechanical description represents a constrained subsystem of that conception, for example, when such a state is represented in the Schrödinger formulation as evolving in time. As such the quantum mode of existence (in the fields description) does not merely stand in contrast with the classical mode of existence; it can also be sensibly compared with Kant's supersensible realm which is outside space and time.

Auyang's formulation explicitly builds upon the Kantian conceptual framework in which appearances (representations) of objects are distinct from the objects as they are in themselves (Auyang 1995:99-100). In the framework of my third alternative in Kantian interpretation, we can distinguish in this regard between the transcendental object and noumena (see section 2.4.2). When we consider the everyday objects of experience, Kant says that we have a direct awareness of their reality. As the ground of those appearances which stand under the principles of understanding, it is conceptualized in the Kantian system as the "transcendental object", which does not refer to any particular object; it is the completely undetermined thought of the object of sensible intuition in general which is the same for all appearances (A251, A253).

In the case of noumena, on the other hand, there is a gap between the appearances in nature associated with these objects and the objects themselves which exist outside space/time (and nature) in a supersensible realm and are the spontaneous cause behind the associated appearances. Although Auyang does not distinguish between the transcendental object and noumena (or even mentions these), it is immediately clear that Kant's conception of noumena corresponds closely with her conception of extensionless objects (events) in quantum fields. Just as is the case with noumena in the supersensible realm, the quantum mode of existence is also supersensible and outside space-time (replacing space/time) in the case of quantum field theory, whereas the appearances caused by these quantum entities are in space-time.

## 4.5 The quantum realm is outside nature

The existence of the quantum mode outside space-time has serious implications for the manner in which we conceive of the entities in that mode of existence. We can now consider the entities that belong to the quantum mode in more detail and ask how they differ from those existing in the classical mode? From a Kantian perspective things can only consist of matter if they can be presented in some manner in space/time (matter constitutes that which exist in the framework of the divisibility of space). This means that entities that belong to the quantum mode of existence (when they are in that mode of existence), do not consist of matter. They are not aggregated wholes which can be divided into smaller parts to which properties can be individually ascribed.

### 4.5.1 Wholes-and-parts

We can distinguish between aggregated wholes that exist in space-time and non-aggregated wholes (wholes-and-parts) existing in the quantum realm in the same way that Kant does in the third *Critique.* As such the superimposed states are taken as the parts that together form entangled superpositions of states or wholes. As in Kant's conception, these parts and wholes are non-extended (i.e they do not occupy proper space-time; section 4.4). This means that these wholes-and-parts cannot as such be individualized as extended entities in space-time; it is not possible to map real numbers onto the individual superimposed states. We can, nonetheless, *conceptualize* quantum entities in terms of parts and wholes, i.e. as wholes-and-parts.

In calling the non-aggregated wholes "wholes-and-parts", I try to capture something about the interwoven nature of such entities. In quantum physics the superposition of states, which I take as the basic feature of the quantum mode of existence, makes the superimposed states possible (insofar as they exist in that mode as physical states) as states that cannot be individually distinguished empirically – neither as states of a single particle nor that of multi-particle systems. Even in the case where the system is comprised of fundamental entities like electrons, for example when the electron cloud of the helium atom is considered, it cannot be decomposed into well-defined states with measurable properties (Albert 1992:49). The states in such multi-particle systems are said to be "nonseparable" (in contrast with the "mixtures" produced after the reduction of the wave packet).

As long as the parts (states) are not individualized (in experiment), variable properties cannot be assigned to them individually (i.e. locally in a spatial region). This is confirmed by the EPR experiments which tested for hidden variables, i.e. variables (properties) which are supposed to be hidden because they cannot be directly measured or controlled. According to a paper by Einstein, Podolsky and Rosen (1935; EPR) the individual quantum states should already possess values associated with these variables before they are measured in experiment. Using the proof developed by Bell, the EPR experiments, especially that done by Aspect, confirmed that such variables do not exist.

In quantum physics we can conceptually distinguish the different states that belong to the entity or entities simultaneously, both in single and multi-particle systems. Although these states cannot be realized in space-time and their existence demonstrated empirically, they can in principle exist physically in the quantum mode of existence. We can therefore *think* that they exist as real, albeit non-individualizable, parts in the whole. This, however, is not the classical mode of existence in which properties can individually be ascribed to these parts. From our human perspective, they can only be regarded in terms of their *possible* realization.

When we take the superimposed states as the parts that constitute the whole, we broaden the Kantian conception where parts refer to fundamental entities. Kant took Leibniz's monads as point of departure for his concept of noumena (Cicovacki 2010:85; Friedman 2010:243); he regards them in the third *Critique* as non-extended fundamental parts which together comprise supersensible wholes. In his reinterpretation of Leibniz's view in *Metaphysical Foundations of Natural Science* these parts of are even called simples: "*[T]he composite of things in themselves must certainly consist of the simple, for the parts must here be given prior to all composition*. But the composite in the appearance does not consist of the simple, because in the appearance, which can never be given otherwise than as composed (extended), the parts can only be given through division, and thus not prior to the composite, but only in it" (Kant 2004:4:507-8). At bottom, in multi-particle systems it is in fact these fundamental entities (through their states) that are coupled into wholes-and-parts as Kant proposed.

The main feature of such wholes-and-parts are that they are beyond our sensible reach and as such Kant concluded that, although we can think them, we are nonetheless not able to understand them (see section 3.4.3). In this regard his view prefigured (motivated?) that of Bohr who recognized the limitations of the use of our classical concepts which would not be definable in quantum context. Bohr, for example, accentuated the unknowability of quantum properties before the reduction of the wave packet which he grounded in its undefinability (Redhead 1987:50).

### 4.5.2 Non-locality

The wholes-and-parts that we (conceptually) associate with superpositions of states of multi-particle systems are not only non-extended and non-separable; they are also *not linked (coupled) within the space-time framework* even in the quantum mechanical description. This becomes clear when we consider the mathematical (vector) formulation of such wholes-and-parts, namely as a product of state vectors in Hilbert space. *As such the relation between the wholes-and-parts are independent of the distance between the different entities involved; it is also independent of time*. Proper space and time do not enter in any manner in this description of the relation between the state vectors which means that the physics described by this formulation (i.e. non-separability) is independent of space-time; it operates outside proper space-time.

The relations between the wholes-and-parts are not governed by proper *space-time*. The relations between the parts are not structured in proper space (insofar as they are in complex Hilbert space); *the relation between the parts are not dependent on time either* (the time framework does not govern the relation between the parts, only the dynamic evolution of the system as a whole is in time). This means that the relations between wholes-and-parts are not merely outside proper space (see section 4.4.1); these relations exist in fact *outside space-time* (its time-independent nature is implicit in the theory) even though the superposition of states on the whole is constrained in a certain manner in time. We can view the dynamics described by the Schrödinger equation as placing a certain constraint on the whole-and-parts description given by the product of state vectors.

*Although the quantum mode is constrained in time insofar as its dynamic evolution is concerned, the quantum mode itself insofar as the internal relations of its wholes-and-parts are concerned are not presentable in space-time.* Wholes-and-parts are internally related and linked outside space-time within the quantum mode of existence. Their relation is not that between aggregated parts in space-time, but between non-extended, non-separable parts outside space-time to which measurable properties cannot be individually (i.e. locally in some spatial region) ascribed (that would be to allow for “hidden variables”). In that sense they are in fact beyond space-time similar to what is specified for entities in quantum fields which exist outside proper space-time before their realization in space-time.

The rules governing spatio-temporal relations between objects only apply insofar as objects are in fact related to each other in space and time. In Kant's epistemology the principles of the understanding (which govern objective cognition) only apply to appearances in space and time. Even Kant's second analogy which governs temporal relations between appearances given in perception, presupposes spatial relations since both the material and formal (i.e. spatial relations) aspects of perception are synthesized together into unified perceptions which are brought under the rules of the principles of the understanding.

When spatial and temporal relations between objects or parts of objects are, however suspended, these principles (rules) are also suspended. Insofar as wholes-and-parts in quantum physics exist outside space-time, those classical rules guided by deterministic causality, do not apply to them. They are not deterministically connected insofar as that principle is restricted to Lorentzian space-time in the framework of special relativity. One can say that the lawful regularity that we assign to theoretical terms that denote the properties of objects consisting of matter (in space), is not applicable to quantum systems (Earman 1996:94). (This obviously does not mean that theoretical formulations, such as the product of state vectors, cannot be used to describe physics beyond space-time although in that case we are restricted in our understanding of the reality described).

In quantum systems the wholes-and-parts are non-extended and their interrelatedness very different from classical parts and wholes (via non-separability). This difference is not only reflected in the relations between wholes-and-parts being outside proper space-time, it is also reflected in the fact that there is no community between these different kinds of wholes existing in these different modes of existence. This is manifest in the fact that we cannot access that realm experimentally (even if we could bring the infinity of deterministic relations in nature into account) since there are no real wholes or parts (with real amplitudes) that can commune with our mode of existence. This means that the pre-measurement quantum mode (in quantum mechanics one would say, the internal relations governing wholes-and-parts) is outside nature – the causal relation which governs our mode of existence (nature) do not extend to the quantum realm.

Wholes-and-parts are not causally connected! This is also the Kantian position in the third *Critique*, namely that the wholes-and-parts that belong to the supersensible realm are outside nature, and therefore not regulated by deterministic causality. As such deterministic causality (called "mechanism" when applied to nature as a whole) does not apply to the internal relation between wholes-and-parts. Whereas (deterministic) causality regulates the relation between aggregated wholes consisting of parts in space/time, Kant conceptualized another kind of relation between these wholes-and-parts, in which the parts are together the cause and the effect of their realization in the framework of material wholes.

This interpretation is supported by the EPR experiments. In this case two particles produced by some source, which do not have well-defined spins, travel in opposite paths along the two arms of the apparatus. When the spin of the one particle is measured, the other is immediately determined, i.e. even though there is no time for the two outcomes to communicate their results. The interaction between the entities is therefore not something that happens locally in space or time. This allows us to say, as Albert does, that "the assumption that the physical workings of the world are invariably local must (astonishingly) be false" (Albert 1992:69).

Since the Bell proof involves the hidden assumption of deterministic causality as Redhead has demonstrated, the experiments also proved false the idea that everything in the world is deterministically connected (Redhead 1987:90). Redhead also formulated a version of the Bell inequality that is not dependent on local hidden variables and showed that the violation thereof negates even "stochastic" determinism, by which I mean that even stochastic causal links between the entities are dismissed (Redhead 1987:83, 103).

Non-separability (as described by the product of state vectors) is not merely characterized as operating outside proper space-time; it immediately implies that determinism (as defined above) is also not applicable in such contexts. The non-locality demonstrated by the Aspect experiment involves giving up on determinism. All interpretations of quantum mechanics can agree that non-separability as described by the product of state vectors is independent of space-time and that deterministic causality does not apply to the extent that this concept is taken to apply only within Lorentzian space-time (there is still the possibility that we may think of determinism in other terms, for example, in the Bohm interpretation; see below).

When we regard the arrangement of the EPR experiments in the context of my Kantian interpretation, we can say on the one hand that the dynamic evolution of the superposition of states in the time framework is in accordance with deterministic causality (because it is continuous in time). The internal whole-and-parts relations between the states of the two entities in the two arms of the apparatus, on the other hand, insofar as they are situated outside space (they cannot be presented as continuously connected in space; we can only ascribe some mathematical space to

them) and are independent of time (i.e. the interaction happens across a temporal gap; Cartwright 1989:249), are not governed by such causality.

Since the whole-and-parts connection is not in space it is independent of spatial relations and distance; since its internal relation is independent of time it is also not constrained to be continuous in time. As such the relations between the wholes-and-parts are not governed by deterministic causality which I take (with Redhead) as being restricted to the space-time framework. As such, the w*holes-and parts also do not stand in any community with the objects of our mode of existence (for this it has to be part of the causal network of nature). This allows us to say, without contradiction, that they belong to another mode of existence where deterministic causality does not apply*. As such their internal relation operates non-causally and non-locally just as is indeed found in the EPR experiments.

We can understand the results of the EPR experiments as not merely confirming quantum non-locality, but more specifically that such wholes-and-parts *exist* (there is obviously a real connectedness between the states of the quantum entities) and that this whole-and-parts is not locally in space-time. The states of the two entities exist as wholes-and-parts that cannot be individualized (localized) in space; they are connected non-locally (i.e. outside space-time). As such they exist outside nature where deterministic rules do not apply. In Kantian terms we can say that the superimposed mode of existence is not in nature and is therefore not guided by deterministic causality in any relations between the whole-and-parts.

In quantum mechanics, where time and Hilbert space are coupled in one system, we can ascribe deterministic causality to the system's evolution in time (the time framework incorporates the classical characteristics), but we cannot do so regarding the internal relations between its states (which are in the quantum mode of existence). Since classical characteristics are combined with quantum modes in quantum mechanics, two heterogeneous rules are brought together in one system. The deterministic causality that is associated with the classical mode of existence does not carry over to the internal relation between the wholes-and-parts in the quantum mode of existence.

### 4.5.3 Quantum probabilities

The outcomes of measurement can now be understood in terms of parts and wholes. The reason for this is clear: although the quantum and classical modes of existence are described very differently in terms of parts and wholes, they are nonetheless both describable in such terms. Whereas superpositions of states can be conceptualized in terms of non-aggregated wholes-and-parts, the outcomes of measurement involve aggregated wholes defined in terms of probabilities in accordance with the Born postulate (the individual outcomes form an aggregated whole as in all probability formulations).

Since definite values cannot be assigned to pre-measurement states in superposition, the outcomes are accordingly not determined by such values; they are given probabilistically. In fact, since causality (even stochastic causal links) does not extend from the classical mode to the quantum mode (see above), there is an ontological gap between the non-aggregated wholes-and-parts in the quantum mode and the aggregated parts and wholes that obtain in measurement in the classical mode; a gap that can only be crossed probabilistically.

We should, however, not think of the outcomes of quantum measurements merely in terms of probabilities of possibilities (possible outcomes judged probabilistically). Quantum measurements do not merely involve a possibility of outcomes judged in terms of probabilities – which can also

refer to many possible transitions and (re)arrangements among the parts of an aggregated whole in space-time. Such probabilities only involve objects in space. It is merely concerned with the relation between two situations in space, namely before and after the outcome for which the probability is calculated. In contrast, in quantum measurements there is a transition from a non-aggregated whole in the quantum mode of existence outside nature to outcomes as part of an aggregated whole in the classical mode of existence in nature. What is needed in this case is some description which captures the capacity or potentiality (not merely the possibility) to produce outcomes in accordance with certain probabilities.

The idea of viewing quantum systems in terms of potentialities goes back to Heisenberg's later writings. He invoked the Aristotelian idea of potentiality, namely that all change consists in the actualization of potentialities, to describe the relation between the quantum state and its outcomes. Margenau also thought in terms of propensities or latent quantities, i.e. that the measurement of an observable converts latent values into possessed values (Redhead 1987:48). More recently Hughes (1989) presented an event interpretation of quantum mechanics in which quantum properties are replaced by "latencies". When a particular latency is ascribed to a quantum system, probabilities are assigned to the values of a family of observables which would be realized in events (Hughes 1989:309). Teller (1995), who also understands superimposed (i.e. quantum) properties in terms of propensities, applies such concepts to quantum fields.

Although potentiality or propensity captures something about the capacity of the quantum state to produce its outcomes, it does not necessarily capture what happens when two different modes of existence are involved in the process (the concept of potentiality can still apply to changes within the same mode of existence). When such potentialities are not viewed as existing outside nature, *non-locality cannot be accounted for even when the quantum outcomes are viewed in terms of potentiality and actualization.* The reason for this is that such potentiality would then be situated in the proper space-time manifold where such non-locality is in conflict with determinism. Even in the Bohm interpretation, where non-locality is viewed in terms of action-at-a-distance, a certain potential (the "quantum potential") that is not in proper space (it is in an abstract so-called "configuration" space), is necessary to complete the picture (Hiley 2010). In this case the interaction between the particles, which are thought to be in space-time, happens through "action-at-a-distance" made possible by the quantum potential.

This means that it is not enough to acknowledge the difference between the quantum and classical worlds (Hughes 1989:316; Teller 1995:); it is also necessary to say what is going on in the actualization of quantum potentialities. Where is this potentiality to be found and how does its actualization work? What is important here is that things are actually produced within the framework of the classical mode of existence, i.e. something is brought into existence in nature (although not into existence *per se*). The transition from wholes-and-parts involves the realization of parts with definite properties. The quantum mode has the potentiality to produce something that has not existed previously *in nature.*

Kant conceptualized *the capacity* of non-extended wholes-and-parts in the supersensible substratum of nature to produce extended parts and wholes in nature (and space/time) in terms of a "formative force" (Kant speaks of "self-organization" in this regard; see section 3.4.1-2) that works hand in hand with a different, ideal kind of causality (called "final causality"), which stands in contrast with Newtonian forces. In this regard the non-extended, interlinked parts have the capacity or potentiality to together produce the arrangements of parts in the extended aggregated whole. This potentiality is grounded in absolute spontaneity: it is not merely that this potentiality is outside space-time and therefore non-determinate in the sense of not partaking in the causal structure of

nature; it is that *this potentiality has a certain ability to from itself produce effects in nature*.

As such the quantum realm is not merely non-deterministically connected (as wholes-and-parts); it also has a spontaneous potentiality to produce outcomes in nature. Without such a spontaneous potentiality it is difficult to see why quantum objects which are outside nature, would produce outcomes in nature. This means that we move beyond a mere negative description of the quantum realm as outside space-time and nature; we accept that this realm can be positively characterized (i.e. thought of as a "noumenal" realm) as accessible for a different kind of intuition than ours, as belonging to a different abstract space-time structure (in some manner corresponding with our space-time) and operating in accordance with an absolute spontaneous potentiality that can produce outcomes in nature. We therefore go beyond the mere logical possibility of such spontaneity (as in Bohr's position) to the conceivability thereof. As such I regard the quantum mode as a different ontological mode, through which absolute spontaneous potentiality becomes possible; *as a different mode of existence it serves as condition for the possibility of absolute spontaneity*. We can furthermore conceptualize this spontaneous potentiality in a positive manner as I do (following Kant's approach).

This view stands in contrast with that of Bohm (1952, 1957) who also allows for a similar potential (also characterized as a "force") but whose theory is purely deterministic. In his case the potential is closely connected with his acceptance of action-at-a-distance. Although Kant also tried to accommodate (Newtonian) action-at-a-distance in his philosophy of science presented in *Metaphysical Foundations* (1786) where he discusses it in the context of his concepts of the repulsive and attractive forces in nature (4:513-9), it seems to me better to discard his view expressed there in favour of the one presented in the third *Critique* (1790) which I use here in my interpretation. In this case the entities *and* their connectedness are outside space-time. In a certain sense one can consider it as "action-at-a-distance" with respect to outcomes but it is obviously not taking place over any "distance" in space-time. This means that it can co-exist with special relativity which is only concerned with causality *within* proper space-time.

The different kind of causality that Kant conceptualizes in the context of wholes-and-parts, stands outside the deterministic causal network that belongs to nature, but produces effects in nature. The parts produce each other mutually in their realization in nature. As such each part is the "cause and effect" of the other in contrast with aggregated parts that cause an effect on each other. In Kant's view this kind of causality involves an inter-linkage between the parts that is not only very different from the classical causal series, but which has a certain capacity to collapse into it.

Although Kant applies this general concept to the biological products of nature, there is no reason why it cannot be applied to any structure in nature that is considered to be produced in this manner (see section 3.4). In this regard the space-time realization of elementary quantum particles (like electrons) with definite qualities adheres to the Kantian conception: both in producing certain "arrangements" i.e. arranged in accordance with probabilities of outcomes, as well in "producing each other", i.e. that the realization of the outcomes are non-separably (and even non-locally) linked.

We can conceptualize, at least problematically (albeit with the risk of oversimplification), the states of particles in quantum systems as virtual properties of entities that are interlinked with each other in the manner that Kant proposes (since they are not realizable in space, individual property values cannot be ascribed to these entities). As such the virtual properties of entities and their inter-linkage can be viewed as having a certain capacity to produce outcomes in nature, that is, as a certain kind of causality behind the outcomes. We can *think* that this linkage (coupling) involves a certain

tension of which the spontaneous relaxation would result in a collapse according to which a whole-and-parts (or even only some part of it in the case of large superpositions) is realized as individualized parts in the framework of an aggregated whole. According to the Kantian conception, this process, which belongs to the supersensible mode of existence, starts totally from itself and is therefore absolutely spontaneous (for us). We have no direct empirical access to it.

In the Kantian view the entities in the supersensible realm, as the substratum of nature, could produce very complicated ordered structures in the framework of nature. Even in this regard the application to quantum physics holds. Auyang writes: "[A]ccording to the current standard model of elementary particle physics based on quantum field theory, the fundamental ontology of the world is a set of interacting fields" (Auyang 1995:45). If we take Kant's supersensible substratum of nature as being confirmed in the network of quantum fields that underlie nature, and through which nature came into being, the agreement seems to be complete.

I have now completed my arguments that the quantum state, in a superposition of states, is in another mode of existence than the classical one. I based this interpretation on various characteristics of the quantum system which together completes this picture, i.e. that its states and amplitudes are supersensible (unmeasurable), that these are not representable in space-time (another, mathematical space-time has to be associated with it) and that the superimposed parts conceptualized as wholes-and-parts are non-locally (and non-causally) linked and therefore do not stand in a community with the objects belonging to our mode of existence.

I take this to mean that the quantum mode of existence (especially in the quantum fields description) adheres to the basic characteristics of Kant's supersensible realm, namely that it is supersensible, not in space-time and outside nature. I therefore identifies Kant's supersensible realm with the quantum realm. My analysis shows that the basic rule governing nature, namely deterministic causality, does not apply to this realm. We can without contradiction think that another law, namely spontaneity, governs that mode of existence. I have shown how such a spontaneous potentiality can also be positively conceived of in this context.

### 4.6. Spontaneity

With this background, I am in a position to introduce one of the most important but also most controversial aspects of quantum physics, namely the "reduction (collapse) of the wave packet". The reduction of the wave packet is said to take the system from the quantum state to reduced states. On the level of the ensemble it takes the superposition into a mix of pure (eigen)states. Individually it takes superpositions into the components of the superposition (Cartwright 1983:168). In Von Neumann's well-known formulation it is incorporated in the theory as a "replacement rule" according to which the equation of the quantum state (in a superposition of states) is replaced with the equation of the eigenstates with their associated eigenvalues (Earman 1986:207). It is called the projection postulate. With the reduction of the wave packet a substantive element of indeterminism which cannot be reduced to deterministic causality enters quantum physics (see below).

#### 4.6.1 The various views

The well-known interpretations of quantum physics can in my opinion be grouped together in three general views regarding the projection postulate. The first view rejects it, the second view combines it with measurement and the third view regards it as independent of measurement. Those adhering to the first view do not think that the projection postulate is a necessary feature of quantum mechanics and they drop it altogether from their formulations. In their understanding of quantum

physics there is no reason for thinking that the projection postulate has reference to any physical process. In this view the gap between the quantum and the classical realms disappear (Hughes 1989:311).

The interpretations that belong to this view are Bohm's theory, that uses a guiding equation to define the positions of the particles (or configurations of fields) described by the wave function, Everett's "relative state" formulation according to which subsystems "branch off" from the state vector of the universe, and Van Fraassen's modal formulation according to which the quantum state delimits what is possible whereas measured properties say what is actual (for discussions of these views, Healey 2009:274; Hughes 1989:311; Earman 1986:223). Bohm and Everett tried to preserve determinism, Van Fraassen accepts non-determinism.

These views stand in opposition to my own because I argue that we have good reason to think that the quantum realm is ontologically different from the classical realm (see section 4.5). If this is indeed the case, the reduction of the wave packet would be a physical event which involves a move from one mode of existence to another.

From my perspective the main problem with these views is that, although they achieve a unified position in bringing the quantum and classical descriptions together, they cannot achieve a truly unified picture of the world if non-determinism is not explained. In Van Fraassen's approach non-determinism is merely accepted, not explained. Although the other views may overcome the problem of spontaneity associated with the reduction of the wave packet (in not taking it as a physical event), they run into problems when trying to overcome another aspect of the same problem, namely the non-determinism inherent in the structure of the two-particle collapse as demonstrated in the EPR experiments. This means that the outcomes – even if they all occur in different worlds – cannot be deterministically decided (which will be in which world?).

In the case of Bohm's theory where determinism is said to be preserved (although not through deterministic causality but through the quantum potential), it may be difficult to give a realistic description of quantum fields insofar as both the complete deterministic picture as well as the Bohmian view of quantum particles in space-time are concerned given the spontaneous nature of field excitations and the difference in ontology (Hiley 1999; Healey 2009:209-11, 221). One should ask if such solutions, which may reflect metaphysical (to keep determinism), pragmatic (for simplicity) or other factors, are not forcing some view onto our world which may in fact encompass (at least) two ontologically distinct realms governed by different rules (determinism and spontaneity) that come together in quantum mechanics.

The second view was that held by Von Neumann and Wigner. According to Von Neumann's formulation in *Mathematical Foundations of Quantum Mechanics* (1932) the superimposed states of the quantum object couples with the classical indicator states of the measuring apparatus to form a larger superposition of states in an accumulative process that would eventually include even the observer's consciousness (subjective perception). As such, it is the consciousness of the observer that in the final instance causes the collapse of the wave function and produces a final state in which a measured eigenvalue is realized.

In this approach the consciousness of the observer serves as cause for collapse. It seems quite a metaphysical leap to include consciousness in this manner. I argue below that collapse is also triggered without measurement, in which case consciousness would play no role. I agree with Cartwright (below) that reduction could happen independent of measurement. In my view a measurement is registered when the reduced state produced by the reduction of the wave packet

(which I regard as belonging to the classical mode; see Cartwright 1999:229) interacts with classical instruments. The consciousness of the observer has no influence on the measurement.

The third view was held by Niels Bohr and is defended by Cartwright (1983), Hughes (1989) and others. In this view the reduction of the wave packet is not understood in terms of measurement. Rather, the reduction of the wave packet is viewed as a physical event that can be distinguished from measurement. Although this view has something in common with that of Ghirardi-Rimini-Weber who also hold that collapse is a spontaneous physical event, it upholds the classical formulation whereas they introduce small amounts of non-linearity to the wave equations.

Among the proponents of this view is Hughes who mentions that, in at least some views of the first kind (see above), the rejection of the projection postulate is based on considerations that relate solely to measurement. He argues that the projection postulate and measurement are, however, conceptually separable (Hughes 1989:299). Cartwright (1983) also argues that the reduction of the wave packet is independent of measurement. She regards it as a transition from one quantum state to another. Since her view has a lot in common with my own, I discuss it in more detail below.

4.6.2 How to accommodate spontaneity?

Cartwright defends two features of the reduction of the wave packet, namely that it is independent of measurement and that it is a spontaneous transition from one quantum state to another. Regarding its association with measurement she writes: “[O]n my view, as in the old quantum theory [i.e. Niels Bohr's view], reduction of the wave packet occurs in variety of situations, and independent of measurement. Von Neumann claimed that reduction of the wave packet occurs when a measurement is made. But it also occurs when a quantum system is prepared in an eigenstate, when one particle scatters from another, when a radioactive nucleus disintegrates, and in a large number of other transition processes as well” (Cartwright 1983:194).

Cartwright views atomic decay as the paramount example where the reduction of the wave packet occurs without any intervention. The “spontaneous emission” of some particle is the “classic indeterminate process”. By this she means that it is absolutely spontaneous without any cause in the causal chains of nature. Which atom will decay, or when, is completely indeterminate. Suddenly, without any external influence, the reduction of the wave packet initiates a transition from one state to another: “In some circumstances a quantum system will make a transition from one state to another. Indeterministically and irreversibly, without the intervention of any external observer, a system can change its state: the quantum number of the new state will be different and a quantum of some conserved quantity – energy, or momentum, or angular momentum, or possibly even strangeness – will be emitted or absorbed” (Cartwright 1983:179). She views measurement in these terms: only when systems exchange energy, is the detector activated and some observable quantity measured.

Cartwright regards non-deterministic motions like the reduction of the wave packet just like deterministic ones as “naturally” occurring events (Cartwright 1983:202). Although she presents her view in the framework of quantum statistical mechanics, she does not think that some deterministic stochastic process underlie such motions. They are absolutely spontaneous. A question then arises: How do we accommodate such freedom as part of a law-governed world? (how is it reconciled with determinism?) Since as scientists we have no choice but to ascribe lawfulness to the world (this lays at the heart of all theoretical science; see my discussion in section 3.2), how would we reconcile such spontaneity with the deterministic lawfulness of nature? Cartwright's answer is that we should give up on “theoretical laws”. She thinks that we should consider scientific (phenomenal) laws in

the context of a "dappled world" (Cartwright 1999; 1983). As such she does not explain the possibility of freedom (in contradistinction with determinism) or how it is to be reconciled with determinism.

I agree with Cartwright that the reduction or collapse of the wave packet involves a transition. I, however, take this not as a transition between quantum states in general, but as a transition between quantum states and reduced states, where this process could include transitions to other quantum states. The reason for viewing this transition in more restricted terms is that "reduction" of the wave packet does not refer to all the transitions involved, but to the transition from quantum modes to reduced modes. It is this transition which produces the emission or absorption of "some conserved quantity – energy, or momentum [etc]".

We can say that the quantum mode has the potentiality *to spontaneously induce* a transition to reduced states with measurable properties. In this regard we can conceive of the operators in quantum mechanics as transition operators which tell us what property values can be realized when a transition of a particular kind takes place. In this regard I agree with Cartwright when she says that the probabilities in quantum mechanics are not position probabilities or probabilities for other values of classical dynamic quantities, but transitional probabilities (Cartwright 1983:179, 191; see section 4.5.3).

In the reduction of the wave packet we are primarily concerned with the transition from a superposition of states to reduced states (even though the system may still be in a superposition of states insofar as another complementary property is concerned – see below), from the quantum mode to the classical mode, although other transitions between quantum modes could also be involved. As such the reduction of the wave packet could be viewed in terms of causality, where effects are produced in the classical realm. In this regard Cartwright mentions that transition plays a "causal role" in quantum mechanics (Cartwright 1983:182). Elsewhere she argues that, in the EPR experiments, the mathematics allows us to say that the quantum state operates as the common cause behind both outcomes (Cartwright 1989:249). This agrees with my view that quantum wholes-and-parts are the spontaneous cause behind outcomes (see section 4.5.3). I conceptualize the superposition of states as non-extended wholes-and-parts that are realizable as aggregated parts that together constitute some probability class.

When we view the reduction of the wave packet as belonging to another ontology, namely the quantum mode of existence *outside nature* (see section 4.5), it is easy to accommodate its spontaneous character. We can just say that the wholes-and-parts in the quantum mode has the capacity or potentiality to spontaneously introduce a transition from one state to another. Insofar as the transition involves a transition to reduced states, we can view it as a kind of spontaneous causality that has measurable effects in nature which cohere with other effects produced in accordance with deterministic causality (this is how we know that such an effect has been produced).

*In my reworking of the Kantian position, this might be formulated as the potential that superpositions of states existing outside proper space-time (and the quantum properties associated with them) have to spontaneously make transitions to other quantum states as well as reduced states with individualized property values (of that observable) in space-time.* In contrast Bohm's quantum potential, which is also said to involve an underlying structure outside proper space-time that impacts on outcomes in space-time, is generally viewed in deterministic terms.

Since the quantum realm is outside nature and its whole-and-parts relationship is not governed by

deterministic causality, this different kind of lawfulness and the associated causality that characterizes this mode can without contradiction be ascribed to it (and even be conceived of as argued above). Since no community exists between nature and such wholes-and-parts (see section 4.5.2), it is difficult to see how determinism (as we normally understand it) can be operative in both realms. We are therefore justified in ascribing a different kind of lawfulness to the quantum mode of existence, namely absolute spontaneity, which stands in opposition to the deterministic lawfulness of nature. Insofar as effects in nature are produced in accordance with this lawfulness, we can conceptualize it as another kind of causality than the deterministic causality which operates in nature. This spontaneous causality grounds the potentiality that wholes-and-parts (in accordance with Kant's concept of "formative force") have to produce phenomenal outcomes.

When we take the quantum realm as Kant's supersensible realm (as I argued above), then spontaneous transitions between quantum states are merely in accordance with the law of freedom (also called the transcendental idea of freedom or the "concept of a causality through freedom" (5:195-6)) that Kant ascribes to that realm. Then the reduction of the wave packet is merely in accordance with the spontaneous causality which he first introduced in the first *Critique* and later used as basis for the "formative force" that he introduces in the third *Critique*. This kind of causality is grounded in the context of the wholes-and-parts in the quantum realm, which correspond with Kant's noumena or non-extended wholes-and-parts. This causality coheres with deterministic causality insofar as its outcomes in nature are concerned (section 3.5.1).

### 4.6.3 Spontaneity and measurement

There is, however, an outstanding question: Even if we accept that the reduction of the wave packet occurs in a variety of situations, it nevertheless seems possible that it is *also* triggered (i.e. controlled) in measurement. If this is so, the question arises: How do we reconcile the spontaneity of the reduction of the wave packet with the seemingly conflicting observation that it can be triggered in measurement? This seems to represent two conflicting positions, namely that collapse is spontaneous and that it is non-spontaneous. To understand this, we should again consider the peculiarities of the quantum mechanical description (in contrast with quantum fields).

There are two features of quantum mechanical systems that are of importance at this point. The first is that the quantum mode of existence (i.e. superpositions of states) *is constrained* with the incorporation of the time framework in the context of the Schrödinger description in quantum mechanics (in a manner not found in quantum fields – see section 4.4.2). In its dynamic evolution, the superposition of states evolve in time and is governed by deterministic lawfulness which subject the state vector to given forces and constraints in a manner similar to classical equations of motion. This evolution constrains the other kind of dynamics (so to speak) that belongs to the product of the state vectors (the inseparability of wholes-and-parts; formulated independently from the Schrödinger description) which in my interpretation are governed by the law of spontaneity that drives a different causal process where the parts are the cause and effect in the production of each other in nature (which can also be conceptualized as a "formative force" as Kant does). What we find in quantum mechanics, is that the dynamic evolution subjects the lawfulness that belongs to the internal relations of wholes-and-parts.

This means that when deterministic causality (in the time framework) and spontaneity (in the wholes-and-parts framework) are both included in quantum systems, the first has superiority over the second. The reason is simple: we cannot have determinism when spontaneity rules. We can, however, allow spontaneity in a constrained sense together with determinism, i.e. in the sense that the system has the capacity (potentiality) *under certain circumstances* to operate in accordance with

spontaneity (when the mentioned constraint is lifted, the lawfulness belonging to the internal relation of the wholes-and-parts comes into action).

When the quantum mode is constrained in this manner, the spontaneity ascribed to it is obviously not an absolutely spontaneous process (starting from itself) *without any outside interference*. It nonetheless incorporates spontaneity in the sense that the process according to which the non-extended wholes-and-parts mutually produce each other in nature has its own ability to do so (without any deterministic casualty producing it). In this case it seems better to speak of "potentiality" rather that "spontaneity". Although this kind of causality involves spontaneity, this is not in the sense of starting without any external intervention (see section 4.5.3)

The second important feature regarding the inclusion of the time framework is that it allows the ascription of classical characteristics to quantum mechanical systems. As such quantum systems stand in a certain relation to the classical world itself which enable us to control the evolution of such systems *in time* in a similar manner that we control classical dynamic systems. We can, for example, place further constraints on the system that would result in its producing observable outcomes (we can force collapse through various experimental settings). Such constraints would disrupt the superposition of states (or relevant part thereof) and with it necessarily also the deterministic evolution thereof. When the classical governing principle is suspended in this manner, the constraint on the principle that governs the internal relations of the wholes-and-parts is lifted. This allows that principle, namely the other kind of causality (potentiality) which takes non-extended wholes-and-parts to extended parts, to kick in and initiate a transition to reduced states.

The Schrödinger description is therefore conditional and only valid as long as the system evolves deterministically in time. When this governing principle is suspended, the other principle kicks in and produces a transition to reduced states. The resulting reduced states, as classical states, stand in a causal "community" (to use the Kantian terminology) with the measurement apparatus that can register particular values of such states. As Cartwright says, the conserved quantity that is absorbed or emitted after the reduction of the wave packet – energy, or momentum, or angular momentum, or possibly even strangeness – activates the detector (Cartwright 1983:179). Although a further constraint on the system (i.e. the disruption of the superposition of states) could involve measurement, measurement is conceptually distinct from this constraint imposed on the system.

This interpretation of quantum mechanics resolves the so-called "measurement problem" (the name originated in the framework of the second view in which the projection postulate (reduction) is connected with measurement). The problem as it is traditionally understood, is that the two kinds of evolution associated with the quantum mechanical description, namely the deterministic evolution in accordance with the Schrödinger equation (that should be generally valid) and the projection postulate (that should be deducible from the dynamic description), is flatly in contradiction with each other (Albert 1992:37).

In my view these should not be regarded as conflicting laws that should be reconciled in the classical framework (to which the Schrödinger dynamics belong). They are heterogeneous laws that can without contradiction be ascribed to two different modes of existence. We should not regard the projection postulate as deducible from the dynamics of the system that proceed in accordance with classical characteristics since it belongs to a totally different mode of existence and is merely constrained by the deterministic evolution of the system. I argued above that, although both laws are included in the quantum mechanical description, they are conditional and mutually exclusive. The deterministic evolution is subject to the condition that the system (i.e. the superposition of states) is not being further constrained (i.e. disrupted); the reduction of the wave packet is subject to the

suspension of that condition (with the disruption of the dynamical evolution, the potentiality that the wholes-and-parts have to be realized in classical context, comes into action).

When a definite property is measured on a reduced state, the system could still be in a superposition of states insofar as another complementary property is concerned in accordance with the uncertainty principle. In the vector description the definite property state can be described as a superposition of the other property states. Albert generalizes this in the framework of two properties, called "color" and "hardness", and says: "states of definite color [black or white] are superpositions of different hardness states and states of definite hardness [hard or soft] are superpositions of different color states" (Albert 1992:32). This means that the inclusion of the time framework in quantum mechanics allows us not merely to ascribe classical characteristics to quantum systems; it even allows the combining of reduced (classical) and quantum modes "back-to-back" in one system.

The control that we have over the activation of the potentiality (spontaneity) rule has some interesting consequences. In Kant's philosophy, spontaneous causality, which I take as in some manner embodied in the potentiality rule (although not as absolute spontaneity), is also called the transcendental idea of freedom and is necessary to ground practical freedom, i.e. the ability of free choice. In this context it seems quite significant that we have temporal control over this freedom (we can also under certain circumstances determine outcomes as in the determination of axis-direction in the EPR experiments). This is, however, not yet free will and in my interpretation a much more comprehensive quantum framework would be necessary to account for it (a detailed discussion falls outside the scope of the thesis).

Although we have some control over the collapse of the wave packet in quantum mechanical descriptions where the evolution of the system takes place in time, the same is not the case when the system is outside space-time in the framework of quantum fields. In this case the system can only be described in statistical terms – we have no control over individual interactions. In a scattering experiment, for example, the particles that interact during scattering, are in the quantum mode of existence described in the framework of a quantum field. As such the time component disappears from the equations (Teller 1995:132).

If we accepts Auyang's quantum fields interpretation, we can say that such a quantum system is outside space-time and the collapse of the wave packets is absolutely spontaneous – we do not have control over such realizations in space-time individually. The statistics of outcomes, however, are as in all quantum physics experiments, governed by the Born postulate which was first introduced in exactly this context of scattering (Cartwright 1983:180). The *same process* happens in both quantum mechanics and quantum fields – in quantum fields we just have no control over it. In this case we may regard the process as absolute spontaneous.

Absolute spontaneity is a distinct feature of quantum physics. I have already mentioned in this regard that atomic decay is the paramount example of this absolute spontaneity, which Cartwright calls the "classic indeterminate process". The primary question is: How is it explained? Even though we might allow it as a logical possibility which may be accepted without contradiction, we should still answer the question as to *how* it is possible? In my view absolute spontaneity is explained as the rule underlying the causality (potentiality) that belongs to the supersensible realm outside nature. It becomes possible through this other mode of existence. In the same manner that our classical mode of existence is structured in such a manner that all matter in nature is causally connected, the supersensible mode of existence is ordered in such a manner that its non-extended wholes-and-parts adhere to absolute spontaneous causality.

Since the same process (driven by the same spontaneous potentiality) happens in both quantum mechanics and quantum fields, these two descriptions are easily compatible in my interpretation – which gives my interpretation some force above, for example, that of Bohm (where such compatibility is difficult) who also thinks in terms of some potential (the quantum potential) that is not in proper space-time but tries to adhere to a complete deterministic picture of the world. In my interpretation determinism and the non-determinism found in the Aspect experiment (which I take as spontaneity) are reconciled in one conceptual framework that brings the classical world (nature) and the quantum world (as a supersensible realm) together (although not in a unified position such that the gap between those pictures is removed). In my view there is a real ontological gap between the two realms and trying to remove that in our theory is to deny an important aspect of reality.

### 4.7 Two kinds of appearances

I have now argued that two modes of existence come into play in quantum physics. These two modes are governed by two heterogeneous laws, namely of determinism and spontaneity. As discussed in the previous section, both these laws regulate relations between objects. Generally, the first law regulates relations between objects existing in space-time. The second law regulates quantum entities that we can conceptualize as wholes-and-parts existing outside space-time which produce effects in space-time.

These laws co-habit in quantum mechanical systems where both are present in a constrained form: as such they together regulate quantum entities that evolve in time even though these are not situated in proper space. Quantum entities can produce outcomes in space-time in accordance with the law of spontaneity. Given the very different origin of these two kinds of causality, the outcomes associated with them are distinctly different. They deliver very different appearances. The representations (appearances) resulting from such transitions from quantum to classical modes are distinctly different from those where no transition is involved (i.e. mere changes within the classical mode).

Since I follow a Kantian approach, the question arises whether these two kinds of appearances can both be described in objective terms. In Kant's first *Critique* he showed how all appearances in space/time can be objectively given in experience. But what about those outcomes produced by the other kind of causality, namely spontaneous causality? Kant introduces the possibility of such outcomes in the second part of the first *Critique* in the framework of the third antinomy. It is, however, only in the third *Critique* that he discusses them in more detail when he develops a scientific approach that takes the possibility of non-mechanistic (i.e. non-deterministic) causality into account according to which non-extended wholes-and-parts produce ordered outcomes in nature. In this case Kant seems to conclude that the divide between nature and the supersensible realm prohibits us from establishing objectively that such products are indeed produced as such. We can only estimate that through “reflective” judgments, which do not result in truth determination.

In my reworking of the Kantian framework, nature is not merely contrasted with the supersensible realm; these are brought together when time is combined with some ideal space that reflects the supersensible ontology. I argued in the previous sections that this is exactly what we find in quantum mechanics. In this framework the possibility arises that we can do more than merely “estimate” that some outcomes in nature are produced by entities beyond space/time. We can in fact establish that objectively.

In this regard the approach by Bitbol (2007) is of special relevance to my Kantian interpretation. He is a neo-Kantian influenced by the work of J. Piaget. He asks how quantum appearances can be

incorporated in the framework of objective cognition (taken broadly in the Kantian sense)? Bitbol discusses the distinct differences between material entities that are extended in space-time and those that merely "appear" or manifest in space-time. These include those microscopic particles that become manifest by impacts, bubble chamber tracts and clicks on counters.

To establish these as objective entities Bitbol proposes that the Kantian rules of the understanding be replaced by other theoretical structures, especially symmetries. He argues that the collective behavior of the different classes of particles, which are embedded in universally valid symmetries, are law-like. Although it is not clear that single instances of phenomena ascribed to one isolated quantum can be ordered like this, he thinks that in the context of quantized fields the individual manifestations in space-time can be combined with global law-like ordering as is manifest in global field equations. In the final instance he writes: "Manifestations in space-time, plus law-likeness (objectivity) applied to probabilistic predictors of classes of phenomena, is enough to characterize matter" (Bitbol 2007:255).

Another approach, not too different from Bitbol, is that of Pringe (2007). In contrast with Bitbol, he uses classical Kantian philosophy to argue that measurable phenomena in quantum physics observe systematic unity and objectivity. Pringe distinguishes two kinds of causality, namely quantum and classical causality. Quantum causality signifies that quantum objects, taken to be outside space, time and causality, are the ground of quantum phenomena, which is why such objects bring meta-contextual systematic unity among contextual phenomena. Such a non-sensible ground can be problematically assumed, and the interactions of quantum objects which constitute this ground are discontinuous and uncontrollable; they may be conceived of as a series with an absolute beginning. Classical causality, on the other hand, operates in the contextual situations as an element of a series of causes and effects. As such it grounds the epistemic objectivity of quantum phenomena (Pringe 2007:156).

Pringe's approach, which proceeds in Bohr's footsteps, is methodological. As such his approach is very similar to that of Allison (2004) (although not the same, since Allison does not think in terms of noumenal objects, which Pringe accepts in the context of quantum mechanics). In the same manner that I accept Allison's methodological approach regarding Kantian epistemology, I also accepts Pringe's application of such an approach to quantum physics. In the same manner that I proceed beyond the methodological approach of Allison to establish an ontological reading in which the noumenal realm is taken as an ontologically distinct realm to account for the conceivability (instead of mere logical possibility) of freedom (see chapter 2), my application thereof to quantum physics also goes beyond that of Pringe (and Bohr). The noumenal realm is central to my ontological approach; it barely figures in the methodological approaches.

I argue that *we have good reason to think* that the quantum realm is in fact an ontologically distinct realm (see my discussion in 4.3-4.5) which would be a condition for the possibility of absolute spontaneity. In my view the Kantian metaphysics of nature, supersensible realm and absolute spontaneous causality may be taken as confirmed in quantum physics. I argue that absolute spontaneity which is part and parcel of quantum physics, is the governing principle of the quantum realm (as an ontological realm different from nature where deterministic causality is the ruling principle) and underlies the potentiality that objects in that realm have to produce outcomes in nature (in accordance with the potentiality that governs Kant's final causality in the third *Critique*). I have shown how we can conceive of such a potentiality in accordance with Kant's concept (involving wholes-and-parts) in the context of quantum physics. Both kinds of phenomena that we observe in nature are therefore not only objectively grounded in Kantian epistemology; we can also understand *how* quantum phenomena are produced – and how all of these are brought together in

one conceptual framework.

### 4.8 Conclusion

In this chapter I use the philosophy of science that Kant developed in the third *Critique* to formulate an interpretation of quantum physics. Although the philosophy of science that Kant developed in the *Metaphysical Foundations* played an important role in laying the philosophical foundations of the mathematical science that has reference to classical systems, the philosophy of science that he developed in the third *Critique* did not get similar attention – especially because his extensive reference to a supersensible realm was taken as nonsensical. In my analysis, however, the "spontaneity of a cause" that forms an essential part of this part of his philosophy of science and the accompanying necessary introduction of a supersensible realm to accommodate it, seem to capture exactly what we find in quantum physics. In my Kantian interpretation of quantum physics these Kantian concepts are taken seriously.

On the other hand, insofar as quantum physics is concerned, I take the introduction of Hilbert space seriously as showing that such systems cannot be presented in proper space. I accentuate that Hilbert space and proper time are combined in one system in quantum mechanics – which I understand as referring to another mode of existence (the quantum mode) that is constrained in time. In my view Kant's concept of nature agrees with the classical picture of the world (where the theories of relativity apply) whereas Kant's supersensible realm is to be identified with the quantum realm since it is supersensible (unmeasurable), outside space-time and outside nature; this follows from the mathematical formulation of quantum mechanics and is confirmed in empirical testing as far as these features are testable. Characteristic but problematic features of quantum mechanics, including non-separability and non-locality, that involve a breakdown in the sufficiency of both space-time descriptions and deterministic causality, are explained in my interpretation: the quantum coupling of wholes-and-parts belong to a different ontology outside space-time and nature and can therefore without contradiction manifest those features.

My interpretation also explains other persistent problems in the interpretation of quantum mechanics, for example how to understand the gap between the quantum and classical descriptions (between a superposition of states and reduced states). Much has been written about this gap. For Bohr the difference is self-evident and differentiates where predicates can be legitimately used and where not. Bitbol writes that "we are faced with a persistent dialect between two irreducible domains of discourse (objectified and situated)" (Bitbol 2007:258). But why is this so? Hughes writes: "Quantum theory may require that we divide the world into two... What is the conceptual relation between the quantum world and the classical world? This is the touchstone, pyx, assay, ordeal, the High Noon, the Big Enchilada for all interpretations of quantum theory" (Hughes 1989:312, 316). In my view the answer is simple: the descriptions of two ontologically distinct realms come together in quantum mechanics.

When quantum states are viewed as ontologically distinct from classical ones, we can ascribe a potentiality grounded in absolute spontaneity to it without any contradiction. Instead of trying to overcome the obvious fact of the spontaneity of collapse as is manifested in, for example, atomic decay, or in the structure of such collapse in the context of the EPR experiments (or having to call upon "action-at-a-distance" or "many worlds"), I present a coherent scientific picture in which the quantum and classical pictures of the world are united in one coherent conception (although not in one position where the gap between those pictures is removed) in such a manner that both determinism and spontaneity can conceivably be accounted for within the framework of those pictures. The classical and quantum realms are integrated in the framework of one world, in which

the first can be viewed as the substratum of the other. There are even contexts where they are closely interwoven – where the quantum mechanical description applies.

In my interpretation spontaneity is accounted for as the lawfulness that belongs to another ontological realm than the classical one. In ascribing two heterogeneous laws to the two different modes of existence I also account for the measurement problem. In my view the reduction of the wave packet occurs *because* of another kind of causality (that is inherently spontaneous or non-deterministic) that takes non-extended wholes-and-parts to material parts as part of an aggregated whole when the deterministic evolution thereof is suspended (disrupted). This is the explanatory power that my interpretation has over its rivals: although the superposition of states and their potential for transition are outside empirical reach (because this is the way the world is), my view *explains how spontaneous potentiality is possible* as well as all the manifestations of non-determinism in quantum physics within one coherent conceptual framework.

Since the measurement problem is dissolved, there is no reason to try and rid quantum theory of the collapse of the wave packet as a physical event that involves spontaneity (non-determinism). Views that do this, can either not account for non-determinism in quantum mechanics (i.e. they merely accept this; in Fraassen's modal formulation) or try to save the deterministic description of the world (like Bohm's theory) which face the problem of extending that picture to quantum fields – a problem that does not arise in my interpretation since in my view both the particles of quantum mechanics and the entities in quantum fields belong to the same quantum realm that is outside space-time (even though in the first case they are constrained in some manner) and is governed by the same principle (spontaneity).

Whereas the quantum potential is necessary for Bohm to establish a complete deterministic causal theory, in my view the corresponding Kantian potential is necessary to account for spontaneity. The question is: Who is correct? Or is it just two ways of modeling and interpreting the same underlying physical potential? Basil Hiley (2010:14) (who worked for many years with Bohm) recently argued that the generally accepted idea in the literature that Bohm tried to "return to a deterministic, mechanical view of the word" is wrong. I fact, the manner in which Hiley interprets and develops Bohm's concepts, shows remarkable agreement with my Kantian approach.

According to Wiley (2010) Bohm understood the quantum potential in terms of a "whole" that determines the properties of the individual particles and their relationship (and not the other way round). In Wiley's view the quantum potential can be regarded as a non-local energy (different from kinetic and (classical) potential energy) necessary for energy conservation which is involved in a "self-organizing" process (which would be spontaneous!) involving a basic underlying field! (Hiley 1999:7; Kant also speaks of "self-organization" in this regard, see sections 3.4.1-2). He even writes: "[T]here is a deep underlying process from which not only particles and fields emerge, but this process is the source of space-time itself" (Wiley 2010:14). A detailed comparison (which falls outside the scope of this thesis) may produce new insights regarding the inner workings of the world of quantum physics.

The work presented in this chapter does not take the quantum fields description into account (only matter fields are considered). I focus only on matter, not on field forces. Kant's view in the third *Critique* is that the supersensible realm would account for both matter and forces. It seems to me that such an enterprise would be possible within the framework of the basic conceptual framework developed here. In this regard one can think that the Kantian potential could also account for the spontaneous "creation" of field-entities which construe the force fields. I hope that the work presented here would provide a solid basis on which a more extended Kantian interpretation could

be established.

**Note 3: General relativity and nature**

In my approach I distinguish between 1) The epistemic conditions for knowledge, when matter is presented empirically in space and time. This stands under Kant's Analogies of Experience (see section 2.2). As such matter is regulated by deterministic causality. This describes the "classical" situation where Newtonian physics apply. 2) When we move beyond the epistemic conditions of knowledge, the empirical use of reason may be logically extended (in the anti-thesis position of the third antinomy) to conceptualize the sensible world as "nature", which is comprised of the totality of casual relations which is called "mechanism" (see section 2.3). In this case space-time becomes a conceptual construct which belongs to nature, outside the reach of human perception. Abstract mathematical theories like general relativity and theoretical descriptions of stochastic behavior – which can never be brought under sensible conditions – are descriptions of aspects of nature. 3) I also distinguish an ontologically distinct supersensible realm outside nature (in accordance with my ontological reading of Kant's first and third *Critiques*) through which absolute spontaneity becomes possible (i.e. that realm serves as condition for the possibility of such freedom). I ascribe a certain spontaneous potentiality to this realm in accordance with Kant's "final causality".

Although the mathematical models used in the formulation of classical physics – from Newtonian science to special and general relativity – include some features which challenge the deterministic description of the world, these do not present a significant challenge to that view (especially in the case of the theories of relativity) because it could be regarded as mere features of the mathematics (Earman 1986). It is, however, true that general relativity also describes a kind of non-local energy of gravitation which might be similar to the Bohm potential (Hiley 1999) – which I relate to the Kantian concept of spontaneous potentiality (see section 4.8).

# 5. Conclusion

In the introduction I mentioned that the problem of reconciling determinism and spontaneity in quantum physics is now more than one hundred years old and no answer as to how such spontaneity can be conceived of as possible in our understanding of how the world is like (in contrast to its mere logical possibility) has been provided. The main questions that I engaged with was: How is such spontaneity possible and how can it be accommodated in physics as part of our overall conception of the world? My answer is a simple (and I hope an elegant) one: We can effectively delineate two modes of existence in quantum physics, the one being the substratum of the other, namely the quantum and classical modes, governed by two very different principles, namely determinism and freedom. Freedom enters physics in the form of the reduction of the wave packet which I interpret as a transition from the quantum to the classical modes.

This unified conceptual picture emerges in the framework of Kant's philosophy that allows for two modes of existence, namely nature and the supersensible realm outside nature, governed by determinism and freedom respectively, which I interpreted as the classical and quantum modes of existence. I showed (I hope convincingly) in the context of my third alternative to the interpretation of the first *Critique* (and reading the third *Critique* consistent with this interpretation), *that Kant did not merely allow for the logical possibility, but for the conceivability of freedom* – both in the first *Critique* and in his philosophy of science in the third *Critique*. As such freedom becomes something that could conceivably exist if his critical metaphysics can be presented, not merely as a metaphysics, but as a scientific hypothesis that finds application in the field of quantum physics.

Kant argues in the first and third *Critiques* that such freedom can co-exists with determinism in one conceptual framework if we accept his critical metaphysics. I applied these concepts to the field of quantum physics with one adaptation: I allowed that time be combined not with space, but with that mathematical space which is associated with the quantum mode of existence. This allowed me to apply the Kantian concepts also to quantum mechanics where the two modes of existence come together in one description.

Kant's approach allows us to also bring classical physics (Einstein's theories) and quantum physics together in one conceptual framework. He laid the basis for this unified picture in the first *Critique*, where his first two moves formalize an epistemology that he used in the *Metaphysical Foundations of Natural Science* to establish the philosophical foundations of not merely Newtonian science, but of classical science in general (including Einstein's theories) as Friedman (2001) has shown. His third move showed how determinism and freedom can co-here. He reworked these concepts in the third *Critique* as part of his philosophy of science that accommodates freedom. The first *Critique* therefore provides the groundwork for mathematical science whereas his later work allows us to bring physics, biology and even the life sciences (in the framework of his concept of “reflective” judgment) together in one unified conception or meta-research programme.

In the final instance I have shown that we can achieve much more with his conceptual framework than Kant thought possible. I showed (I hope successfully) that the supersensible realm is confirmed in the quantum realm. I also showed that Kant's “final causality”, which is conceptualized as a spontaneous potentiality in the third *Critique*, is realized in the spontaneous reduction of the wave packet. More generally, the ascription of freedom (in the context of a Kantian “potential”) to the quantum realm explains non-determination in cases like atomic decay and the EPR experiments. In my interpretation both determinism and freedom can be accounted for within the constrains of contemporary physics without having to call upon “action-at-a-distance” or “many worlds”. My interpretation may be the only one which explains *how* such freedom is possible and how it can be

accommodated as part of a unified conception of the world.

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