

The Boundaries of Reality: Quantum Physics within a Transcendental Ideal Framework

Grensene for vår virkelighet: Kvantefysikk innenfor
et transcendentalt idealrammeverk

Master Thesis
by
Twisha Mukherjee



Department of Philosophy
University of Bergen
Norway
Spring 2021
Master's thesis in FILO350
Supervisor: Anita Leirfall

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Abstract

In this project I am going to explore how the boundaries of our reality are conditioned by metaphysical principles. I will argue, in the spirit of Immanuel Kant, that these metaphysical principles also ground our knowledge and description of the natural sciences, and more specifically, within quantum physics. My main objective is to study the framework of our cognition of knowledge along the lines of model-dependent reality. We will see why in the science of physics, a paradigm shift was needed to be able to expand and account for new knowledge, along with novel discoveries. This newer theory of knowledge and newer framework, being quantum theory, reflects that our objective knowledge must always contain an element of the subjective observer. This leads us to re-think what we understand to be ‘objective’ reality. The so-called *human standpoint* becomes one of the main themes in this thesis, then. When we ask ourselves, “Where does reality begin and where does it end? What are the limits to our reality?” – I shall argue that it both starts and ends with the transcendental subject, as this specific subject is what conditions our experience, and is found at the boundaries of our reality. Thus, in thesis I will ultimately argue for a different notion of objective knowledge *because of* what sets the boundaries of our reality.

Sammendrag

I dette prosjektet skal jeg utforske hvordan grensene for vår virkelighet blir betinget av metafysiske prinsipper. I Immanuel Kants ånd, vil jeg argumentere for at disse metafysiske prinsippene også forankrer vår kunnskap og vår beskrivelse av naturvitenskapene; og dette gjelder særlig innenfor kvantefysikken. Jeg vil se nærmere på rammeverket som betinger vår kunnskap og erkjennelse i tråd med hva jeg vil betegne en modellavhengig virkelighet. Vi vil se hvorfor det er nødvendig med et paradigmeskifte for å kunne utvide og redegjøre for en ny type kunnskap i vitenskapen om fysikk. Kvanteteori, som representerer denne nye kunnskapsteorien og det nye rammeverket, gjenspeiler at vår objektive kunnskap alltid må inneholde et element av den subjektive observatøren. Dette leder oss til å tenke nytt angående det vi tenker på som ‘objektiv’ virkelighet. Det menneskelige synspunktet blir på bakgrunn av dette et av hovedtemaene i denne oppgaven. Når vi spør oss selv: «Hvor begynner virkeligheten og hvor ender den? Hva er grensene for vår virkelighet?» -- Jeg vil argumentere for at svarene på disse spørsmålene både begynner og slutter med det transcendentale subjektet, siden dette spesifikke subjektet er betingelsene for vår erfaring og er funnet på grensene for vår virkelighet. Derfor vil jeg i denne oppgaven argumentere for en annen forestilling om objektiv kunnskap *på grunn av* det som setter grensene for vår virkelighet.

Dedication

To my parents and my sister.
Without their love and support, this project would not have been possible.

Declaration

I declare that this thesis has been composed solely by myself and that it has not been submitted, in whole or in part, in any previous application for a degree. Except where stated otherwise by reference or acknowledgment, the work presented is entirely my own.

Acknowledgements

My experience with this project has led to personal and academic growth. I wish to express my gratitude to those who have helped me along the way. First and foremost, to my supervisor, associate professor, Anita Leirfall, whom I spent many hours with discussing Kant's complicated and intricate system of cognition presented in the *Critique of Pure Reason*. Also, to Robin Tveiterås, who showed genuine interest and encouraged me throughout this project. Thank you also to my professor Sorin Bangu who made some preliminary and encouraging comments on my chapter three.

Sist, men ikke minst, er jeg også takknemlig for filosofiavdelingen som gav oss masterstudenter muligheten til å studere og fokusere på lesesalen.

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Guide to Citations

The *Critique of Pure Reason* is the main source of reference I take from Immanuel Kant in this thesis, for which I will cite the standard pagination of the A and B editions. There is also some reference to Ludwig Wittgenstein's *Tractatus Logico-Philosophicus*. These two sources will be referenced accordingly for the in-text citations within this thesis (with the exception of the standard pagination mentioned above). In addition, the reader will come across some paragraphs which contain quotations and paraphrases without an immediate citation afterwards. This is because those particular quotations and paraphrases share one common source, which is given at the end of the quotations, paraphrases or paragraphs, in order to avoid redundancy within the paragraph.

- | | |
|-----|---|
| CPR | Kant, Immanuel. <i>Critique of Pure Reason</i> , trans. and ed. Paul Guyer and Allen. W. Wood (Cambridge University Press, 1998). |
| TLP | Wittgenstein, Ludwig and Bertrand Russell. <i>Tractatus Logico-Philosophicus (Routledge Classics)</i> . 2nd ed., Routledge, 2001. |

Introduction

The boundaries of our reality play a crucial part in what natural science has thought of as objective knowledge. Immanuel Kant, being a tremendous influence in metaphysical philosophy, has investigated the metaphysical foundations of natural science. In doing so, he has constructed a complex philosophy of transcendental idealism. In this transcendental philosophy, we can see that there is a metaphysical level that is always reflected into natural science; and as I will argue, especially quantum physics.

In this project, I will give an explication of Kant's transcendental idealism. Keeping this transcendental ideal framework of reality in mind, I will point out its parallels to the model of reality given to us by physics, but mostly quantum theory. By 'model of reality', I mean the description of nature given to us by physics and metaphysics. These models will be discussed in chapter three where I shall present in more detail the 'model of reality' with the help of Stephen Hawking and Leonard Mlodinow.

Also, as a side note, I will mention here that I am not going to be viewing everything from strictly Kantian spectacles, but also from my own interpretation of the research I present. As a result, this thesis will analyze and re-interpret what is thought of as objective knowledge on a philosophical level, which is determined by certain boundaries of reality. In Kant, these boundaries are the apriori forms of experience.

What is known as Kant's "Copernican revolution" will give us a starting point for Kant's construction of his transcendental ideal framework. Simply put, Kant proposes that we might "get farther with the problems of metaphysics by assuming that the objects must conform to our cognition", rather than our cognition conforming to objects (CPR Bxvi).¹ Chapter one of this thesis will develop this notion further to necessitate objects conforming to the conditions of their representation, i.e. the framework of transcendental idealism. Likewise, with Copernicus' astronomical discovery, we see that the model of the solar system happens to depend on the observer and *his* position. This is not to say that the model of the solar system will be different for each and every one of us, but rather, with this shifted perspective, what is observed becomes conditional to *all* of us as observers. This universal shift in perspective for all observers is

¹ As mentioned in the "Guide to Citations" preceding my Introduction, I will hereafter cite the rest of the *Critique of Pure Reason* according to the standard pagination for the A and B editions.

established by the science of astronomy.² What quantum physics furthers in this shift, is that the position of the observer also becomes an element in the account of our description of knowledge.

This philosophic revolution mirrors the revolution in physics with the introduction of quantum theory. In the words of Don Robinson, “Kant’s model is the achievement of physics. The achievement of physics is sufficient to satisfy him that our cognitive resources are capable of unearthing lawfulness in reality—the objective events of the external world” (2019). The forces of Kant’s metaphysical revolution and the revolution of quantum physics will help me to shed new light on the concept of objective knowledge. We will learn that, if according to science, objectivity is that which is the case without an observer, then *pure* objectivity is unattainable from the human standpoint.³ The objective knowledge that we do have access to, however, is via the model of science, which gives us a description of nature. On behalf of Kant, Robinson further explains, “The rational structure of science is at once created by the cognitive resources of an intelligent being, apriori resources that must be in place for order itself to be cognized; and at the same time, that apparatus generates representations of external reality in a manner that is objective; and the model is the model of science.” (2019) Hence, what we will come to find out is that the model of transcendental idealism is one that is reflective of, and more so, can include within it, the model of quantum physics. Both these frameworks of knowledge investigate the boundary of our reality and in turn, our objective knowledge.⁴ This investigation includes analyzing the role of the observer (or the subject) being a part of what we call objective knowledge. As a result, one of the driving questions of this thesis is this: Is objective description possible if the subject must be a part of the observation of the object?

Henry Allison’s double-aspect view of Kant’s transcendental idealism (which will be discussed in chapter one) parallels on certain points what quantum theory tells us about the state of atoms, or so I shall argue. According to quantum theory, atoms are in a constant state of possibility, and it is only when the observer observes them, that they take form and become a version of reality for us, the human observer. Similarly, the noumenal objects in Kant’s philosophy of transcendental idealism cannot become a form of representation *for us* as

² Or in other words, the different positions of different observers does not result in complete subjectivity.

³ The notion of *pure* objectivity will become clearer as we approach the end of this project.

⁴ Each framework however, operates on a different level description, as will be explained in chapter three. Shortly here, the transcendental ideal framework is on a metaphysical level of description while the quantum physics framework is on a scientific level of description.

phenomenal objects unless the apriori conditions of human cognition (what Allison terms “epistemic conditions”) given to us by the apparatus of our minds are applied (which emphasizes the role of the subject/observer) (Allison, 2004, p. xv). These terms will be more specifically explained in the first chapter of this thesis. In chapter three, we will see that that these epistemic conditions are also applied (albeit on a scientific level of description) in quantum theory as demonstrated by Niels Bohr’s notion of complementarity and Werner Heisenberg’s uncertainty principle. These conditions are what act as apriori for the reality that is measured. It is important for us to note that Kant himself often referred to Newtonian physics in his own account of nature. Quantum physics, which provides us with an alternate theory of physics and reality, does not dismiss the classical concepts of Newtonian science. Rather, these classical concepts act as an apriori set of rules needed for quantum theory; and this will be further discussed in chapter three.

The notion of the transcendental subject is what I will discuss in chapter two. There we will see that it is the subject itself that we find at the boundary of reality. This subject is what Kant terms the “transcendental subject” as opposed to the “empirical subject”; and as we will see, P.F. Strawson tries to refute this distinction that is attached to the concept of *subject*. I will point out the flaws in Strawson’s attempted refutation and conclude why the notion of the transcendental subject is in fact crucial when it comes the bounds of our reality.

As we move on to chapter three of this thesis, it will become apparent how Kant wants to metaphysically ground the natural sciences such as physics. The two different levels of description (the metaphysical level of description and the scientific level of description) and their relationship with each other will become clearer. Furthermore, an essential question influenced by Bohr will appear in chapter three: How do we address the growth of the sciences, or better yet, the growth of our description of our knowledge of the sciences? Quantum physics makes room for this growth by providing a wider framework for our scientific knowledge, i.e. Bohr’s notion of complementarity.

Arriving at the end of this project, I will shed some new insight into questions such as: 1) Where does reality begin and end? 2) How exactly can we view the term ‘objective’? – Objective to what extent? 3) How are reality and possibility correlated? I will arrive at answers to these questions with the help of the connection between Kant’s transcendental idealism and the empirical demonstrations of quantum physics. In doing so, I will point out the metaphysical implications of quantum physics.

Being specifically interested in the philosophy of natural science throughout his career, Kant published *The Metaphysical Foundations of Natural Science* in 1786, which succeeded his first publication of the *Critique of Pure Reason* in 1781. This later work set out to do exactly as the title declares: to establish metaphysics as the foundation of natural science. Kant argues that even though occurrences in natural science, such as movability of an object in space, cannot be *known a priori*, it must be given to us in experience according to *principles a priori* (Kant, 2004). That is to say, our knowledge of empirical events, such as an object's movement in space, would not be possible without certain apriori conditions, which he also argues for in the *Critique of Pure Reason*. In this thesis, I will focus on how these apriori conditions given to us on the metaphysical level of description, support the philosophical findings of quantum physics. Not only do they support findings of quantum physics, but the studies of both levels of description (the metaphysical and scientific) lead us to possible answers to the questions mentioned above in ways that would be outside the normal bounds of classical science and physics.

Chapter I: Kant's Transcendental Idealism

In this chapter, I will explain Kant's philosophy of transcendental idealism as it is presented in the *Critique of Pure Reason*.⁵ In section A I hope to convey a clearer picture of what transcendental idealism is by contrasting it to other metaphysical viewpoints, such as transcendental realism. The entirety of section B will be dedicated to the a priori conditions of space and time because of their vital role in our framework and conditions for knowledge. Thereafter, in section C, I will discuss in more detail the intricate structure of the mind that Kant meticulously depicts in his *Critique*. Together, these faculties, elements, conditions and how they relate to each other within Kant's philosophy of transcendental idealism depict our framework for our possible experience of objects in the world, and in turn, our framework for reality.

A. What is Transcendental Idealism?

1. What Differentiates Transcendental Idealism

I will here present Immanuel Kant's transcendental idealism with the help of one of the leading commentators on Kant, namely Henry Allison. I will use Allison's interpretation first and foremost in accordance with his book *Kant's Transcendental Idealism. An Interpretation and Defense* (2004). A brief and introductory way of defining transcendental idealism is to say that objects of our cognition and experience are mere appearances. For Kant, an *appearance* (*"Erscheinung"*) is a representation *for us* (*"für uns"*). As such appearances, they are representations of the things-in-themselves. The things-in-themselves are something that we do not have access to, as they lie outside of our forms of experience. Most of all, for Kant, transcendental idealism is a position defending the stance that "The conditions of the **possibility of experience** in general are at the same time conditions of the **possibility of the objects of experience**, and on this account have objective validity in a synthetic judgment *a priori*" (A158/B197). Why and how Kant wants to defend this position, and what these technical terms mean, will be clarified in this chapter.

⁵ From here on, I will refer to Kant's *Critique of Pure Reason* as *Critique*.

While some Kant scholars hold the two-worlds view when interpreting Kant, Allison holds a two-aspects view (also referred to by some scholars as the one-world view) when it comes to the way objects of our experience are cognized. He interprets Kant's metaphysics from a double-aspect view that reduces metaphysics to mere epistemic conditions while passing over the ontological aspect in silence.⁶ Allison writes that there are "two ways of *considering* things (as they appear and as they are in themselves) rather than as, on the more traditional reading, between two ontologically distinct sets of entities (appearances and things-in-themselves)" (2004, p. 16). For Allison, it is the one and same object that has two aspects about it: 1) The appearance/representation, and 2) The-thing-in-itself (which we do not have access to). The alternative and more traditional interpretation by other Kant scholars, being the two-worlds reading, holds that appearances and things-in-themselves are two different objects (Stang, 2018). Things-in-themselves are absolutely real, as in their existence is not dependent on human cognition. They exist independently of our forms of experience. The appearances, on the other hand, have an existence and properties which depend on human perceivers, which for Kant also means dependent on our apriori forms of cognition.

Going back to Allison's two-aspect view, we can say that there are two different epistemic aspects of the object.⁷ In the introduction of his book, Allison strongly defends this epistemic reading of transcendental idealism when he writes, "That Kant viewed the transcendental distinction between things as they appear and the same things as they are in themselves as a major philosophical discovery is undeniable". This implies a limitation of our cognition of objects in general, as will become clearer in the progression of this thesis. He goes on to write, "Nevertheless, it would be more accurate to say that he [Kant (TM)] viewed this limitation as liberating or therapeutic rather than as depressing". This transcendental distinction is furthermore crucial because it "rests upon a radical reconceptualization of human knowledge as based on *apriori* conditions (epistemic conditions)" (Allison, 2004, p. 19).

Transcendental idealism opposes transcendental realism, according to Kant. To get an idea of what transcendental idealism *is not*, I shall briefly here discuss transcendental realism, taking aid from Allison's chapter two (2004). Transcendental realism is the common belief where

⁶ In other words, Allison does not commit himself to anything else but epistemic conditions.

⁷ As we will see later, this epistemic difference of aspects of the same object parallels what we find within quantum physics (because particles take on certain appearances/representations based on our method of observation).

appearances are taken to be real, or in Kant's terminology, appearances are thought to be identical with things-in-themselves. For instance, as Allison points out, both Descartes and Leibniz held this view (according to Kant) as fundamental in their philosophies. Leibniz, for example, believed "that in any true proposition the predicate is contained in the concept of the subject" (Allison, 2004, p. 29). What we find is something different when we come to Niels Bohr's discussion of subject and object, where we discover that it is really the subject that is "contained" within the object, as demonstrated by looking into the conditions of observation of the quantum world.

Transcendental realism holds that space and time are something given in themselves (independent of our a priori forms of sensibility). As Allison points out, Kant thinks that this leads to empirical idealism. In empirical idealism the mind can have immediate access only to its own ideas or representations (cf. "phenomenalism" in Berkeley, for instance). Because of this, the existence of spatial objects/outer appearances as things-in-themselves (outside of the mind) becomes problematic since the mind has no immediate access to them, according to Kant. This view conflates appearance as things-in-themselves (Allison, 2004, pp. 21-27).

Now returning to Kant's own transcendental idealism, we can say that it is a "metaphysical standpoint," not a doctrine, "about the nature or ontological status of the objects of human cognition." To separate this form of idealism (that is, transcendental idealism) from that of Berkeley's and Descartes', Kant has referred to it also as "formal idealism". Formal idealism "is a theory about the nature and the scope of the conditions under which objects can be cognized by the human mind" (Allison, 2004, p. 35). This distinguishes it from, for example, material/empirical idealism, which as Kant explains is "the common idealism that itself doubts or denies the existence of external things" (B519). Kant also wished to call his form of idealism "critical" idealism; and according to Allison, "It is 'critical' because it is grounded in a reflection on the conditions and limits of discursive cognition, not on the contents of consciousness or the nature of *an sich* reality" (2004, pp. 35-6).

One crucial feature of transcendental idealism is something Allison terms as "epistemic conditions". Allison explains that an epistemic condition is "a necessary condition for the representation of objects." It could also be termed as an "objectivating condition" because it gives us objective reality, i.e. the reality that we experience via the appearances that are our forms of experience of the things-in-themselves. Here we must note that it is objectivity in terms

of our representations, not things-in-themselves. We must distinguish epistemic conditions from psychological and ontological conditions, according to Allison. Psychological conditions are involved with the “mechanism of the mind, which governs belief and belief acquisition”. Ontological conditions are concerned with existence itself, or things as they exist/are. Although psychological and ontological conditions are different from epistemic conditions, they do have some traits in common. Like the former, there is “the property of being ‘subjective’, that is, they reflect the structure and operations of the human mind”. Like the latter, there is a shared property of being “objective or objectivating”. However, epistemic conditions “differ in that they condition the objectivity of our *representations* of things rather than the very existence of the things themselves”. This now leads us to a fundamental problem concerning transcendental idealism. How can these epistemic conditions be both subjective and objective at the same time? (Allison, 2004, pp. 11-12).

2. Kant’s Empirical Realism

Kant’s empirical realist stance can help to answer this conundrum of how epistemic conditions can be both subjective and objective at the same time. While being a transcendental idealist described in the ways above, Kant is also an empirical realist when it comes to our world of experience. What we experience is empirically real, and this is *because* of the transcendental ideal forms. In other words, the empirical real is not possible without the transcendental ideal. Experience is conditioned by the transcendental ideal forms, and in addition, these forms need a given matter in order for us to have experience. There is objective validity to this experience and the objects of our experience. This objectivity is given to us by the combination of empirical realism and the transcendental ideal forms, in that the empirical real concerns the matter and this matter is given with the apriori forms of space and time (forms of intuition). However, at the same time, we must remember that this world of experience (*our* world) is the phenomenal world – it is the world of representations; and as such, our epistemic conditions are subjective. The structure and operations of our human minds gives us the phenomena of the world, through our subjective forms of sensation/sensibility, namely the apriori forms of space and time. Nevertheless, Kant does not doubt the existence of the noumenal world, keeping in mind we cannot talk about it. What is “real” for Kant, is what is *empirically real*, that is “matter”, given within the apriori forms of intuition and further determined but the apriori concepts given to us

by the understanding. According to Allison, Kant is not denying that objects really do exist, but rather that there are two aspects of an object—one being the-thing-in-itself and the other being appearances. In his *Critique Reason*, Kant explains:

Our transcendental idealism, on the contrary, allows that the objects of outer intuition are real too, just as they are intuited in space, along with all alterations in time, just as inner sense represents them. For since space is already a form of that intuition that we call outer, and without objects in it there would be no empirical representation at all, we can and must assume extended beings in space as real; and it is precisely the same with time. Space itself, however, together with time, and, with both, all appearances, are **not things**, but rather nothing but representations... (A492/B520).

Here we see the importance of the empirical real as the *matter* of our appearances whereas space and time are the *forms*. As a part of the conundrum of how epistemic conditions can be both objective and subjective at the same time, we shall see in the next section that space and time are the forms of intuition within which the sensible manifold is given. They are a part of the structure and operations of our mind, and in this way, they are subjective conditions to our possibility of knowledge. To be more explicit, the subjective apriori forms of space and time (in addition to the apriori forms of the understanding) are subjective conditions of the possibility of representations in the sense that they are based on the subject's forms of experience. Yet, based on such conditions, we can have objectively valid representations – which simultaneously make it possible for us to objectively represent real objects. This is how our knowledge is objective, but our objective knowledge depends on the subjective conditions of the possibility of representations. This is the paradox that makes epistemic conditions both subjective and objective at once.

B. Space and Time as Apriori Conditions

Kant starts out his *Critique* with the chapter on *The Transcendental Aesthetic*, in which he gives an account of the role of space and time within his transcendental idealism. This section will be dedicated entirely to space and time because of their crucial role in this thesis as well. The following section in this thesis (section C: *The Apparatus of the Mind*) will help to situate all technical terms found also within this chapter.

1. The Nature of Space and Time

For Kant, space and time are viewed from the transcendental perspective as being apriori forms of intuition that are imposed on objects in the phenomenal world by our mind. The nature of space (what space *is*) can be described as an outer sense, and it is a “property of our mind.” The nature of time can be described as an inner sense; and time is the entity by which “the mind intuits itself” (A23/B37).

In the *Transcendental Aesthetic*, Kant asks, “Now what are space and time? Are they actual entities? Are they only determinations or relations of things...?” (B38). To answer these questions, he first starts with space. The representation of space is the grounds for our outer experiences. In other words, for us to have knowledge about objects outside of ourselves, and in different positions, there must be the representation of space. Hence, space is a necessary condition for outer appearances. To demonstrate this, Kant writes, “One can never represent that there is no space, although one can very well think that there are no objects to be encountered in it” (A24/B39). This answers the question about space being a determination—it is not a determination dependent on objects. Instead, the objects are dependent on space (and time) in order to be given – as such space (and time) serve as conditions for the possibility of the object.

Kant goes on to explain why space must be an apriori necessity, because if its representation to us was given aposteriori, “the first principles of mathematical determination would be nothing but perceptions. They would therefore have all the contingency of perception, and it would not even be necessary that only one straight line lie between two points, but experience would merely always teach that” (A24/B39). Furthermore, space cannot be a concept of relations, but

must instead be a pure intuition; although it makes relation of objects in space possible. We can only represent a single space, “and if one speaks of many spaces, one understands by that only parts of one and the same unique space” (A25). It will later be clarified why this singleness of space must therefore be apriori intuition rather than a concept (but to briefly explain here, it is because a concept can have relations and an intuition cannot). Space is a subjective form of apriori intuition and as such, it is the only “subjective representation related to something external” which makes possible objective representations (A28/B44). For example, the properties of color and taste attached to an object are not objective qualities of that object. Color and taste are subjective with respect to modification of light and to the subject doing the tasting, respectively. Space on the other hand, is a “condition of outer objects”; it is necessary as the condition of the given manifold in which the representation of objects exist. Kant summarizes this point well when he writes, “Through space alone is it possible for things to be outer objects for us” (A29).

The representation of time is overall similar to that of space. The main difference is that time is an inner sense rather than an outer sense. However, just like space, time is an apriori necessary condition. It grounds simultaneity and succession of things which comes into our perception. Also, like space, Kant writes, “one cannot remove time, though one can very well take the appearances away from time. Time is therefore given *a priori*” (A31/B46). Time is not empirical because it is universal and necessary, which are the two conditions for apriori status, according to Kant. Reverse to the nature of space however, “different times are not simultaneous, but successive (just as difference spaces are not successive, but simultaneous)” (B47). Time is also a form of sensible intuition (and not a general concept). The representation of a single object can only be given through time and space, which are, as we have seen, intuitions.

As a result of these characteristics of time, we can conclude with the empirical demonstration of time “i.e., objective validity in regard to all objects that may ever be given to our senses”. On the other hand, where absolute reality⁸ is concerned, “we dispute all claim of time” because here we are concerned with things-in-themselves, and these “can never be given to us through the senses” (A36/B52). In this way we have the transcendental ideality of time, because our

⁸ I will expand on why time cannot be “absolute” in chapter three.

subjective conditions of sensible intuitions cannot apply to absolute reality, i.e., things-in-themselves.

2. Givenness of Space and Time

Now that we have covered the nature of space and time, let us move onto how space and time are given. Since, for Allison, Kant's idealism depends heavily on his conception of human cognition being discursive, he (Allison) points out that this entails that neither space nor time can just be "given" to the mind. Furthermore, as Kant explains himself, the mere form of intuition of space and time are not themselves objects of intuition. Rather, they are the *forms* for intuiting (A291/B347).⁹ Given this, Allison then asks, "If space and time are not given as *objects* of intuition, in what sense can they be said to be given (or intuited) at all?". Allison seems to answer this question with the expression 'pre-intuition' because "it underscores Kant's point that every determinate space is represented as a region or determination of the one unbounded space... This one unbounded space is 'pre-intuited' in the sense that it is given together with every determinate space as the latter's 'horizon,' without itself being actually intuited as an object" (2004, p. 113). Hence, when Kant writes "space is represented as an infinite given magnitude", this is a "claim about the *a priori* structure of our spatial experience in general, rather than as one about a unique (pre-conceptual) representation of an infinite space" (CPR B40; Allison, 2004, pp. 113-14). The focus here is on space being a pure intuition (apriori) rather than an empirical intuition, meaning that it is not a representation among other empirical objects/appearances. Instead, it is the *form* of intuition (the condition) in which those empirical objects are given.

As we have seen, besides from being given as apriori forms, space and time can also be represented as formal intuition. By 'formal intuition', we mean that when we receive an object through our senses, the structure/form of said object is already contained within it, this being the form of space and time. For example, when we construct a triangle in space, space itself is exhibited through the geometrical construction (within Euclidean space), and space then

⁹ However, we can represent the form of space as a *formal* intuition when we, for instance, have a representation of a geometrical construction given in space. In this scenario, space is represented as a formal intuition.

becomes a formal intuition. This example of formal intuition is independent of the conceptual activity of the understanding, as the spatiotemporal order is not provided by the understanding. Instead, it is revealed, or through an act of synthesis, brought to consciousness, as it is given independently of the understanding. Then the understanding can determine the synthesized representation. However, we must note that although space and time are given independently of the understanding, they are *not* independent of the nature of human sensibility (Allison, 2004, pp. 114-15).

3. Representation of Space and Time

As we have discussed, space and time are apriori forms of intuitions. Now we shall see that they also have a manifold of their own. Kant attempts to explain this with the differentiation between ‘form of intuition’ and ‘formal intuition’. He writes, “the form of intuition merely gives the manifold, but the formal intuition gives unity of the representation” (B160-61, note). To break this down, let us analyze further. Space and time are *given* as forms of pure intuition. This simultaneously gives us the manifold, which is either the form or manner of intuiting. The form of the intuited, of space for example, “is required to characterize the single, and all-inclusive, space that contains within it the manifold of all spaces” (Allison, 2004, p. 115). In contrast, the *manner* of intuiting concerns the question of *how* it was intuited, i.e. the disposition to intuit things a certain way.

Finally, in regard to ‘formal intuition’, (in addition to the description earlier), here is where the manifold of space and time themselves are represented. Formal intuition gives us the unity of the representation of space and time . By ‘formal’, we mean the universal and necessary features of objects (that is, the *apriori*). Allison elaborates, “The crucial point here is that, as determinate, a formal intuition is a hybrid, requiring both the form of the intuited and a concept by means of which this form is determined in a certain way” (2004, p. 116).

In conclusion, there is already a manifold given in space, apriori; and it is given with unity. When we represent the given manifold, we make it a particular, thus making it an intuition. This is how the manifold of space and time come to be *represented*, via formal intuition.

4. Concluding Space and Time

There has been much controversy with this interpretation of space and time as merely being apriori forms of our sensible intuition.¹⁰ For example, there are philosophers such as Norman Kemp Smith who argue “that although our representation of space is subjective in origin, space is itself an inherent property of things in themselves” (1962, p. 313). This objection to Kant’s definition of space and time fails to comprehend the human standpoint (our point of view rather than a God’s eye point of view).¹¹ Allison, with the help of Lorne Falkenstein, answers this objection as such: “As forms of sensibility, space and time are forms or conditions of the order in which phenomena present themselves in intuition. Moreover, as such, they are quite distinct from any purely conceptual ordering that might pertain to things as they are in themselves (as conceived by some pure understanding)” (2004, pp. 130-31). So, Allison argues that the God’s eye point of view for seeing space and time from an ontological thesis applied to things-in-themselves is not what Kant’s transcendental idealism is about. Rather, we are concerned with the human standpoint as it is the only standpoint available to us, from which we are capable of thinking and sensing. Because of this we cannot warrant space and time as being forms for *both* phenomena and noumena. We only have the standpoint for the phenomena—the human standpoint.

This is not to say that things really are not spatial. Objects are spatial and do exist in time for *us*. Outside of us, however, we cannot speak on the behalf of the ontology of space (as scientists like Newtown attempted, with his claim of space and time being absolutes). From the Kantian framework, we cannot speak of the existence of space outside of us. Here we have to “deontologize” space, as Allison remarks. Representation of space and time outside the human standpoint signifies nothing at all, as it cannot be justified (from Kant’s perspective). However, in the only meaningful sense there is for us (that being within the human standpoint), space and time are formal intuitions of sensibility, and are given as the structure and manifold of objects of possible experience. Furthermore, for Allison, this means that space and time are epistemic

¹⁰ This interpretation, meaning Kant’s and Allison’s as I have just explained in section B.

¹¹ As such, Kemp Smith makes the a priori forms of intuition a thing-in-itself. Hence, he does not accept Kant’s transcendental idealism.

conditions. As we will see further on in this thesis, the emphasis of our human standpoint is not only brought out by Kant's transcendental idealism, but also by the study of quantum physics.

C. The Apparatus of the Mind

I will often use the term "apparatus of the mind" when referring to the structure of cognition Kant depicts in his *Critique*. This is not to reduce Kant's structure of the mind as simply a tool—because what Kant describes about the workings of our mind are on a fundamentally much deeper and stronger level than the mind being 'simply' a tool. But rather, the analogy here of the mind being an 'apparatus' is crucial for the metaphysical connection to the empirical findings we will see via quantum physics. Namely, the mind as a measuring instrument is a part of the objective reality we know. On the empirical level (for instance within quantum physics), the measuring apparatus plays a role in determining the observation. This same role also occurs on the apriori level within the structure of the mind acting as an apparatus for determining our reality.

Leading into the intricate apparatus of the mind, I will mention here that Allison argues that Kant's transcendental idealism rests heavily on the idea that human cognition is discursive. As Allison summarizes it, "to claim that human cognition is discursive is to claim that it requires both concepts and *sensible* intuition. Without the former there would be no thought and, therefore no cognition; without the latter there would be nothing to be thought" (2004, pp. 12-13). As Kant himself phrases it in a popularly quoted line: "Thoughts without content are empty, intuitions without concepts are blind" (A51/B75). Sensible intuition is not enough to produce the cognition of objects. It is only to give us the objects (matter) for such cognition. The cognition itself, then, is done via the apriori concepts (through the understanding and judgment). Cognition has a "conceptual nature" as Allison describes it (2004, p. 14). While sensible intuition gives us the *objects* for thought, it is the concepts that give us *thought*, which in turn give us objectively valid cognition of given objects. In short, this is Kant's "discursivity thesis" as Allison refers to it. It will be expanded upon now as we describe the apparatus of the mind and how the structure of the mind functions, being discursive at the base.

1. Sensibility

In the *Critique*, Kant describes an intricate apparatus of the mind which constitutes the framework for human cognition and accounts for the possibility of our acquisition of knowledge. As emphasized by Allison, Kant believes in a very discursive method to our cognition. Both concepts and intuitions contribute to this discursive cognition. However, before fully describing concepts and intuitions, let us start with sensibility.

In the Transcendental Aesthetic of the *Critique*, Kant defines sensibility as “The capacity (receptivity) to acquire representations through the way in which we are affected by objects” (A19/B33). The way in which we are affected by objects (these objects being *empirical intuitions*) are through the apriori *forms* of intuition, which are space and time. Another way of expressing this is to say that empirical intuitions represent the matter that are given within the apriori forms of space and time, which constitute the forms of intuition. Kant writes, “all thought...must ultimately be related to intuitions, thus, in our case, to sensibility, since there is no other way in which objects can be given to us” (A19/B33). In turn, an *appearance* is “The undetermined object of an empirical intuition” (A20/B34). As we have discussed before, it is these appearances which make up our phenomenal world; and they are undetermined in the sense that we cannot have knowledge about their noumenal aspect, or as I would say the true nature of the object.

Now let us move on to the notion of “concepts” (“*Begriffe*”) within Kant’s apparatus of the mind. Although concepts are required for the understanding (which is the other major faculty of the mind, to be discussed in more detail below), I will here discuss concepts because they are the other element needed for our cognition. Kant explains this when he writes:

Our cognition arises from two fundamental sources in the mind, the first of which is the reception of the representations (the receptivity of impressions), the second the faculty for cognizing an object by means of these representations (spontaneity of concepts); through the former an object is **given** to us, through the latter it is **thought** in relation to that representation (as a mere determination of the mind). Intuition and concepts therefore constitute the elements of all our cognition” (A50/B74).

We see here that both concepts and intuition are needed in order for us to have a cognition. Allison elaborates on this when he writes, “...sensible intuition, of itself, is insufficient to yield cognition of objects and requires the cooperation and spontaneity of the understanding” (2004, p.

77). Furthermore, concepts are not just given, “but made through an act of the understanding” (Allison, 2004, p. 80). As mentioned before, the understanding acts as one of the major faculties within the apparatus of our mind, and because of this, I will dedicate a section to it later in this chapter. For now, let us focus on Kant’s conception of judgment and its tie to concepts.

2. Judgment

The activity of the understanding is exhibited through judging. It is through judgments that we determine objects given in our spatiotemporal form via concepts. Concepts are “predicates of possible judgments” (A69/B94). The understanding, as we will see later, gives rise to categories (concepts).¹² Looking at the relationship of all three (the understanding, judgment and concepts), we see that the understanding produces concepts, and the concepts are then applied via judgment, meaning there can be no application of a concept without judging. However, ‘judgment’ can be broken down into 1.) The act of judging and 2.) The product (the judgment). When we perform the act of judging, we do two things: 1.) Unify representations by combining them in a concept (producing an analytic unity); and 2.) Relate these same representations to an object in a manner that purports to be valid with respect to the object (Allison, 2004, p. 84).

For Kant every judgment involves conceptualization and vice versa (Allison, 2004, p. 84). We must remember that a concept is never directly related to an object. Rather, a concept can be related to a representation of an object, whether the object is an intuition or the representation itself is a concept. Kant then concludes, “Judgment is therefore the mediate cognition of an object, hence the representation of a representation of it” (A68/B93). Allison describes this relation more clearly when he writes,

...intuition provides the sensible content for the judgment, while the concept provides the discursive rule by means of which this content is thought. It is precisely by determining this content that the concept is brought into relation with the object. That is why Kant characterizes the relation between concept and object as mediate (2004, p. 85).

¹² The apriori forms of the understanding *are* the apriori categories/concepts.

So, we see here that while intuition provides the appearance (“the undetermined object of an empirical intuition”), the concept provides the rules for thinking the thought, and the judgment gives us cognition.

Another way to describe this relationship between judgments and concepts is the following: Concepts are “predicates of possible judgment”. As such, predicates (concepts) function to determine the very content (given by sensible intuition) to be judged about. This is done when they (the concepts) provide the “general description under which the content can be thought”. Once this is done, the concept is a “real” predicate rather than a merely “logical” predicate. This such predicate is called a determination (Allison, 2004, p. 86). The importance of the distinction between a “logical” and “real” predicate will be seen very soon when we discuss the difference between analytic and synthetic judgments.

3. Analytic and Synthetic Judgments

Kant’s conception of judgment is the root of the distinction between analytic and synthetic. This very distinction, between analytic and synthetic judgments, is what must be investigated, according to Kant, to advance metaphysics. As such, let us now explore the differences between the two. In an *analytic* judgment, “the predicate B belongs to the subject A as something that is (correctly) contained in this concept A” (A7/B11). An example of this would be “Bachelors are unmarried men”; because the predicate [unmarried men] is contained within the subject [bachelors]. In synthetic judgments, on the other hand, “B lies entirely outside the concept of A, though to be sure it stands in connection with it” (A7/B11). Synthetic judgments extend our knowledge about the world. Analytical judgments are formal in that they clarify or explicate “what is already implicit in a concept”; and they are “derivable by strictly logical means from a given concept” (Allison, 2004, p. 91). Analytic judgments are apriori, and because they are merely logical, they can be empty (without any content). Meaning, the subject can hold reference to a non-existent thing and/or impossible subjects. For example, if we say “King Henry VIII is going for a walk right now”, this statement is empty because King Henry VIII is no longer alive. The emptiness in this statement is due to the lack of an empirical intuition in this case (since King Henry VIII is no longer alive).

Because they extend our knowledge, synthetic judgments are material (in that they may refer to something empirically real). Unlike analytical judgments, synthetic judgments teach us

something outside of the subject. For example, if “All bachelors are unmarried men” is analytic, then a judgment like “All bachelors are bald”, would be synthetic. Unlike the former example, we learn something new from the latter example. The predicate “being bald” is not contained within the concept of the subject “bachelors”. Let us remember here that this judgment (inherently holding objective validity) holds a truth value, which can either be true or false.

Kant further describes synthetic judgments as having a determination. This means that the reference to the subject has to be empirically real, and the reality of the predicate is of concern. As Allison explains, a synthetic judgment is so because “the judgment simply asserts the existence of an object corresponding to [the] subject” (2004, p. 93). This is in contrast to an analytical judgment as explained above, where the reference to the subject can be empty. Therefore, in an analytical judgment, we do not worry about the reality of the predicate either—it does not matter if King Henry VIII is actually (empirically) walking right now because he is no longer alive. In an analytical judgment, we only focus on the *relation* between the subject and the predicate of the judgment.

Synthetic judgments, as Allison explains, “can materially extend our knowledge only if the concepts in it are related to intuition”. We already know that a judgment can never relate a concept immediately to an object, but rather only to a spatiotemporal representation of the object in the intuition. However, if a judgment holds a real predicate within the concept (in that it is empirical), then the concept is related to a representation that is immediately related to the object (in other words, the object is given in an intuition). This is important because when both the subject and predicate within a synthetic judgment are related to an intuition of the object, this is when there is objective validity (Allison, 2004, p. 93).

4. Apriori and Aposteriori Judgment

The central problem of metaphysics and the main question that Kant is concerned about within his *Critique* is “How is synthetic apriori cognition possible?” Since we have sorted the differences between ‘synthetic’ and ‘analytic’ in the previous section, let us now focus on the differences, and definitions of, ‘apriori’ and ‘aposteriori’. To see the difference between these two forms of judgment, we can ask, “How are they grounded or how are they known to be objectively valid?” The role of experience is key. Apriori knowledge is free of experience (or

comes before experience), whereas aposteriori knowledge appeals to experience (comes after experience). In Kant's words, the description of these terms is as such:

Now such universal cognitions, which at the same time have the character of inner necessity, must be clear and certain for themselves, independently of experience; hence one calls them *a priori* cognitions: whereas that which is merely borrowed from experience is, as it is put, cognized only *a posteriori*, or empirically (A2).

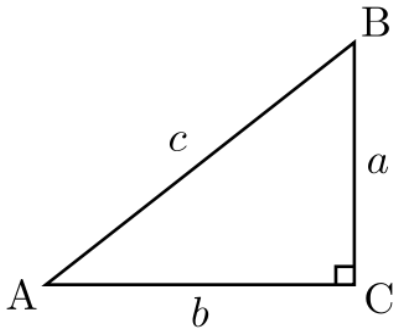
For Kant, necessity and universality are a *must* for apriori cognition, and such an a priori cognition cannot be grounded empirically. So then, how is synthetic apriori grounding of a judgment possible?

Allison believes that "Perhaps Kant's clearest answer to this question is in a text not published in his lifetime", where Kant wrote that synthetic apriori judgments require pure (apriori) intuitions as well as concepts. To completely understand this answer, and specifically to understand the importance and role of pure intuition in synthetic apriori judgments, Allison poses three questions: 1.) Why do synthetic apriori judgments require intuition at all? 2.) Why *pure* intuitions rather than merely empirical intuitions? 3.) Can such judgments relate pure concepts to pure intuitions, or, do they require that pure intuitions be subsumed under pure concepts? (Allison, 2004, pp. 94-95).

To answer Allison's first question, intuitions are required because "the mutual reference to the intuition of the concepts connected in a judgment is what alone makes possible the material extension of knowledge" (Allison, 2004, p. 95). Intuitions must work together with concepts to give us any sort of synthetic judgment, i.e. objectively valid knowledge. Here Allison even makes it a point to state that "From the standpoint of theoretical knowledge at least, the limits of our sensibility (the source of all of our intuitions) are at the same time the limits of our world" (2004, pp. 95-6). This latter point emphasizes the importance of intuitions in general. Without them, our thoughts would be empty. As we saw earlier in this chapter, "thoughts without content are empty; intuitions without concepts are blind" (A52/B76). We would have no material or sense data (no sensible manifold) to judge in order to acquire knowledge.

This now brings us to the second question of why we need *pure* intuition and cannot make do with just empirical intuition. Allison sums it up by saying that empirical intuition is simply not enough to ground synthetic apriori judgments. The problem lies in the particularity of empirical intuitions. He writes, "As particular, the representation is incapable of expressing the

universality and necessity that is thought in a pure concept and asserted in a synthetic *a priori* judgment” (2004, p. 96). For example, let us consider the intuition of a chair versus that of a right triangle. The chair gives us no universal or necessary concepts. The right triangle on the other hand, always tells us that the angles $A + B = C$ (where C is the 90-degree angle):



However, “as *a priori*, it [in this case, the triangle (TM)] cannot be grounded on the intuition (image) of any particular triangle. Its possibility thus rests upon there being some non-empirical or pure intuition of ‘[right (TM)] triangularity as such’”. This singular representation contains within it “the generality of the concept” making it valid for all right triangles (Allison, 2004, p. 96; A141/B180).

Lastly, addressing Allison’s third question, we can discuss how pure intuitions are related to pure concepts. Let us recall that synthetic judgments require the subsumption of intuitions under concepts, and this “must also apply to the connection between those that are cognized *a priori* and pure intuition” (Allison, 2004, p. 96)¹³. Here Allison argues that pure concepts must be related within judgments to pure intuitions because they apply universally and necessarily to a sphere of objects. It *must* do this if the judgment is both synthetic and *a priori*. Intuitions in this case become ‘pure’ because they are governed by a “form” of universal and necessary conditions, i.e. the right triangle. Hence, synthetic *a priori* judgments are made possible because of the subsumption or pure intuitions under pure concepts.¹⁴

¹³ However, the subsumption of *empirical* intuitions under pure concepts is done via the schematism, which will be explained in the section below.

¹⁴To differentiate pure concepts and intuitions from empirical concepts and intuitions, Kant writes: “Both are either pure or empirical. **Empirical**, if sensation (which presupposes the actual presence of the object) is contained therein; but **pure** if no sensation is mixed into the representation. One can call the latter the matter of sensible cognition. Thus pure intuition contains merely the form under which something is intuited, and pure concept only the form of thinking of an object in general. Only pure intuitions or concepts alone are possible *a priori*, empirical ones only *a posteriori*” (A50-51/B74-75).

5. The Understanding

The understanding is a crucial faculty (on par with the faculty of the sensibility) within the process of our discursive cognition. The faculty of understanding is that through which objects are thought (A15/B29). To summarize how the understanding fits into the apparatus of the mind, and where it is placed in the process of our cognition amongst the other elements and faculties we have covered, I will use Kant's explanation as such:

The capacity (receptivity) to acquire representations through the way in which we are affected by objects is called sensibility. Objects are therefore given to us by means of sensibility, and it alone affords us intuitions; but they are **thought** through the understanding, and from it arise concepts (A19/B33).

We see now that it is the understanding that gives us concepts. The conditions of concept application are then questioned in Kant's section regarding the schematism of the pure concepts of understanding (A137/B176). Allison believes, "The question the Schematism addresses is not *whether* the categories apply to appearances (that question is dealt with in the Deduction) but under what (sensible) *conditions* they can do so" (2004, p. 203). This requires knowledge of how the concept is schematized (expressed in sensible terms). While there is no need for us to delve into the conditions (rules) of concept application under the faculty of the understanding, what is important to note here is that it is the schematism which makes possible the subsumption of an *empirical* intuition under a pure concept (A138/B177).

In addition to concepts, another strong tie to the understanding is judgment. As Kant writes, "If the understanding in general is explained as the faculty of rules, then the power of judgment is the faculty of **subsuming** under rules" (A132/B171). However, Allison points out, "this does not mean that the *ability* to judge is equivalent to the ability to understand" (2004, p. 205). The ability to judge applies to the conditions of possibility, and when we do this, we are also able to understand. Judgment itself has no rules; and it must be practiced, not taught, according to Kant (A133/B172). The rules for the pure concepts of the understanding, on the other hand, are given through transcendental philosophy and mathematics, which "*can specify a priori* the conditions of their rules" (Allison, 2004, p. 207). For example, in terms of mathematics, we can refer back to the triangle above which exhibits apriori rules of right triangularity in general. In general when we judge, we are applying apriori rules given to us by the understanding.

Now let us return to the general role of the understanding within the apparatus of the mind. Kant summarizes this general role as such:

If we call the **receptivity** of our mind to receive representations insofar as it is affected in some way **sensibility**, then on the contrary the faculty for bringing forth representations itself, or the **spontaneity** of cognition, is the **understanding**. It comes along with our nature that **intuition** can never be other than **sensible**, i.e., that it contains only the way in which we are affected by objects. The faculty for **thinking** of objects of sensible intuition, on the contrary, is the **understanding** (A51/B75).

Furthermore, to conclude the place of the understanding, we have seen that it governs judgment whose task is to subsume pure intuition under pure concepts. In turn, objective validity within our experience is given to us by exercising this apriori capacity to judge, which is governed by the faculty of the understanding. Experience is structured by the pure concepts (the rules) given to us by the understanding. These experiences are the representations, which in turn give us the cognition that we judge to be objectively valid.

6. Conclusion Regarding the Apparatus of the Mind

From this chapter, we can conclude that for Kant, there can be three types of propositions that express human knowledge. Firstly, we can have analytic apriori propositions, such as “All bachelors are unmarried”, where the predicate is contained within the subject, therefore not giving us any new information about the world. Second, we can have synthetic aposteriori propositions, such as “It is raining outside”, where we gain knowledge from an object of experience. Third, we can have synthetic apriori propositions, such as “Every event has a cause”. This last type of proposition is what Kant aims to defend with his transcendental idealism and is controversial for many philosophers, such as P.F. Strawson (as we will see in the following chapter). In a synthetic apriori proposition, it is possible to know the proposition independently of experience (even though the predicate term is not contained within the subject term), because it expresses a condition imposed by the forms of sensibility.

Kant’s intricate apparatus of the mind discussed in this section (section C of chapter one) does not end here. Kant continues in his *Critique* to question the givenness of pure reason and investigate how pure reason is even possible as far as we can comprehend. The section on pure reason is covered under the Transcendental Dialectic within the *Critique*, where Kant also

examines the limits of the legitimate use of pure reason, which will be lightly touched upon in chapters two and three of this thesis. For now, we have covered the basic functions and relations of the elements and faculties of our mind which are covered under Kant's Transcendental Aesthetic and Transcendental Analytic in his *Critique*. Kant emphasizes especially the importance of the sensibility and understanding when he writes:

Further, these two faculties or capacities cannot exchange their function. The understanding is not capable of intuiting anything, and the senses are not capable of thinking anything. Only from their unification can cognition arise. But on this account one must not mix up their roles, rather one has great cause to separate them carefully from each other and distinguish them. Hence, we distinguish the science of the rule of sensibility in general, i.e. aesthetic, from the science of the rules of understanding in general, i.e. logic (A52/B76).

We learn from this passage that the Transcendental Aesthetic is the science concerned with the faculty of sensibility and the transcendental logic (or also referred to as the Transcendental Analytic) is the science concerned with the faculty of the understanding. Within these two crucial faculties, we find intuitions and concepts, which are needed for our discursive cognition. Intuitions (objects of our experience, which are representations) provide matter for our sensibility (the way in which we are affected by objects). The sensibility is crucial because this is the way in which objects are given to us. Understanding is the faculty that gives us concepts and governs judgment. Judgment is that which applies pure concepts to pure intuitions. When pure intuitions are subsumed under pure concepts, we have synthetic a priori judgments.

Chapter II: The Transcendental Subject

A. Introduction

In this chapter, I will discuss what it is that constitutes the boundaries of our experience, namely Kant's conception of the transcendental subject. The limits of our world, that is, the world given as the spatiotemporal framework holding within it our empirical experience (according to Kant), and the boundaries of our reality, are generally a crucial discussion point in metaphysics, and particularly for this thesis. The limits of the empirical reality in our world (for example, the extent of our knowledge of an object in the world), ultimately lead to the boundaries of our known reality. As P.F. Strawson writes in his book *The Bounds of Sense: An Essay on Kant's Critique of Pure Reason* (1966), "The first task of philosophy is to set its own limits" (p. 17). Setting these limits is important to both Strawson and Kant, although they do not agree on where exactly the limits are to be found. In fact, we have seen that this is one of Kant's central aims with his critical philosophy, in which he criticizes the limits of our knowledge, and, in turn, the limits of our reality. As Strawson explains, "There are limits to what we can conceive of, or make intelligible, to ourselves" and "The investigation of these limits, the investigation of the set of ideas which forms the limiting framework of all our thought about the world and experience of the world, is evidently an important and interesting philosophical undertaking". Strawson credits Kant as being the philosopher who has made the most "strenuous attempt" at the task of setting these limits (1966, p. 15). However, as we will see, Strawson ultimately criticizes Kant for drawing the bounds of sense from a point outside of them (the bounds), and this, he argues is simply not possible. For a Kantian, Strawson sees this as not possible because he (Strawson) ultimately tries to conflate the transcendental with the empirical subject. As a result, I shall argue that Strawson commits a paralogism, in Kant's sense, when constructing his analysis.

Such a paralogism is a consequence of Strawson's rejection of the synthetic a priori in Kant's transcendental philosophy. As an alternative to the synthetic a priori and transcendental idealism, Strawson bases his analysis on an analytic framework, where he still holds the a priori in terms of concepts but rejects the synthetic aspect of our judgments of the world. The way in which Strawson holds the a priori in terms of concepts can be explained by the following:

There is “the idea that the experiences of a self-conscious creature must provide room for the thought of experience itself. But one can apply that notion only in the context of the application of categories of things which are not experiences. However, such categories can be available to a subject only if its experiences provide it with the grounds for applying them, which involves the idea that its experiences relate it to non-experiences, that is to say, independent things” (Snowden, 2019).

Here we see the “independent things” as the apriori concepts or categories Strawson argues for. However, because Strawson rejects synthetic apriori judgments and Kant’s transcendental idealism, we will come to see what his redefinition of the ‘empirical’ is, contrasted to Kant’s empirical real which is connected necessarily to his transcendental ideal, as we saw in chapter one.

To explain Strawson’s epistemology briefly now, there are two ways of having knowledge—either from analytic concepts (analytic apriori) or from empirical experience (synthetic a posteriori) in the world.¹⁵ (Notice here that the third type of proposition that can express human knowledge for Kant, namely synthetic apriori propositions, is missing.) Strawson argues for an analytic framework of justification where the object is thought of as an empirical reference to the concept. Strawson does not explain the spatiotemporal givenness of an object. Kant would have a problem with this lack of explanation because, as we recall, for Kant, the givenness of an object is determined by the apriori forms of sensibility, namely space and time, which serve as apriori conditions for the possibility of experience. In other words, Strawson has a less complex understanding (one without the necessity of synthetic apriori) of what conditions the possibility of the empirical. He does not reach as far as Kant does, meaning he does not take the transcendental realm into consideration because he believes the-thing-in-themselves are what we find in space and time (Strawson, 1966, p. 41). For Strawson, there is no distinction between appearances and the things-in-themselves; and therefore, he rejects the critical distinctions Kant makes such as the distinction between the transcendental ideal and the empirical real. As a consequence, there is no need to defend synthetic apriori cognition in Strawson’s metaphysics, since he rejects the synthetic all together.

¹⁵ Here we can refer back to the conclusion in chapter one, where we saw the analytic concept (analytic apriori) of a bachelor (an unmarried man), in which the predicate is contained within the subject; and an example of a synthetic aposteriori proposition, in which we gain information, such as “The cat is on the mat”.

While Strawson tries to point out a fallacy in Kant's argument, we end up seeing that it is actually Strawson who is committing what turns out to be a parallogism. My proceeding arguments will show why this is so. In his General Review within *The Bounds of Sense*, Strawson writes a passage in which he tries to show a fallacious reasoning of Kant's when Kant is formulating his own transcendental idealism:

The doctrine that we are aware of things only as they appear and not as they are in themselves because their appearances to us are the result of our constitution being affected by objects, is a doctrine that we can understand just so long as the "affecting" is thought of as something that occurs in space and time; but when it is added that we are to understand by space and time themselves nothing but a capacity or liability of ours to be affected in a certain way by objects not themselves in space and time, then we can no longer understand the doctrine, for we no longer know what 'affecting' means, or what we are to understand by 'ourselves' (1966, p. 41).

In this passage Strawson is drawing attention not only to the important concept of 'affection'¹⁶, but also to the conception of 'ourselves'. Let us recall from chapter one of this thesis that according to Kant, we live in a world of representations, that is, the phenomenal world. Because of this, Strawson is trying to show a fallacious reasoning on Kant's part. He is asking how is it possible for us to be affected by objects outside of space and time, if space and time themselves are dependent on our constitution? However, even more importantly, in the quotation above it is asked, "where do we stand? Inside or outside of space and time?" As a philosopher who rejects Kant's transcendental ideal framework, Strawson believes that not only the empirical, but also the transcendental subject exists *within* space and time. For Strawson, everything that we can acquire knowledge about, including the subject, exists within the spatiotemporal framework, because he argues it does not make sense to speak about what is outside this framework. In Kant's terms, Strawson makes the transcendental subject transcendently real; and at this point, Strawson commits a parallogism from the Kantian stance, in the sense that the transcendental subject is both real *and* knowable.¹⁷ So, in this chapter of my thesis, I will investigate Strawson's analysis

¹⁶Although I will not address the problem of affection here, as it stands beyond the scope of this thesis.

¹⁷We will see that for Kant, the transcendental subject serves as a condition of possibility, and as such, it is not knowable (being a pure form).

of the claim that the transcendental subject exists within space and time and focus on where exactly I think the transcendental subject is situated when it comes to our way of experiencing reality.

For Kant, the transcendental subject is that which grounds the appearance of ourselves (or of *myself*)— in addition to all other possible appearances we can have. In a certain sense, we can see this transcendental subject as a parallel to the thing-in-itself in that it ‘exists’ but it is not knowable.¹⁸ Likewise, both the transcendental subject and the things-in-themselves ground the appearance of objects we experience within space and time. This is not to say that they are on the same level of description, because the transcendental subject is that which we find at the *limit* of our framework while the things-in-themselves lie completely *outside* of this spatiotemporal framework. However, as a ground, they both serve, respectively, as the condition for the possible representations of ourselves and of objects in space and time. Within my interpretation on this matter, it is this transcendental subject which serves as the limit of our world since it lies at the boundaries for all possible experience within space and time. A further discussion of the transcendental subject will shed light on our understanding of the subject-object relation (which is of concern in chapter three of this thesis). Specifically, we will see that the transcendental subject is always serving as a condition for the possibility of experience and the objects we experience, which is a central point in Kant’s philosophy and, hence, vital for this thesis. I will demonstrate this by analyzing how the transcendental subject serves as a condition for the possibility of *x*, and how it is given as the boundary of the world within which we have representations of objects. This boundary, in which the transcendental subject serves as the limit of the world, will, in turn, be crucial when we arrive at the next chapter, discussing the metaphysical implications of quantum physics.

Before proceeding, I will here summarize Strawson’s main differences from Kant’s philosophy of transcendental idealism. Firstly, Strawson holds an analytic framework for knowledge that does not need the synthetic [in Kant’s sense]. Secondly, Strawson can be interpreted as having a “horizontal” view of the transcendental and empirical subject, as opposed to Kant’s “vertical” view (let us think of these terms of “horizontal” and “vertical” as metaphors). To make this

¹⁸ I will address the concept of ‘exist’ further into this chapter.

clear, let us think of the vertical representation in which the transcendental subject is on a level above the empirical subject, that is, as a condition, and there is a conditioning line connecting them in this vertical sense. For the horizontal sense, which, according to my interpretation, is what Strawson sees, the transcendental subject is on the same level of description as the empirical subject. This is because for Strawson, the line is “collapsed” – it is not there at all because the transcendental subject and empirical subject is one and the same. Thirdly, Strawson does not have a framework to include or acknowledge the transcendental realm (Strawson, 1966). These tenets of Strawson’s own philosophy will be explained in more detail below while investigating his claims against Kant. For the time being, I will state that Strawson’s distorted view of Kant’s transcendental philosophy leads him to commit a series of mistakes when questioning the transcendental subject and the boundaries of our reality.

B. Strawson’s Mistakes

In *The Bounds of Sense*, P.F. Strawson criticizes Kant’s transcendental ideal framework which gives us the bounds of our reality. While doing so, he asks a series of questions which I believe are mistakenly asked because they do not lead to any further clarifications or insights, as I shall argue for in this chapter. To start with, Strawson believes that Kant molds the spatiotemporal framework to hold within it only appearances/representations rather than what is actually (noumenally) real; and this is because Strawson conflates noumenal objects with phenomenal objects, since he believes they are actually one and the same thing. As we know from chapter one of this thesis, space and time are the apriori conditions and forms of intuitions, which are made possible to us by means of sensibility, for objects in the phenomenal sense, not in the noumenal sense because the noumenal realm exists outside of our sensible forms of space and time. Because of Strawson’s disagreement here with Kant on this point, we see that he (Strawson) holds an anti-idealist stance (cf. “descriptive metaphysics”) where he disagrees with Kant that we can have no knowledge of what is noumenally real. Because for the anti-idealists, within Kant’s philosophy, reality is supersensible, meaning it cannot be attained via our forms of thinking and experiencing. The anti-idealists see no need for such an explanation of what a noumenal reality is or where it lies. They might perhaps, like Strawson, see this as a superfluous

interpretation of reality; or even as a superfluous dimension, unnecessarily postulated by Kant. Allison presents such a critical view of the anti-idealists when he writes,

[T]ranscendental idealism is often attacked on epistemological grounds for its complementary claim that we can know only appearances. Equating Kantian ‘appearances’ with ‘mere representations,’ critics take this to mean that we know only the contents of our own minds, that is, ideas in the Berkeleian sense. This is then sometimes used as the basis for a critique of the doctrine of the ideality of space and time (2004, p. 5).

From the view presented here, we can see that for philosophers like Strawson, this doctrine of the ideality of space and time is incoherent and unnecessary. Strawson himself expresses this when he writes,

The doctrines of transcendental idealism, and the associated picture of the receiving and ordering apparatus of the mind producing Nature as we know it out of the unknowable reality of things as they are in themselves, are undoubtedly the chief obstacles to a sympathetic understanding of the *Critique*” (1966, p. 22).

Strawson’s alternative argument, then, is to ask, “But do not our own experiences or states of consciousness” occur in space and time? “And, do we not at least, in knowing what our own states of consciousness are, know something about ourselves as we really are...?” In turn, he believes this refutes Kant’s stance that “knowledge of temporally ordered items is not knowledge of anything as it is in itself” (1966, p. 54). Let us here expand on the notion of “in itself”. For Strawson, the “in itself” is within the bounds of space and time, as that is where our knowledge lies, including the knowledge of the subject (ourselves). However, for Kant, it is the transcendental ideal form of the “in itself” which *grounds* or *conditions* the knowledge of objects we have within the bounds of space and time, and this “in itself” [“an sich”] lies outside of the framework of space and time. Hence, Strawson is having difficulty understanding why Kant does not believe that knowledge of temporally ordered and spatially related objects can lead to us have knowledge of anything as it is in itself. Now returning to the argument Strawson presents from the quotations above (that the ideality of space and time is incoherent and unnecessary), I will provide my own response to his questions in the following paragraph.

Strawson does agree with Kant that our human constitution is partly responsible for the way things appear to us. For example, Strawson argues that there are primary and secondary

qualities; and it is our minds which grasp *secondary qualities* based on the primary qualities (and these secondary qualities are considered to be purely subjective) (Allison, 2004, p. 5). However, in my own terms (and on behalf of Kant), our system of representation, i.e., the faculties of our mind, alter the objects in space and time from their noumenal state. So, to answer the quotes from Strawson above, I will answer that yes, knowing our own states of consciousness does tell us something about ourselves, namely how we are as the empirical subject.¹⁹ However, I will not say it tells us something about ourselves as we *really* are, but only that there *is* a real version of ourselves- namely we know the *form* of this supersensible subject but not its essence. That is to say, we have the apriori concept (form) of this transcendental subject which we find at the limit of our world, and this form acts as the ground for the empirical subject we find within the limits, and we cannot speak further of the transcendental subject (we do not know its content or essence). We can self-reflect, but the self-reflection only goes so far. It cannot cross the bounds of space and time because they are our framework for knowledge.²⁰ Hence, knowledge outside of this framework cannot be known nor made sense of in terms of our framework, since it lies outside of it. The transcendental subject (what we *really* are, as Strawson put it) lies at the border of this framework, so we cannot truly speak of it, according to Kant. This discussion of the essence of the transcendental subject will be expanded upon in the last section of this chapter.

For Kant, noumenal objects do not exist in space and time because these are the things-in-themselves. Although for Kant we do have objectively valid judgments in the empirical real given to us by subjectively grounded conditions of the possibility of representations. This is a point where Strawson differs from Kant. This is so because Strawson thinks the only things that can exist in space and time are those which are empirical and determined by analytical concepts. These empirical objects are already real, in that they are already given to us (however, as mentioned above, Strawson fails to explain the *givenness* of these “real” objects, that is, *the way* the objects are given to us); and for Strawson, it would not make sense to say that the reality which grounds appearances exists outside of space and time. Because for Strawson, what is empirical *does* exist within space and time, so there is no need to speak of that which exists outside of space and time. This is so because he lacks the critical distinction between the thing-

¹⁹We can, in fact, only know ourselves as we appear to ourselves – in space and time.

²⁰ At this point, we are crossing into Kant’s Transcendental Dialectic in the *Critique*. In the Dialectic, Kant explains there are objects which are thinkable but not experienceable. For example, it is *thinkable* that there is a squared circle, but it is not possible to *experience* it within our spatiotemporal forms.

in-itself and the appearances. Also because of this reason, Strawson does not believe it would make sense to say that I, the transcendental subject, do not exist in space and time. However, according to Kant, it is the *appearance* of ourselves (the representation of the transcendental subject) that we encounter in space and time (A546/B574). I can never represent myself as a thing-in-itself.

In a section titled “The Metaphysics of Transcendental Idealism” (1966), Strawson refutes Kant on this point. He believes that the doctrine of transcendental idealism “takes swift plunges into unintelligibility.” He continues,

Consider, for instance, the view that since space and time are nothing but forms of our sensibility, our awareness of all things in space and time, including ourselves, is awareness of things only as they appear and not as they are in themselves. We are aware, then, of ourselves in a temporal guise and hence only as we appear to ourselves and not as we are in ourselves. But what sort of truth about ourselves is it, that we appear to ourselves in a temporal guise?...I really do *appear* to myself temporally; but I do not really *temporally* appear to myself. But now what does ‘really do appear’ mean? The question is unanswerable; the bounds of intelligibility have been traversed, on any standard (pp. 38-39).

From this section, it is clear that Strawson is struggling with the placement and delimitation of the transcendental subject. He is trying to demonstrate that Kant’s placement of the transcendental subject outside of the bounds of space and time is unintelligible. For Kant, the subject is both a limit of the world and an appearance in the world, and Strawson seems to have trouble making sense of how this double perspective can be. However, Strawson himself does not offer a solution that is really any different from Kant’s. This is most likely because Strawson does not offer a solution *at all* since he thinks such a problem of a double perspective of the subject is superfluous and therefore not necessary.

My response to the section quoted above, in defense of Kantian transcendental idealism, is to say that we can exist temporally, but we cannot temporally exist. Quite like Strawson says himself, “I really do *appear* to myself temporally; but I do not really *temporally* appear to myself”. That is to say, we can exist within the realm of time because that is the realm of

appearances and representations.²¹ But to *really temporally appear* to myself is not possible because the *real* in this case is unattainable (given we are within a spatiotemporal framework). Here, I am not thinking of the *real* in terms of the empirical real, which for Kant is within the spatiotemporal framework. Rather, this concept of *real* is in the sense of the noumenal object being real. The temporal subject is unattainable as such. In this case, the *real* would be the transcendental subject. As we saw, Strawson goes on to ask, “But now what does ‘really do appear’ mean?” and himself answers, “The question is unanswerable; the bounds of intelligibility have been traversed, on any standard”. It seems that what Strawson fails to realize in answering the question in this way, is that he is actually echoing what Kant himself believes and defends with his doctrine of transcendental idealism, which will be further explained in the sections below.

The question of “what really *is*” (as such – “in itself”) is indeed unanswerable. The things-in-themselves, including the real substance of what the representation of *ourselves* is based on, are inaccessible. Our existence is an existence that is accessible for us in appearance (spatially and temporally). Here we can differentiate between *how* we exist and *that* we exist. That is, the *way* we exist is *how*; and that I have an immediate “consciousness” *that* I exist is the latter.²² We exist on the level of appearances and representations (encompassed by the setting of space and time as the apriori forms of intuitions that constitute our framework for our experience regarding the world); because an objective existence, in the noumenal sense, cannot be defined, nor can it be attained. Or in other words, we only know *that* we exist. The question of *how* falls within the framework of the transcendental idealism, as it explains the way we ourselves and objects are given to us as representations.

Later in the book, Strawson expands on his objection regarding where the transcendental subject lies. In a section titled, “The Thing-in-itself and Appearances in Inner Self” (1966), Strawson discusses how there must be a point of connection “between the supersensible world and the world of human beings, between things as they are in themselves on the one hand and Kant and his readers, the ordinary referents of personal pronouns and possessives, on the other”

²¹ Hence, speaking of ‘existence’ in our framework of space and time is equating ‘existence’ to ‘appearance’. Kant’s notion of ‘existence’ is quite heavy, and I will not divulge in it here. See Uygur Abaci’s article “Kant’s Theses on Existence” (2008) for further reading on what ‘existence’ is for Kant.

²²This is just an immediate “feeling”, according to Kant; that is, it is neither a cognition, nor a representation of the senses, (“*Gewissheit*” -- “*that*”). Kant writes about this in several places, for instance, in the Paralogism chapter of the *Critique*, in some of his pre-Critical writings, and in his *Prolegomena*, just to mention some sources.

(p. 247). This point of connection and concern with personal pronouns is Strawson's way of describing the transcendental subject, or as he also refers to it as, the 'supersensible subject'. There are two senses of 'self' discussed in this section of Strawson's book. First, there is the empirically self-conscious subject. This is the subject that presents itself as an appearance in space and time; and it has a history which can be traced causally. The second sense of 'self' is the real (noumenal) or supersensible subject (what we as humans and Kant are referring to as the transcendental subject). This subject has no history and is not within space and time (B132-B134). In an attempt to void out the distinction between the empirically self-conscious subject and the supersensible subject as "superfluous and unjustified", Strawson writes, "If the appearances of x to x occur in time, they cannot be assigned to the history of the transcendental, supersensible subject, for that being has no history" (1966, p. 249). Here, Strawson is making another mistake, as I argue from a Kantian point of view; and, as it turns out, a kind of paradox (in the sense that it is distorting or conflating the levels of description) in the form of a paralogism. This paralogism, in Kant's terms, will be expanded upon further down in section C.3 of this chapter. The mistake is that it is not possible to assign a history to that which can have no history, i.e., the supersensible subject. "History" applies to that which exists in time, and the supersensible subject does not. It lies on the boundary of our framework of space and time, on the boundaries of our reality. The core of Strawson's argument here seems to be when he continues with "That is to say, they cannot justifiably be described as appearances *to* myself as I (supersensibly) am in myself, nor – since what they are appearances *to* they are also appearances *of* – as appearances *of* myself as I (supersensibly) am in myself" (1966, p. 249). Here, Strawson is having a problem with the duality or "the double aspect" view (cf. Allison) of the subject. He cannot seem to come to terms with the ascription of a transcendental subject as a ground for the representation of ourselves, and as such, the limit of the world. Considering Allison's double aspect view (as discussed in my chapter one), this double aspect is indeed possible. The same object (or in this case, the subject) can be viewed from two aspects of itself – the phenomenal aspect we encounter within the framework of space and time, and the noumenal aspect which lies outside of space and time and has no definition²³ as far as we know from our human standpoint.

²³ Definition in terms of what is knowable to us from the human standpoint, i.e., representations.

This latter aspect of the subject (that being the transcendental subject) is that which serves as a ground for the former aspect (that being the empirical subject).²⁴

In conclusion of his critique on Kant's stance of the transcendental subject, Strawson claims that "Kant fails to overcome the difficulties concerning identity because they cannot be overcome" (1966, p. 249).²⁵ Once again, the echo of Kant's transcendental idealism is unmistakable here.²⁶ Hence, I am arguing now that precisely *because* the identity problems concerning the transcendental subject cannot be represented, defined or overcome is exactly *why* the transcendental subject lies at the boundary of our reality. It is something that cannot be known, otherwise it would be within our framework of space and time. Ludwig Wittgenstein's discussion of the metaphysical subject in his *Tractatus Logico-Philosophicus* (2001) especially touches upon this very topic. Wittgenstein, in an arguably Kantian spirit, writes "The subject does not belong to the world: rather it is a limit of the world" (TLP 5.632). Why Strawson refuses to accept this, when he offers no other real differing solutions to the problems he probes, can be inferred as a bit mysterious, and therefore worth examining. Perhaps we can say that Strawson lacks the "Copernican Turn" in his philosophical thinking. As we have seen, he has mistakenly asked the wrong questions to refute what he believes he is going against; when in reality, we see him arriving to the same conclusions which he was trying to avoid. Perhaps, in the vein of Strawson, it is easier to deny such problems as the transcendental subject rather than accept it and accept that it has no known solution from the human standpoint.

²⁴ Cf. the relation between *the condition* and *the conditioned*, explained further below in section C.2.

²⁵ The type of identity in question here is that which is in and of the subject itself. How many levels of identity can the subject have? As discussed, Strawson does not want to accept Kant's double aspect answer to this specific question. Kant furthermore discusses the identity relation between the subject and its representations, including objects in his transcendental deduction, and this discussion is included in the next section.

²⁶ Although this is "echo" is silent for Strawson (but not for the Kantian reader of Strawson).

C. Kant's Transcendental Subject

1. Relations of the Subject

In this section, I will present how Kant thinks of the transcendental subject as distinguished primarily from the empirical subject. He discusses the different modalities of the subject in, for instance, section 16 of the Deduction in the *Critique*. How does the subject relate to the “I think” and the self-consciousness? Kant answers with the following:

The **I think** must be able to accompany all my representations... That representation that can be given prior to all thinking is called **intuition**. Thus all manifold of intuition has a necessary relation to the **I think** in the same subject in which this manifold is to be encountered. But this representation is an act of **spontaneity**, i.e., it cannot be regarded as belonging to sensibility. I call it the **pure apperception**, in order to distinguish it from the empirical one, or also the **original apperception**, since it is that self-consciousness which, because it produces the representation **I think**, must be able to accompany all others and which in all consciousness is one and the same, cannot be accompanied by any further representation. I also call its unity the **transcendental** unity of self-consciousness in order to designate the possibility of *a priori* cognition from it (B132).

Here we see that it is the pure apperception, or in other words, the original apperception, which conditions the possibility of all thinking and intuiting; that is, *all* our (possible) representations. When the subject considered as the pure apperception (or original synthetic unity of apperception) spontaneously makes possible the “I think”, then the “I think” is in a sense the result of this act of spontaneity. The “I think” is a result in that it then becomes an empirical proposition which accompanies all my representations. When this “I think” is spontaneously activated, it is the representation of the empirical subject, and in this sense, it is the empirical subject within the pure apperception that we can say exhibits the “I think” and then accompanies all our representations. The “I think”, then, stands in an analytic relation to its representations. The pure apperception is the transcendental subject, as opposed to the empirical subject. The transcendental subject is unitarian subject in that it goes beyond the empirical representations, and as such it also unifies our various representations. As the ‘unity of the apperception’ it unifies the given manifold of all intuition and it grounds (conditions the possibility of) the empirical subject, which is the self that undergoes alterations. Kant further distinguishes the empirical subject from the transcendental subject, “For the empirical consciousness that

accompanies different representations is by itself dispersed and without relation to the identity of the subject” (B133). The empirical subject is found in the world of representations, side by side with other intuitions, and is distinct from the transcendental subject. Since Kant argues that the “I think” must accompany all my representations, this means that there is an analytic relation between the representation and the “I” that is thinking this representation. In other words, as explained above, there is no representation without an accompanying “I think” to each and every representation (and let us remember this representation of the “I think” is the empirical subject). The transcendental subject, on the other hand, is the original synthetic unity of apperception which makes possible synthetic a priori cognition needed for such analytic relations as the empirical subject or the representation of the “I think”.

2. Synthetic Unity of Apperception

The distinction between the empirical and transcendental subjects is the prelude to my major argument against Strawson’s mistakes regarding the placement and identity of the subject, which was described in the previous section. Kant emphasizes that the relation of the subject is not the act of “accompanying each representation with consciousness, but rather by my **adding** one representation to the other and being conscious of their synthesis” (B133); and this gives us a more vertical (rather than horizontal) picture of the relation between the transcendental subject and the empirical subject (and other possible representations) as was discussed in the introduction of this chapter. The vertical picture concerns the *condition* and *conditioned* relation—the condition being the form of the transcendental subject which gives us the conditioned empirical subject. Continuing on this line of thought, the following is an important passage Kant writes which may serve as an argument in our effort to refute Strawson’s analytic-only framework: “Therefore it is only because I can combine a manifold of given representations **in one consciousness** that it is possible for me to represent the **identity of the consciousness in these representations** itself, i.e. the **analytical** unity of apperception is only possible under the presupposition of some **synthetic** one” (B134). Within this text (and the footnote which accompanies it) we see the importance of why synthetic unity of apperception is necessary; because without it, we would not have the analytic unity of apperception. In other words: *The unity of the consciousness* is a condition of *the consciousness of unity* (i.e., our unified representations). To give an example, I will say that the synthetic unity of the color red is needed

first in order to make it applicable for a common concept of red in an analytical unity. Kant writes this is because “A representation that is to be thought of as common to **several** must be regarded as belonging to those that in addition to it also have something **different** in themselves”. So, thinking of ‘red’ in general presupposes a concept of red that “can be encountered in anything, or that can be combined with other representations”. Hence, we need the possible synthetic unity of a concept before we can represent to ourselves the analytical unity of a concept (B133-134n).

Strawson disagrees with Kant here because he sees no need for the synthetic unity, or the concept of synthetic a priori cognition. For him, it would suffice to say that there is an analytic concept of ‘red’ without necessitating a synthetic unity of ‘red’. For Strawson the concept of red is only an analytic concept, while for Kant there is also a synthetic concept. Similarly, for Strawson, the empirical subject (the analytical unity of apperception) is sufficient in itself to serve as self-consciousness for a priori analytic cognition (as opposed to a priori synthetic cognition because Strawson does not need this in his framework for knowledge). However, for Kant, the unity of self-consciousness (the transcendental subject) serves as the boundary that yields synthetic a priori cognition. This understanding of the self-consciousness is the synthetic unity of apperception. To summarize, that we *have* analytic unity of apperception is as far as Strawson can agree with Kant. Strawson stops here while Kant goes further to explain that all the representations that belong to me (analytically) do so under the presupposition that they are all unified in one consciousness (namely my consciousness) synthetically. Therefore, for Kant, all the different representations belong to one and the same consciousness, this being a synthetic unity of apperception, which then makes analytical unity of apperception possible.

The notion of unity leads to an important discussion about the underlying ground for our representations. With the help of Michelle Grier’s article, “Kant on the Illusion of a Systematic Unity of Knowledge” (1997), I will show why this grounding for our representations is crucial.²⁷ In this article, Grier probes more into reason’s duties to help the understanding. She writes,

...we certainly can and must consider these ‘appearances’ as necessarily connected somehow...One way of putting this is to say that reason defines and presents the problem

²⁷ Just to note, at this point of the discussion, we are moving into Kant’s Transcendental Dialectic section of his *Critique*, which concerns the use of reason.

to the understanding, and that it does so by ‘picking out’ a set of phenomena which needs to be ‘connected’ (1997, p. 22).

Again, we see the importance of the *combining* of the manifold of given representations. According to Grier, reason unifies the combination of these representations with a broader field of knowledge which then brings it to completion. This unification is needed for Kant’s argument because as Grier explains,

...it is only by representing the aggregate collection of phenomena in some necessary connection to a shared underlying ground or substrate that such phenomena can be taken to exhibit the necessary connections requisite for the discovery and articulation of empirical laws (1997, p. 22).

This “underlying ground” or “substrate” is what is of major importance for our discussion here. From Grier’s arguments on behalf of Kant, we see that this all boils down to a necessary relation to an unknown ground or substrate. Earlier, I mentioned the vertical relationship between the *condition* and the *conditioned*. Now we can expand even more on that relationship by saying that the condition which conditions the conditioned is itself unconditioned. That is to say, that the ultimate ground or substrate *is* the unconditioned condition.²⁸ In this sense, the unconditioned condition cannot itself be represented—it can merely serve as a condition for all our possible representations. Since we are here concerned about the subject, both the empirical and the transcendental, we see that the ultimate ground for the empirical subject is the transcendental subject. This grounding is a necessity for us as humans to have anything as a conditioned representation, including the empirical subject. The consequences of this ultimate ground being unconditioned will be discussed more in the next section.

Moving on in defense of Kant and his argument for the necessity of the synthetic unity of apperception, I will hereby continue with using the example he gives in the footnote to sections B133-134:

The analytical unity of consciousness pertains to all common concepts as such, e.g., if I think **red** in general, I thereby represent to myself a feature that (as a mark) can be encountered in anything, or that can be combined with other representations; therefore only by means of an antecedently conceived possible synthetic unity can I represent to

²⁸This relationship is supported by Kant’s Transcendental Illusion which he considers as natural and unavoidable. This topic exceeds the scope of our discussion here, but is explained in more detail in Grier’s article.

myself the analytical unity... And thus the synthetic unity of apperception is the highest point to which one must affix all use of the understanding, even the whole of logic and, after it, transcendental philosophy; indeed this faculty is the understanding itself (B133-134n).

In this crucial footnote, Kant is highlighting the importance of the synthetic unity of apperception, which is performed by the faculty of the understanding. Because “Combination does not lie in the objects,” we need the understanding to actively synthesize a priori, “bringing the manifold of given representations under unity of apperception, which principle is the supreme one in the whole of human cognition” (B135). This is how synthetic a priori cognition is possible. Not only is it possible, but it is also needed for analytic a priori cognition, or for the possibility of the analytic unity of consciousness, as we have seen.

Now, we can ask through what subject (the empirical or transcendental) is this synthetic a priori cognition possible? Well, firstly, we must note that no manifold is given through the “I” as a simple representation.²⁹ Namely as a simple, the “I” is pure and empty (pure meaning without any synthetic content); therefore, it does not contain any manifold within it. A synthetic manifold must be given in the intuition for the “I” to receive any content to synthesize, and, in turn, to represent. Thus, it is rather “the original synthetic unity of apperception” (the transcendental subject), “under which all representations given to me stand”; and these representations are possible due to synthesis, or otherwise, the operation of the understanding (B136). So, it is the transcendental subject, while performing the active function of the understanding (combining a priori and synthesizing the manifold of intuitions under unity of apperception) which yields to us humans synthetic a priori cognition.

3. Essence and Existence

In the Ideal, Kant is concerned with the noumenal rather than with sensible/phenomenal reality. In between the phenomenal realm and the noumenal realm is where we find the transcendental subject, on the boundary, looking in at our framework for the empirical realm. As mentioned above, the transcendental subject is the unconditioned ultimate ground for the empirical subject. I would now like to discuss what we know in terms of the essence and

²⁹ Again, we can think of this as the empirical subject.

existence³⁰ of the transcendental subject, which will help to further analyze why Strawson makes a mistake with the questions he asks. We know where we can find the transcendental subject (at the boundary of our framework of space and time), but what about its essence or existence? Can we speak of these qualities of the transcendental subject itself? Also, what does it mean to say that it is an unconditioned condition? Let us see what Kant answers in an important passage found in the *Dialectic*:

For if we follow the rule of nature only in that which might be the cause among appearances, then we need not worry about what sort of ground is thought for these appearances and their connection in the transcendental subject, which is empirically unknown to us. This intelligible ground does not touch the empirical questions at all, but may have to do merely with thinking in the pure understanding...and the intelligible character, which is the transcendental cause of the former [that being the empirical character (TM)], is passed over as entirely unknown, except insofar as it is indicated through the empirical character as only its sensible sign (A546/B574).

From this passage, we can see that the transcendental subject is “empirically unknown to us” and its character is “passed over as entirely unknown”. In strikingly similar words, Wittgenstein also addresses this idea of the unknown in the introduction of his *Tractatus* (2001). He writes, “what can be said at all can be said clearly, and what we cannot talk about we must pass over in silence” (2001, p. 3). Once again, we are drawing attention to the boundary line—specifically, the line between what we can and cannot talk about. The transcendental subject crosses the bounds of what we can experience in space and time, and hence what can be known to us (so then we can speak of it). It is, as Kant mentions, “the highest point” from which the understanding activates from (B134). This is the point, at the boundary line of our empirical world, crossing over to the noumenal world, where we find the transcendental subject—between the known and unknown. We can know it as a form; however, its essence cannot be known to us, just as the essence of objects in the noumenal realm cannot be known. Although, we know that

³⁰ By “essence” I mean the intrinsic nature which determines its character. By “existence” I refer to *how* and *that* it exists.

they are there, and the transcendental subject is there, because their forms ground the representations we find in our reality of the phenomenal world.³¹

The double sense of self is elaborated on when Kant continues to write, “Yet the human being, who is otherwise acquainted with the whole of nature solely through sense, knows himself also through pure apperception...he obviously is in one part phenomena, but in another part, namely in regard to certain faculties, he is a merely intelligible object” (A547/B575). Knowing ourselves through pure apperception, we know that there *is* a transcendental subject, one that encompasses the representation of the empirical subject. By encompassing the representation of the empirical subject, we have knowledge of the transcendental subject as a form.

The paradox of knowing that there is a transcendental subject, and yet, not knowing what its essence is, is presented as a transcendental paralogism by Kant. In the “Second Book of the Transcendental Dialectic, First Chapter” of the *Critique*, Kant defines a transcendental paralogism as having “a transcendental ground for inferring falsely due to its form. Thus a fallacy of this kind will have its ground in the nature of human reason, and will bring with it an unavoidable, although not insoluble, illusion” (A341/B399). Regarding this transcendental paralogism itself, Kant writes, “from the transcendental concept of a subject that contains nothing manifold I infer the absolute unity of this subject itself, even though in this way I have no concept at all of it. This dialectical inference I will call a transcendental paralogism” (A340/B398). So, again, we know *that* the transcendental subject exists, because we infer its absolute unity, which is “above” (in other words, it conditions) the unity that is manifold within representations on the empirical level.³² But yet, this gives us no knowledge of what the transcendental subject actually is in essence (“I have no concept at all of it”).

Kant also investigates the doctrine of psychology to see if it provides us with any help in answering this question of what the transcendental subject *is*. The system of psychology brings us “against the existence of thinking beings, which in this system are conscious of themselves not only as independent of external things but also as being able to determine themselves from themselves” (B417). Here we see a separation, not only of the subject from all the possible

³¹ We “know” about the transcendental subject and the noumenal objects through regressively referring back from the conditioned to its condition(s). There must be an unconditioned condition that is presupposed for all our knowledge, although the unconditioned condition cannot itself be represented.

³² Here I am referring back to the vertical (Kantian) picture versus Strawson’s horizontal picture, as discussed previously in this chapter.

objects of experience (“independent of external things”), but also a separation *of* the subject itself *from* the appearance of the subject (“able to determine themselves from themselves”). This separation leads Kant to then conclude that “if the existence of external things is not at all required for the determination of one’s own existence in time, then such things are only assumed, entirely gratuitously, without a proof of them being able to be given” (B418). Kant says this conclusion is derived from a synthetic connection of propositions that disprove Mendelssohn’s proof of the persistence of the soul.³³ On the other hand, if we investigate from the analytic perspective, Kant says that the “I think” is “given as a proposition that already includes existence itself” (B418). This, however, leads us to the problem of actuality. If existence is given by the mere empirical proposition “I exist thinking”, then this “contains the determinability of my existence merely in regard to my representation in time” (B420). Once again, we are lacking something that is unifying, something that grounds this empirical existence of the subject. Kant continues, “it is not possible at all through this simple self-consciousness to determine the way I exist, whether as substance or as accident... and the conclusion is that in no way whatsoever can we cognize anything about the constitution of our soul that in any way at all concerns the possibility of its separate existence” (B420). What Kant is saying here, is that knowledge of the *way* of existence beyond the way we know the empirical subject exists, is simply not possible. Thus, Kant concludes that “there is no rational psychology as **doctrine** that might provide us with an addition to our self-consciousnesses, but only as a **discipline**, setting impossible boundaries for speculative reason in this field” (B421). These “impossible boundaries” are the same that Strawson refers to when he writes, “the bounds of intelligibility have been traversed” as addressed earlier, when he questions what does it mean to really appear? (1966, p. 39). These questions reach beyond the human standpoint, and remind us that our only knowledge lies within the boundaries of our framework, with the transcendental subject looking in. What constitutes the essence, and what exactly grounds the empirical existence of this transcendental subject is something that is beyond our grasp, in that it cannot be represented for us.

Regarding existence in time, Kant writes, “the subject, in which the representation of time originally has its ground, cannot thereby determine its own existence in time, and if the latter cannot be, then the former as a determination of its *self* (as a thinking being in general) through the categories can also not take place (B422). Kant is pointing out the fallacy of one

³³ See CPR B414-B415.

claiming they can exist in time. If the subject itself is a necessary condition of time (time being an apriori formal intuition), then how can the subject say “I myself exist in time”? It is time that is dependent on the subject, not the other way around. This corresponds to when Strawson writes, “I really do *appear* to myself temporally; but I do not really *temporally* appear to myself” (1966, p. 39). Here again, we see that a subject can *appear* in time because the subject grounds the representation of time, but it does not work the other way around – where temporality, nor the subject itself, can ground the subject’s (in this case the transcendental subject’s) existence. Perhaps another way of explaining how this works is to say that if one wants to attribute existence of the subject within time, then that ‘existence’ will be a mere appearance, i.e., the empirical subject. This is supported when Kant writes “existence is not yet a category” (B423n).

Just as existence is not an apriori category, existence is also not a predicate. In his critique of the ontological argument, Allison points out, “Kant denies that existence is a real predicate or determination because it does not add any content to the description of a thing to say it exists” (2004, pg. 86, note 25). Allison follows up with this point later in his chapter 14, when discussing absolute necessary existence and the *ensrealissimum*. He writes, “what naturally leads human reason to the thought of *ensrealissimum* is... merely the need to assume something that exists with absolute necessity in order to find a resting place for thought”; and so, for Kant, “if one admits that anything at all exists, then one must also concede that something exists with absolute necessity” (2004, pp. 410-11). This is why we cannot ascribe predicates to things-in-themselves; and noticeably the predicate of existence. Predicates have to do with experience, and while we can ascribe predicates to intuitions (representations) within our framework of space and time, we cannot ascribe them in the noumenal realm. Therefore, one must either deny that ‘existence’ is a real predicate or admit that everything which exists, does so necessarily. If we choose the latter, we run into the problem of the concept of a being whose existence is absolutely necessary. This is how Allison demonstrates (on Kant’s behalf) that both the cosmological and ontological proofs fail, because they both appeal to the concept of *ensrealissimum*.³⁴ In turn, both proofs end up relying on the assumption that absolutely necessary existence pertains uniquely to the object of this concept (Allison, 2004, pp. 417-18). The problem of absolutely necessary existence is its necessity to sustain the being and duration of a subject. As Allison writes, “Since

³⁴ See Allison’s chapter 14 for more on the refutation of these proofs, which have to do with the problem of absolute necessary existence.

only a being whose existence is absolutely necessary can serve as the required ultimate sustainer, the abyss of human reason is that it both requires and cannot recognize anything that exists in that manner” (2004, p. 419). This is of course, another paralogism, and brings us back to the theme of this chapter. What lies beyond the boundary of our framework for experience of possible reality cannot be talked about— it must be passed by in silence. It is the transcendental subject we find at the boundary of this framework, of which we know its possible form, but not essence.

Chapter III: The Parallels Between Quantum Physics and Transcendental Idealism

A. Introduction

I will start out this chapter departing from Stephen Hawking's and Leonard Mlodinow's thoughts on model-dependent reality, which will be presented in the next section. However, we will here make a distinction between the two levels of description regarding reality that will come forth. While discussing model-dependent realities, I will view Kant's project in the *Critique* as a model since "it catalogs the entire outline of the science of metaphysics, both in respect of its boundaries and in respect of its entire internal structure" (Bxxii). Therefore, we can say that Kant's model is that of a metaphysical model which is his transcendental ideal framework. Even though Kant formulates conditions of the possibility for any representations at all, models included, we can still view his transcendental ideal framework as a metaphysical model because it is possible for models to encompass other models or structures within it. Hawking and Mladinow, on the other hand, present us with the model that is needed for the sciences, which relates more to our empirical knowledge.

What is of particular interest as a whole for this thesis, are the parallels between the two levels of description, which are between the metaphysical and empirical models. We will see that as two different levels of description, they coincide at a certain point. Specifically, the two models complement each other, one being on the metaphysical realm of description and the other on the empirical realm of description. The scientific model described by Hawking and Mladinow fits into Kant's metaphysical model where the latter grounds the empirical science of physics transcendently. Kant himself commented frequently on Newton's physics, which is the classical conception of physics. Kant's aim was to establish an independent (autonomous) metaphysical (and transcendental) grounding of the natural sciences, such as physics. This chapter will demonstrate and support such efforts.

B. Model-Dependent Reality

One essential aspect of this thesis is to acknowledge that our concept of reality needs a metaphysical framework.³⁵ In the book, *The Grand Design*, Stephen Hawking and Leonard Mlodinow present a view which is called “model-dependent realism”, and this is “the idea that a physical theory or world picture is a model (generally of a mathematical nature) and a set of rules that connect the elements of the model to observations. This provides a framework with which to interpret modern science”. The connection here to the metaphysical level of description in Kant’s model of reality, is that there is “a set of rules that connect the elements of the model to observations” (Hawking and Mlodinow, 2010, p. 43). From what I interpret through our discussion of Kant, this is done through the model and structure of the mind—with faculties such as sensibility and understanding, and the elements of intuitions and concepts, which work together in a system to give us knowledge. This is done in the way that they connect to our observations in the world via a set of rules, or as Kant would call it, conditions, as is explained in chapter one of this thesis discussing Kant’s transcendental ideal philosophy.

Furthermore, as is explained in the introduction of this thesis, Kant revolutionized our understanding of reality. Rather than reality shaping our minds, it is actually the model (i.e., the structure) of our minds that determines the reality we experience. Our objective reality is the phenomenal world which is given to us through both the apriori forms of sensibility, namely space and time, and the apriori forms of the understanding, that being the categories. For Kant, space and time are transcendental ideal forms of intuition. For Hawking and Mladinow, the model is a model of realism. These two different levels of description (one being metaphysical and the other being empirical) can be seen as working together in order to give us a more thorough understanding of the model of reality which is acquired through our possible knowledge. I argue here that Kant’s model of apriori cognition must be presupposed as the grounding for the scientific model concerning our empirical knowledge.

Quantum physics as a science will help my argument regarding this grounding of apriori cognition and as such, I will now bring in the concept of *possibility*. Hawking and Mladinow

³⁵Here we are specifically concerned with reality in terms of our empirical experience within the spatiotemporal world. However, I do believe that reality in other terms, such as nature or the supersensible world also needs a framework for our knowledge of it. (For Kant, such a supersensible world belongs, as we have seen, to the domain of the *Things-in-themselves* (*Ding(e) anSich*)).

adopt the approach of model-dependent realism on a scientific level of description in order to help us with the paradoxes that quantum physics reveals to us. For instance, quantum physics teaches us that not “all knowledge of the world could be obtained through direct observation”; and rather, as Richard Feynman describes it, “a system has not just one history but every possible history” (Hawking and Mlodinow, 2010, pp. 6-7). Here we encounter the notion of possibility. Moving forward, we will investigate how *possibility* of reality coincides on both the apriori metaphysical level and the scientific empirical level.

1. Feynman’s “Sum Over Histories”

To explain the notion of possibility within our acquired reality more thoroughly, I will take the help of the double-slit experiment, which was originally performed by Thomas Young in 1801 as a challenge to Newton’s ideas on the nature of light. The double-slit experiment has since been used in quantum physics to show that light can act as both particles and waves.³⁶ In *The Grand Design*, Hawking and Mlodinow present Feynman’s representation of the double-slit experiment in which the findings focus on the notion of possibility and simultaneity. These findings specifically contrast the classical view (the Newtonian view) of science with the quantum physics view of science. I will now present two drawings showing the difference between the two scientific frameworks.³⁷ In the classical view, a particle has a well-defined path, which we can illustrate as follows:

³⁶ See Hawking’s and Mladinow’s chapter four in *The Grand Design* (2010) for further detailed reading on the double-slit experiment.

³⁷ Both drawings given here are drawn by me, representing the double-slit experiment.

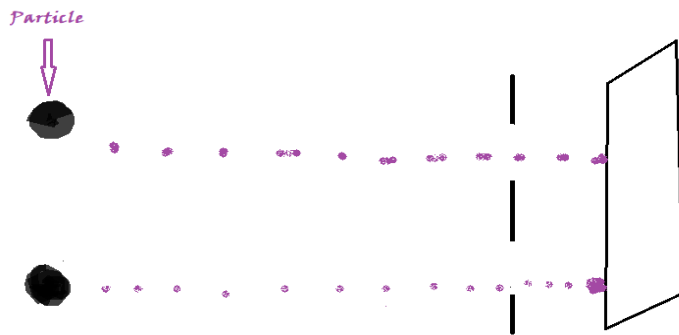


Illustration of the path of a particle within the classical framework of science

Above, we see that the particle can be located at a specific place and time as it takes a direct path towards the slits. In the framework of knowledge that is quantum physics, the particles have no definite position between the starting point and the end point. That can be illustrated as follows below:

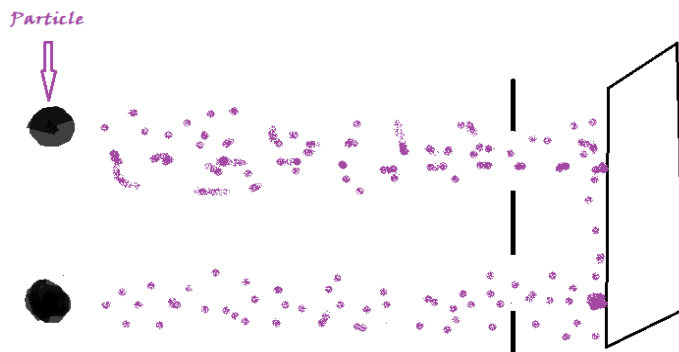


Illustration of the path of particles from a quantum framework of science

The behavior of particles in this latter illustration demonstrates what Feynman talks about when he says a system has every possible history. In a humorous description, Hawking and Mlodinow explain:

In the double-slit experiment Feynman's ideas mean the particles take paths that go through only one slit or only the other; paths that thread through the first slit, back out

through the second slit, and then through the first again; paths that visit the restaurant that serves that great curried shrimp, and then circle Jupiter a few times before heading home; even paths that go across the universe and back (2010, pp. 75-6).

The description here gives us the sense of what it can mean for the particles in the quantum framework of science to have every possible history.

Feynman believed that this double-slit experiment is an example of the insufficiency of the classical framework of physics but is supported by the quantum framework. It is insufficient within a classical description because the classical model cannot account for how the particles can act as both waves and particles.³⁸ In the quantum model of the illustration above, both wave and particle behavior are taken into consideration with regard to the end result of the particle's position in space and time. As a result, Feynman pointed out this could mean that the particles take every possible path *and* that they take them simultaneously. It is explained that this is Feynman's "sum over histories" which "reproduces all the laws of quantum physics" (Hawking and Mlodinow 2010, p. 75). It is the sum because Feynman would add up the numbers associated with all the possibilities of the path of the particle, keeping in mind that some of the sums are cancelling each other out and some are adding up (think of waves and interference patterns). The resulting sum would then give us the probability of the particle being in a specific time and space (i.e., reaching its "destination" at the board after passing through the slits of the experiment) (Pössel, 2006). This "sum over histories" is the physicist's way of saying the "sum over possibilities". The notion of possibility correlates with model-dependent reality in that it tells us that until the observer makes the observation, the particles can be at any given possible position within space and time. On the Kantian level of description, we would say that the noumenal object is not yet represented to us in our phenomenal world until our apriori forms of space and time, along with the other faculties of our minds are imposed upon the object which will then become a representation *for us*, qua *phenomenae*.

³⁸To understand this, further reading is required on the double-slit experiment. See Hawking and Mlodinow (2010), chapter 4. I will also expand on the insufficiency of the classical model later in this chapter.

2. Simultaneity

In this section, I will focus on what the notion of simultaneity reveals to us, as displayed in Feynman's description of the double-slit experiment, where the particles take every possible path *and* they take them simultaneously. First, let us consider the problem of 'simultaneity'. From the classical Newtonian view, we think that space and time are absolutes. However, this view presents a problem: If time is absolute, and cannot be demonstrated empirically, how is simultaneity possible? The notion of simultaneity must be presented through empirical objects of our experience which occur or co-exist at one and the same time. This problem of simultaneity revealed to us that the Newtonian view of space and time being "absolutes" must be altered. In a two-part article written about Kant's influence on Einstein's worldview, Stephen Palmquist explains that both Kant and Albert Einstein argued, in their own ways, that time must be an apriori intuition (for Kant) and relative (for Einstein). Space and time cannot be absolutes (Palmquist, 2011, pp.99-100). For Einstein, the problem of simultaneity is that it "does not appear to be determinable in any absolute sense" (Palmquist, 2011, pg. 99).³⁹ Kant argued for the same when he, for example, wrote, "The time, therefore, in which all change of appearances is to be thought, lasts and does not change; since it is that in which succession or simultaneity can be represented only as determinations of it" (B225). With this statement, Kant is arguing that time must be a condition for simultaneity to occur—and that simultaneity and succession are determinations of time. Take note however, that as a *condition*, Kant does not mean an *absolute*—in Kant's philosophy, space and time are apriori intuitions that condition objects of our experience, rather than being absolutes; and for Einstein, time is not absolute, but it is rather *relative* to the coordinate system presupposed by an object's movement (Einstein, 1954, p. 229). Connecting this to Feynman's observations on the double-slit experiment, we see now that *because* the particles take every possible path simultaneously, this seems to validate Kant's notion of time being an apriori form of intuition that grounds our empirical experiences of objects (or particles), which in turn are determinations of time.

Furthermore, in a detailed article titled "The Intuition of Simultaneity: *Zugleichsein* and the Constitution of Extensive Magnitudes" (2010), Michael J. Olson explains,

³⁹ Einstein's theory of special relativity, which resolved the problem, will be further discussed below in section D of this chapter.

This recognition of the necessity of simultaneity to the epistemological descriptions in the first *Critique*... is interesting insofar as it points towards a more significant place for spatiality and the limits of human cognition in what is generally taken to be Kant's autonomous temporal determination of experience (2010, p. 444).

Olson points out that because simultaneity must be demonstrated empirically, this places an emphasis on the importance of space and time, which serve as the apriori conditions which contain the manifold for simultaneity of objects of our experience to occur in. Simultaneity is a determination of time, and as such, time is not an absolute. Rather, it is an apriori condition on the metaphysical level (Kant) and it is relative on the empirical level (Einstein). In addition, as Özge Ekin Gün writes, "Kantian characterization of space and time explains what we can know phenomenologically with certainty. It is not an attempt to know or describe a space and time outside of human cognition", as I myself have argued in the previous chapters (2016, p. 11). If space and time were constructs that we regarded as being outside, or independent of human cognition, then they would be absolutes. Within a Kantian framework, this is no longer thought to be possible, as I have argued in this section. Therefore, we are reminded once again about our limited human standpoint, one in which we cannot speak of knowledge about absolutes.⁴⁰

3. Possibility

With simultaneity, comes possibility in the double-slit experiment. Here I will explain why the empirical realm of possibility, as was demonstrated by Feynman's "sum over histories" with regard to quantum particles, is conditioned by the metaphysical rules and transcendental principles given by Kant's transcendental idealism. Firstly, let us take into consideration Kant's "material of all possibility", which he presents to us in the Transcendental Dialectic (A573/B601). The "material of all possibility" is given to us via the principle of thoroughgoing determination, which is a part of Kant's regressive argument. For Kant, a regressive argument is an argument that departs from the conditioned to its conditions in order to attain the unconditioned (*Critique*, 1998). In this section, I will construct my own regressive argument to

⁴⁰Although Kant addresses the notion of absolutes in his Transcendental Dialectic, these are based on transcendental illusion and fall outside the scope of the argument of this thesis.

show the importance of the “material of all possibility” in connection to the empirical realm of quantum particles. Kant writes:

Every **thing**, however, as to its possibility, further stands under the principle of **thoroughgoing determination**; according to which, among all possible predicates of things, insofar as they are compared with their opposites, one must apply to it...it considers everything further in relation to the **whole of possibility** as the sum total of all predicates of things in general... and it contains a transcendental presupposition, namely that of a material **of all possibility**, which is supposed to contain *a priori* the data for the **particular** possibility of every thing (A572-73/B600-01).

In this passage, Kant sets the apriori condition for the particular things of our experience in the empirical world. The condition presented in the passage above is the “material of all possibility”, and this stems from *Reason*. Reason is another cognitive faculty we find within Kant’s apparatus and structure of the mind, which is close to, but distinct from, the understanding (Allison 2004, p. 308).⁴¹ In the following regression, I am going to argue that reason (from Kant’s Transcendental Dialectic) provides us with the “transcendental presupposition”, that being the material of all possibility, for the understanding (from Kant’s Transcendental Analytic) which in turn gives us the concepts needed for application unto intuition (given to us by the apriori forms of space and time in Kant’s Aesthetic) in our empirical world. Hence, this section will convey the importance of how Kant’s Aesthetic, Analytic and Dialectic connect with each other.

So far, we have seen that the notion of possibility is found in both the empirical realm and metaphysical realm. Although these notions of possibilities are on different levels of description—Feynman’s notion of possibility being within a scientific/physics description and Kant’s notion of possibility being within a metaphysical description—I interpret it such that Kant is grounding apriori the physical possibilities, which are intuitions in the empirical world, with his metaphysical possibilities, that being concepts of the understanding which are apriori. The metaphysical possibilities are in turn grounded by the transcendental presupposition that is the material of all possibility. The material of all possibility must be there for concepts, and concepts must be there for intuitions in order for us to have empirical experience and

⁴¹ In fact, Kant’s arguments about the reason and its functions in the Transcendental Dialectic concerns the entire critical system.

knowledge.⁴² Once concepts are applied to intuitions, making one of the possibilities an actuality, as described by Feynman, this gives us our reality. I will clarify this further below with a short discussion on the schematism.

In his chapter 14 of *Kant's Transcendental Idealism*, Allison emphasizes the importance of “the material of all possibility”. He writes that in

exhaustively defining an individual, the understanding necessarily presupposes the sum total of possible predicates as available for the task. This sum total may thus be thought of as an all-inclusive ‘predicate pool’ ... Thus, in the *Critique* it is this pool of predicates that provides the ‘material of all possibility’, which is presupposed by **the principle of thoroughgoing determination** (2004, p. 398-99).

Here we see the relation between the understanding and the reason. The understanding needs the reason in that the presupposition of the “material of all possibility”, given to us by reason, makes it a precondition for the condition (this condition being concepts given by the understanding) which then gives us the conditioned (and we can think of the conditioned as being an intuition subsumed under a concept, thus giving us an object of empirical experience). Allison goes on to explain that the material of all possibility is the storehouse of all possible predicates and it lies within the substratum.⁴³ I argue here that this necessity of the material of all possibility is congruent (on a metaphysical level of description), with Feynman’s all possible paths which the particles take on.⁴⁴

To clarify this similarity, let us think of Kant’s schematism of the pure concepts of the understanding. This is arguably a difficult section in Kant’s *Critique*, and I do not see reason to delve too deeply into it. However, I wish to mention it because it deals with “the possibility of applying **pure concepts of the understanding** to appearances in general” (A138/B177). This possibility of application of concepts to intuitions is emphasizing the importance of our mind as an apparatus or as an instrument of measurement, since it is the mechanisms within the structure of our minds that gives us our empirical reality. It is because of the mechanics of the schematism that we can have knowledge of an object, i.e., its location in space and time. However, in order

⁴²As a result, we see here the relation between the Transcendental Analytic and Transcendental Dialectic—mainly that the Dialectic provides the conditions for the Analytic, i.e., reason is needed for the understanding to do its job.

⁴³As Grier puts it in her article, the substratum is the “grounding” which is found in the Dialectic (22).

⁴⁴Congruent in that they are not equals, but they are in agreement and in harmony with Feynman’s level of description.

for the Schematism to work, we first need schema. As Michael Pendlebury explains in his *Making Sense of Kant's Schematism*, a “schema” for Kant is a precondition of a concept, and “it is necessary to exercise the schema in order to subsume an intuition under the concept” (1995, p. 787). Subsuming an empirical intuition under a concept is what Kant equates to the application of the categories to appearances (A138/B177). This application is done through the faculties of the mind, i.e., the sensibility and understanding. As we saw from the paragraph above, applying a concept to an intuition firstly requires the possible predicates in the pool that is the “material of all possibility.” Hence, the work of the Schematism actualizes one of the quantum possibilities in our phenomenal realm, which in turn gives us an object of experience on the empirical/scientific level.

Due to the apriori relation between the two levels of description we have discussed, we can say that at the “end” of a scientific observation, one of the possible paths of the particle takes form. In order for the quantum to take a form in the empirical realm, it must be grounded by not only the metaphysical rules of the understanding, but as we have now seen, also the transcendental principles of reason.⁴⁵ Furthermore, as Kant writes, “Nothing is an object **for us** unless it presupposes the sum total of all empirical reality as condition of its possibility” (A582/B610). Here we see the emphasis of the condition for the conditioned. The regressive argument for this case is that the empirical object (given to us in Kant’s Aesthetic of our spatiotemporal framework), and we can think of this as the quantum, is conditioned by the understanding and concepts (which Kant labels under the Analytic) and the concepts in turn are conditioned by the “material of all possibility” (given to us in Kant’s Dialectic, namely given to us by reason). As a whole this regressive argument metaphysically and transcendently grounds (conditions) Feynman’s sum over possibilities/histories because in order for us to have an objectifying empirical experience, there must first be reason.

According to Kant, our reason is construed in such a way that we have an inclination to try to exhaust the totality of nature. This is ascribing to reason some good and “proper” use (A643/B671). In her article, “Kant on the Illusion of a Systematic Unity of Knowledge” (1997), Michelle Grier explains further, “One of the most curious aspects of this...position is Kant’s insistence that the non-empirical, or transcendental, principles and ideas of reason play a crucial role in empirical (scientific) inquiry and theorizing” (p. 1). This claim, also being a major

⁴⁵ See Allison’s chapter 11 (2004) for a further discussion between the Understanding and Reason.

argument within my thesis, has now been supported by the regressive argument we have seen in this section. Furthermore, sciences such as physics also set out to uncover truths in nature, and these uncovered truths are in principle infinite. These infinite uncovered truths apply to nature as a whole, and we see this is why the reason comes in seeking to exhaust the totality/wholeness of nature. In this spirit, Kant has argued that there is a systematic structure of our minds with his distinction between the Aesthetics, Analytic, and Dialectic; which in turn, all work together to explain how we obtain our knowledge and determine our reality.

Despite our quest to exhaust the truths of nature, we find that we can only go so far. For example, “Quantum physics tells us that no matter how thorough our observation of the present, the (unobserved) past, like the future, is indefinite and exists only as a spectrum of possibilities” (Hawking and Mlodinow, 2010, p. 82). This takes us back to the theme of this section—possibility. We know now that the spectrum of possibility is needed as a precondition to our reality, and this applies not only on the empirical level, but also the metaphysical and transcendental levels.

4. The Inadequacy of the Classical Framework

Going back to the illustrations we started with at the beginning of this section, it can now be seen how the classical framework of physics does not account for or acknowledge the notion of possibility on an empirical level of description, as described in the previous section. Specifically speaking, the classical framework of physics cannot account for quantum behavior. As Hawking and Mlodinow explain:

Classical theories such as Newton’s are built upon a framework reflecting everyday experience, in which material objects have an individual existence, can be located at definite locations, follow definite paths, and so on. Quantum physics provides a framework for understanding how nature operates on atomic and subatomic scales... [and] it dictates a completely different conceptual schema, one in which an object’s position, path and even its past and future are not precisely determined (2010, p. 67).

Even though the classical framework and the quantum framework operate on these “different conceptual schema”, we can still have a reality encompassed by both frameworks.⁴⁶ This complementary dualism within physics reflects back to Kant’s transcendental idealism, where there are apriori conditions utilized by our minds in order for us to yield empirical knowledge; and this can be compared to the classical framework because, as we will see, classical concepts may be interpreted as apriori conditions for quantum physics. The external world, which is the world beyond our apriori forms of knowledge, and thus independent of the human observer, is what Kant describes as the noumenal world (and as we have seen, we have no access to knowledge of these objects from our human standpoint). Supporting this crucial notion of the human standpoint, Hawking and Mlodinow write “There is no way to remove the observer—us—from our perception of the world, which is created through our sensory processing and through the way we think and reason” (2010, p. 46). Hence, I argue that model-dependent realism is inescapable on both levels of description—on the empirical phenomenal realm and the metaphysical realm.

Ultimately, Hawking and Mlodinow draw our attention to model-dependent reality and how it leads us to this fundamental question: “do we really have reason to believe that an objective reality exists?” (2010, p. 34)⁴⁷. As the development of my arguments come forth, it will become more and more apparent that this is one of the underlying questions driving this thesis, and I will come to a more comprehensive answer in my conclusion.

In the meantime, Hawking and Mladinow introduce important findings from physicists such as Niels Bohr and Werner Heisenberg, which all touch upon this question of objective reality. They write, “quantum physics recognizes that to make an observation, you must interact with the object you are observing” (2010, p. 80). This will lead us to the next section, where we discuss the subject-object distinction, within both physics and philosophy, as explained by Bohr. Furthermore, Heisenberg’s uncertainty principle will support our discussion of the material of all possibility. As Hawking and Mlodinow explain, “Quantum physics...leads us to accept a new form of [scientific (TM)] determinism: Given the states of a system at some time, the laws of nature determine the *probabilities* of various futures and pasts rather than determining the future

⁴⁶ This complementary relationship between the classical and quantum frameworks will shine through in the next two sections when discussing Bohr’s contribution regarding the philosophical implications of quantum physics.

⁴⁷That is, objective reality beyond our subjective forms of experience. This is not the same concept of ‘objective reality’ that Kant holds, which is *within* the bounds of experience—a reality conditioned by the human standpoint.

and past with certainty” (2010, p. 72). I will expand more on this uncertainty principle and Heisenberg’s contributions later in section D of this chapter. For now, we have learned that the conception of reality needs a metaphysical framework. Kant’s transcendental idealism provides one such framework, within which we can acknowledge the paradoxical findings of quantum physics.

C. The Subject-Object Distinction: Bohr’s Contribution

Within the study of quantum physics and philosophy, many scholars have pointed out the connection between Kant and the Danish physicist Niels Bohr. While Bohr was a physicist by trade, he was also very much a philosopher, which shines through in his essays and speeches collected in the book *Atomic Physics and Human Knowledge*. Within this section, I will present my interpretation of Bohr and his conception of physics as exemplifying a transcendental view of knowledge, emphasized by the need for a conceptual framework and the investigations of the limits of this framework. Furthermore, it was mentioned in the previous section that the classical framework is inadequate in terms of capturing the behavior of quantum particles. Here I will now expand as to why this is the case, with the focus on Bohr’s notion of complementarity and the subject-object distinction.

1. Complementarity and the Need for a Conceptual Framework

Niels Bohr writes that the “epistemological lesson” that atomic physics (quantum physics) is concerned with are “the conditions for an unambiguous account of experience” within the framework of complementarity (2010, p. v). So then, let us first start with the notion of complementarity. In short, the framework of complementarity allows for us to take the whole experimental arrangement into consideration. This was something the classical framework within physics failed to do. Bohr explains, “The conceptual framework which is characteristic of classical physics was long thought to provide the correct tool for the description of all physical phenomena, and not least was it suited to the utilization and development of atomic ideas” (2010,

p. 84). Classical physics becomes what Bohr calls “the old doctrine of the limited divisibility of matter” (2010, p. 85). Meaning that the classical framework could not account for the findings within the quantum (atomic) world. This is because “In phenomena of the ordinary scale, the actions involved are so large compared to the quantum that it can be left out of consideration” (Bohr, 2010, p. 85). While classical physics can account for the descriptions on a larger scale, i.e., billiard balls, it cannot account for the “behavior” of quantum particles. The quantum world defies the pictorial description provided by classical physics. Bohr explains that it was Planck in 1900, with the discovery of the universal quantum of action, who exposed the limited applicability of the classical framework. Although even within this realization, Planck seemed hesitant to abandon the classical foundations. It was rather Einstein who “daringly pointed to the necessity of taking the quantum of action into account in individual atomic phenomena” (Bohr, 2010, p. 86). Hence, classical physics was no longer sufficient for new discoveries within physics, i.e., quantum physics.

The work of physicists such as Planck and Einstein revealed that a new conceptual framework was needed. Bohr writes,

...it became more and more clear that, in order to obtain a consistent account of atomic phenomena, it was necessary to renounce even more the use of pictures and that a radical reformulation of the whole description was need to provide room for all features implied by the quantum of action (2010, p. 87).

What the framework of classical physics was lacking (to account for atomic particles), was the description of the functioning of the measuring instrument. For the description of quantum phenomena, “the whole experimental arrangement must be taken into account in a well-defined description of the phenomena” (Bohr, 2010, p. 90). Epistemologically, this means the observer and the instrument making possible the observation, have to be taken into account as well. This implies an entirely new way of approaching and measuring the physical phenomena.

This lack of inclusion of the observer and the measuring instrument, became a problem of “unambiguous communication” for Bohr. In 1954, he wrote,

Every scientist, however, is constantly confronted with the problem of objective description of experience, by which we mean unambiguous communication...and especially with the problem of how objectivity may be retained during growth of experience beyond the events of daily life” (2010, p. 67).

He felt that the framework of classical physics was too narrow to comprehend the new experiences quantum physics advances to our human knowledge. This now poses a big problem for our theory of knowledge due to the classical boundaries and limits of our framework.

In his paper, “The Transcendental Philosophy of Niels Bohr” (1982), John Honner explains that there is a problem of observation at the boundary of ordinary experience (that is, at the limit of our human experience). Furthermore, in regard to our theory of knowledge, Honner writes,

If one is to have a theory of knowledge, and if one is to begin that theory with an account of the priority of *phantasmata*, experience or referents (like Aristotle, Kant and Strawson, respectively), then one must immediately involve oneself in a performative, transcendental consideration. That is, the emphasis falls not just on the conditions for our use of *concepts*, but equally, if not primarily, on *our use*. It is at this point that the difference between ‘conceptual explication’ and ‘transcendental argument’ should become recognizable (p. 13).

The emphasis that Honner places here, on *our use* as a *transcendental consideration*, once again highlights our human standpoint, in the same vein as Kant, as I have explained in the previous chapters.

The solution for the problem of accounting for unambiguous communication regarding our experience, is the new framework of *complementarity*. Bohr introduces this principle when he writes, “However great the contrasts exhibited by atomic phenomena under different experimental conditions, such phenomena must be termed complementary in the sense that each is well defined and that together they exhaust all definable knowledge about the objects concerned” (2010, p. 91). A motivating factor for this new framework of complementarity was the dilemma of the double-slit experiment, where light and matter can display characteristics of both classically defined waves *and* particles. Taking the whole experimental arrangement into consideration, Bohr believes that the new complementarity framework “clarified the above-mentioned dilemma with respect to the propagation of light, [and] also completely solved the corresponding paradoxes confronting pictorial representation of the behaviour of material particles” (2010, p. 90). As we see, *sole* pictorial representation (the framework of classical physics) has to be renounced for the state of atomic particles; while instead, the *whole* experimental arrangement (meaning including the observer, which can at times also act as the

measuring instrument) has to be taken into consideration as well. Thus, the joint efforts of the classical framework along with the quantum framework complement each other not only in order to enhance our human knowledge, but to give a more unambiguous account of our experience.

2. The Limit of Description

The limit of description (for our discussion here) is related to the boundaries of experience as discussed by Kant. The boundaries of experience lead us to a specific conception of the relation between subject and object. In this section, we will explore the limits of the subject-object distinction in order to confront the limits and extent of an ‘objective’ description of our knowledge in both physics and metaphysics. Bohr writes that through philosophical thinking

...it is understandable that one has sometimes seen in the notion of complementarity a reference to the subjective observer, incompatible with the objectivity of scientific description. Of course, in every field of experience we must retain a sharp distinction between the observer and the content of the observations, but we must realize that the discovery of the quantum of action has thrown new light on the very foundation of the description of nature (2010, pp. 90-91).

Here, Bohr points out the incompatibility between the subjective observer and the objective findings that are given within a scientific description. It is incompatible with the classical description. However, “In quantum physics,” Bohr points out, “an account of the functioning of the measuring instrument is indispensable to the definition of phenomena” (2010, p. 91). In an arguably Kantian fashion, Bohr is stating the objects in our world of phenomena cannot be detached from the subjective observer. We, the subjective observers, are at least a part of the measuring instrument when perceiving the reality around us. This can now blur the lines between subject and object because we find that the subject is a part of the object, in terms of the outcome of our scientific description *and* in terms of being part of the initial conditions of the measurement of the object in question. Quantum physics teaches us that when taking into account the whole experimental arrangement, the subject (which can also be the measuring instrument) must also be included in the description.

Within physics, the quantum shows us that there is a limit to wholeness and a limit to the indivisibility of the atom (and on a bigger scale, our objective description of knowledge); and

this acknowledgement of the limit was the problem with the classical description. According to Honner, Bohr realized this:

There seemed to be a need to take into account the entire system of ‘object’ and its interaction with the means of observation. In physics, according to Bohr, this meant that any description of quantum processes (i.e., of atomic or sub-atomic experiments) demanded taking the whole experimental arrangement into consideration. For what was ‘observable’, Bohr claimed, was not the sub-atomic object itself (which lay outside the limits of objective classical description set by Heisenberg’s uncertainty principle), but its interaction with the macroscopic experimental arrangement. And in philosophy, as Bohr also insisted, there was a striking parallel in the difficulty which one experienced, in the very consciousness of one’s own subjectivity, in distinguishing between ‘subject’ and ‘object’. One can describe the subject only as ‘disclosed’ in the awareness of itself, by which awareness, of course, it becomes an object. Only an account of the ‘wholeness’ of consciousness provides the possibility for speaking about the ‘subject’ as distinct from the ‘object’ (1982, p. 20).

What is being said here is that when we consider the whole experimental arrangement, the subject and the interaction of the subject and object in relation to the instrument of measurement must be included in our search for objective findings. In terms of Kantian philosophy, this demonstrates that the object in our phenomenal world cannot exist completely independently of the subject, and the measuring instrument (or condition – in Kantian terms), i.e., the apparatus of the mind. The subject holds the conditions of the representational framework which makes possible knowledge of the object. This framework, now being the notion of *complementarity* in natural science, emphasizes the “relationship which is connected with our position as observers in nature” (Bohr, 2010, p. 92). This is the position of the human standpoint. As Bohr continues, “...the word consciousness, applied to oneself as well as to others, is indispensable when observing the human situation” (2010, pp. 92-93). The subject must be included in our description of nature, and this is also why a complementarity mode of description is required.

Ultimately, we operate within a model-dependent reality, on both the scientific and metaphysical levels of description. The conception of reality needs a framework, which, from our studies, has shown is a set of conditions of possibility of knowledge given to us on the

metaphysical level which must be presupposed as a condition for the possibility of representations and knowledge on the empirical level. However, Bohr found that any frame, no matter how useful it has proven itself to the present, “may be found to be too narrow to comprehend new experience” (2010, p. 67). Given this, he asks how can objectivity be retained “during the growth of experience beyond the events of daily life” (2010, p. 67)? He concludes that the normal framework (i.e., the classical framework of physics) loses its validity when one is working at the boundary of our everyday (Euclidean) experience. This is what takes place under quantum conditions or when we find ourselves at the boundary of everyday experience. Let us recall that at this boundary, we find the transcendental subject (as discussed in chapter two), where one starts exploring one’s own subjectivity. By ‘normal framework’ (our empirical framework) we are referring to the Euclidean spatial-temporal framework, which is the framework from the human standpoint; and this is what is limiting us on the quantum level, where it is difficult to retain scientific objectivity on this basis during the growth of experience in terms of knowledge. So, this is where Bohr’s solution of ‘complementarity’ comes into play “as the new framework for the ordering of knowledge about the quantum processes” (Honner 1982, p. 25). Bohr concludes that no matter the realm we are in, whether it is classical, quantum or metaphysical, we need a framework for our knowledge; and such a stance has also been endorsed by Hawking and Mlodinow.

3. The Transcendental Ties Between Bohr and Kant

Both Bohr and Kant were concerned about the limits of knowledge. A current professor in Paris, France—Michel Bitbol—has published a paper titled “Bohr’s Complementarity and Kant’s Epistemology” (2013), in which he points out the similarities between Kant’s transcendental philosophy and Bohr’s epistemological findings through the study of quantum physics. While Kant was concerned with the limits of our representations employed by metaphysics, Bohr was concerned with “the limits of the representation employed by science” (Bitbol, 2013, p. 145). Kant’s metaphysics grounded Bohr’s epistemological reflections upon quantum physics, or so I shall argue.

First, let us focus on the ‘Copernican’ turn in metaphysics. Copernicus brought the focus of the *astronomer’s* view from planet Earth and “addressed the problem of how this particular

situation contributes to shaping cosmological knowledge” (Bitbol, 2013, p. 146). Similarly, Kant brought the focus within metaphysics to objects conforming to *our* cognition. Bitbol points out that this “does *not* mean that objects are so to speak *created* by our cognition, but (i) that one cannot dispense with a proper analysis of our own faculties of knowing, if knowledge is to be understood at all, and (ii) that the form of objects is predetermined by a set of cognitive conditions...” (2013, 147). Let us remember that for Kant, in the phenomenal world (or our world of representations) the term ‘object’ involves that which is within our experiential boundaries, determined by our a priori forms of knowledge. These experiential boundaries are formed by the givenness of the manifold within space and time, which is a part of our structural cognition (i.e., the formal structure of the mind), and makes phenomenal experience possible. The faculties of our knowledge also include the categories, or the concepts of our understanding, “which are used to bring the manifold of sensory appearances under a common organization” (Bitbol, 2013, p. 147). This is to say, as we know from the first chapter of this thesis, the apriori given sensible manifold is determined by the apriori forms of understanding. Or to put it more simply, the understanding organizes, via a synthesizing activity, sensory appearances into categories. Furthermore, as we recall from chapters one and two of this thesis, we can say that the given apriori spatiotemporal manifold is synthesized, and determined by, the apriori categories via a unifying principle, namely the transcendental apperception. This is all possible due to the processes which occur within the apparatus of our minds, as argued by Kant.

Bohr was also very much concerned with the apparatus of our minds. With his framework of complementarity, he acknowledged there was no way of not considering this cognitive apparatus as necessary in order to evaluate and interpret scientific objective knowledge. In other words, the whole experimental arrangement, including the observer, has to be taken into consideration. Bitbol writes, “Bohr’s notion of experience is definitely Kantian in that he takes ‘the boundary of our concepts’ to be ‘exactly congruent with the boundary to our possibilities of observation’” (2013, p. 147).⁴⁸ These boundaries are determined in part by the measuring apparatus, which is the “technical counterpart of sensibility” and by language, which is an “intersubjective counterpart of the understanding”, according to Bitbol (2013, p. 147). Let us recall here that this analogy between Bohr and Kant represent two different levels of

⁴⁸ Bitbol himself quotes here from Honner (1982, p. 7), of which the original source is from a letter Niels Bohr wrote to Albert Einstein on 13th of April, 1927.

description (meaning it is not a one-to-one relation between them). Both men acknowledge that the boundaries of our empirical experience and knowledge are limited by the measuring apparatus—which, in this discussion, is the apparatus of the mind. The apparatus of the mind here functions on both the metaphysical level and the scientific level, as supported by Bohr above, when he says that the cognitive apparatus of the observer must also be taken into consideration in order to evaluate scientific objective knowledge. All in all, Bitbol is endorsing Bohr's Kantian epistemological grounding of the empirical scientific level of description. As for my interpretation, the very fact that there *are* two different levels of description is exactly why it is possible for me to make the connection that I am making in this thesis. We are intertwining the metaphysical and scientific descriptions such that the findings within the scientific realm are grounded by the metaphysical.

The apparatus of the mind and its faculties are aspects of a model-dependent reality, i.e., a conceptual framework, which is needed as the condition for an unambiguous communication of scientific objectivity. This sort of reflective knowledge concerning the apparatus of the mind and the analysis of the conditions of possibility on both levels of description is what is *transcendental* in both Kant and Bohr. As Bitbol explains, while the terms 'transcendent' and 'transcendental' (i.e., a transcendent object) apply to something *outside* of experience, "a transcendental structure exceeds experience because it is a *precondition* of experience: it shapes experience without being part of experience" (2013, p. 148). Here when Bitbol is stating that a transcendental structure *exceeds* experience because it is a *precondition* of experience, we can interpret this in the Kantian way and say that as exceeding experience, the transcendental is a *limiting condition* in that it exceeds the scope of experience, and as such, it conditions the possibility of experience. For Kant, it is the transcendental subject (considered as the original synthetic unity) that serves as the limit of our experience, making it a condition of our experience of the empirical world, or in other words, our knowledge of it.⁴⁹ For Bohr, it is the measurer (which also acts as a part of the measuring instrument) that serves as the condition of experience.

This now brings us to a discussion of the subject-object distinction. When we refer to this distinction, we are discussing within the bounds of the phenomenal realm in Kantian terms

⁴⁹ As Bitbol writes, "In other words, what plays the roles of the knower cannot be known in the very process of knowing" (2013, p. 148). This is why we can never have knowledge of the constitution of the transcendental subject, besides from simply knowing that it *is*. This has been discussed at the end of chapter two of this thesis.

(rather than the noumenal realm). The noumenal realm is what holds the things-in-themselves, which are the noumenal objects lying beyond what can be known through our spatio-temporal forms of experience.⁵⁰ For this reason, these objects of the noumenal realm do not have any connection with our faculties of knowledge, and hence, the subject-object distinction cannot apply to them. The subject-object distinction must apply to phenomenal objects however, because this is where our experience takes place and hence knowledge *can* be attained. Bitbol points out that because of these very terms such as ‘noumenal’ and ‘thing-in-itself’, Kant is showing us “the impossibility of disentangling ourselves completely from *the content* of our knowledge” (2013, p. 149). In other words, as we are the subject (being observers of our reality), we are embedded in our realm of phenomena in that we are entangled in determining the content of our experience. The objects in the phenomenal realm are the only objects we can have knowledge of.

Similarly, Bohr demonstrated how phenomena cannot occur without our interaction with the measured phenomena. Bitbol refers to Bohr when he writes that because of the “impossibility of a strict separation of phenomena and means of observation...any discourse about phenomena going on in nature independently of any measuring interaction appears to be meaningless” (2013, p.149). The conclusion Bohr draws here about the meaninglessness of any discourse about the unobservable/unobserved objects parallels that of Kant’s transcendental knowledge. Both philosophers recognize that for any knowledge to be *our* knowledge, we must acknowledge the limit that is inherent in the subject-object distinction, wherein we cannot exclude the involvement of the subject from the knowable object. In this regard, we can also say that the subject becomes a part of the object since the subject is considered as an inevitable condition of the possibility of knowledge of the very same object.

Moving on from the subject-object distinction (or the blurred distinction), let us now see how classical concepts within the classical framework of physics serve as the apriori forms needed for the objectivity of knowledge. Bohr did not have any intention to do away with the classical concepts. Even though he found the classical framework too narrow (as discussed above), he still acknowledged some of the concepts within the framework to be vital for the description of the measuring apparatus and for the complementary features of an atomic object (Bitbol, 2013, p. 151). Serving as apriori, the classical concepts become the conditions for

⁵⁰This realm is only thinkable, via the reason, and not knowable, via the understanding (Kant, 1998).

possibility of unambiguous knowledge, as will be explained. Bitbol points out that for Bohr, “the crucial point was the peculiar role that classical concepts play *within* language” (2013, p. 160). This is because “the application of these concepts alone makes it possible to relate the symbolism of the quantum theory to the data of experience” (Bohr 1934, p. 16). Bohr went on to explain that “However far the phenomena transcend the scope of classical physical explanation, the account of all evidence must be expressed in classical terms” (Bohr 1958, p. 39). Hence, it is the language of classical concepts which must be used to describe the findings within the quantum realm.

From my interpretation, Bohr attributes a transcendental status to classical concepts because they are needed to make the separation between the measuring instrument, the measured object, and the measurement interaction (Bitbol, 2013, p. 161; Bohr 1958, p. 72). Given this, Bitbol notes that, “Since the object-instrument separation is, for Bohr, demanded by the very *concept* of observation, classical concepts could be said to be essential in order to make observation possible” (2013, p. 161). All these observations listed above are given to us with a focus on separating factors within the whole experimental arrangement (i.e., the measurer, the measuring instrument, the measured object, and the measurement interaction). This separation must be communicated via classical concepts serving as the apriori conditions for communication, observation, and description of knowledge.

If the very *concept* of observation demands a subject (i.e., instrument)-object distinction, does this mean that observation is not possible without such a distinction? Furthermore, is objective description even possible if the subject is always involved within the observation of the object, and hence included in the description of the object? What is objectivity if observation always requires a measuring subject? On a Kantian note, what can we make of empirical experience when the conditions themselves must be a part of what they condition? These are all questions that Bohr and Kant tried to make sense of (although in different ways), which coincide, on their respectively different levels of description. What I find through my investigation is that ultimately, they arrived at a limited answer—in which they had to acknowledge that there is no way to truly detangle ourselves from what we experience or observe. Bitbol explores two answers to these questions, which Kant also gave the answers to in both the *Critique of Pure Reason* and in the *Critique of Practical Reason*. The first answer, as Bitbol describes it, is the following: “Our role in this picture mimics that of an external *spectator* of nature, and the

knowledge thus acquired qualifies as objective”. The second answer, contrary to the first, holds that we are actors (rather than spectators) in our own actions and experiences. The conclusion, he writes, is that we must be *both* spectators *and* actors “in view of our inseparable entanglement” (2013, p. 162). Bohr, as well, believed that “we are both onlookers and actors in the great drama of existence” which “the new situation in physics ...has so forcibly reminded us” (Bohr 1934, p. 119). As for myself, I believe this situation of being constituted as both the spectator and the actor, is the realization of the transcendental subject being found at the boundaries of our reality, and as such, serving as a condition of the possibility of our representation of the object, and hence, the world. As Bohr has demonstrated, quantum physics plays a crucial role regarding our knowledge and reality here, within the boundaries of the framework of complementarity. For Kant, our knowledge is within the boundaries of space and time; and if we were to step outside the apriori framework of space and time, we would lose all knowledge by way of making metaphysical erroneous judgments.⁵¹ As we will see in the upcoming section, the findings of quantum physics further enforce the limit of objective reality because there always exists different possibilities of the spatial and temporal coordinates of observed objects within our phenomenal world. It is only when the measuring instrument is applied, that we come to have what we call objective knowledge of reality.⁵²

⁵¹ Kant discusses metaphysical erroneous judgments within his Transcendental Dialectic which starts at A293/B249. However, this topic exceeds the scope of this thesis.

⁵² However, ‘objective knowledge’ becomes a paradoxical finding in this thesis, as will be discussed in my Conclusion.

D. Heisenberg's Contribution to the Investigation of the Limits

In the first half of the 20th century Werner Heisenberg re-evaluated the relation between position and velocity within atoms in physics. The findings of his re-evaluation are known as the *Uncertainty Principle*, and this has great philosophical implications specifically in the realms of metaphysics. Heisenberg himself wrote about the philosophical implications in a book titled *Physics and Philosophy, the Revolution in Modern Science* (1958). This will be the text by Heisenberg that I take reference from in this section. It is explained by David Lindley in the introduction of this book that “rules fundamentally different from classical mechanics” were needed to describe the behavior of atoms (2007, p. ix). This again touches upon one of the main themes in this chapter—specifically that the classical framework was not sufficient to describe our reality, or rather the representation of reality, including the description of it within physics.

The uncertainty principle revealed that position and velocity are not unambiguous in quantum physics as they are in classical mechanics. Lindley writes that rather, “position and velocity become, in a sense, secondary characteristics that the experimenter must derive from some quantum system by making a suitable measurement” (2007, p. x). This revelation puts great importance on the act of measurement. Before going any further, let us state *what exactly* the uncertainty principle is. Simply speaking, the uncertainty principle tells us that the more precise the measurement of a particle's position is, the less precise will be the measurement of its velocity, and vice versa. Lindley continues, “A more careful statement [of the uncertainty principle (TM)], however, is that the quantum particles have no intrinsic properties that neatly correspond to position and velocity, and that measurement forces a quantum system to cough up values for these quantities in a way that depends on how the measurement is done” (2007, p. x). Let us here notice the vital role of *measurement*. This again emphasizes the role of the observer, or subject performing the measurement, when speaking of the object.

Furthermore, the descriptions of observation used in classical physics cannot be applied in quantum physics. While words like “wave” and “particle” work in classical physics because they are derived from our everyday experience, “[a] quantum object is, in itself, neither one thing nor the other” (Lindley, 2007, p. xi). It is the method of measurement that ultimately leads to our description of reality. So again, we see not only the vitality of the *measurement* but also the

measurer utilizing the measuring instrument to obtain the description of our empirical knowledge and in turn, our reality. This is supported by physicists such as Bohr and Heisenberg on the scientific level of description and by Kant on the metaphysical level of description.

Heisenberg who was also one of the physicists along with Bohr during the time of the Copenhagen Interpretation, also gave an account of Bohr's complementarity. In addition, both men questioned the subject-object distinction. However, as we will see, Heisenberg had a bit more of a scientific and mathematical approach in his investigation. He focused on the uncertainty relations within our classical descriptions, and how these actually became necessary when formulating quantum theory. Keeping in mind that Bohr and Heisenberg worked together, we will see much common ground regarding their philosophical interpretations of quantum physics in this section with the previous section. In addition, the implications of the uncertainty principle in our discussion will strengthen the ties between quantum physics and Kant's transcendental idealism.

1. Uncertainty Relations and Quantum Theory

I would like to begin by discussing the importance of measurement itself. Lindley writes, "...in quantum mechanics, the act of measurement defines the thing being measured, or that the thing measured and the thing doing the measuring are inextricably intertwined" (2007, p. xiii). Does this mean, then, that our reality is ultimately subjective and uncertain; and hence, not objectively valid? Heisenberg would answer no, not really. Because as he says, "We have to remember that what we observe is not nature itself but nature exposed to our method of questioning" (Lindley, 2007, p. xiv). Here I will point out that this is a very Kantian-like statement. "Our method of questioning" is the a priori framework of space and time, as an integral part of the apparatus of the mind, imposed on the true state of nature (which we can think of as Kant's noumenal objects) that give us our model-dependent reality. Kant emphasizes "*die Denkungsart*"—"the way of thinking" rather than the object of thinking (CPR Bxv-Bxvi), in accordance with his "Copernican Turn". A further implication of the significance of measurement is that (as has been mentioned earlier) the subject must ultimately be taken into consideration in the description of the object. Meaning, the whole experimental arrangement (cf.

Bohr's *complementarity*) must be taken into account, and this includes the subject. This takes us back to our discussion of the empirical subject, in which we find that "I think" always accompanies each and every one of my representations.⁵³ Also, in Bohr's terms, here is where we can see the line blurred between the subject-object distinction, in that we cannot give what we know to be an objective description of an object without taking into consideration the subject's "influence" on said object. In Kantian terms, this blurred line of the subject-object distinction would be due to the subject being the condition for the represented object.

The need for quantum theory as an alternative to classical physics, is something Heisenberg gives a full account of in his book *Physics and Philosophy: The Revolution in Modern Science* (1958). He recalls late night conversations with Bohr in which the two perplexed over questions such as "Can nature possibly be as absurd as it seemed to us in these atomic experiments?" Heisenberg concluded that there was a final solution to such questions, which was approached in two different ways. The first way he called "a turning around of the question". He explains that classical physics had a limited scope, where it assumed this question was true: "Is it true, perhaps, that only such experimental situations can arise in nature as can be expressed in the mathematical formalism?" To only be expressed in the mathematical formalism of classical physics enforced a limit on our understanding. This is where Heisenberg's uncertainty principle comes into play. Heisenberg realized that within Newtonian mechanics, which is the classical framework of physics, "One could speak of the position and of the velocity of an electron...and one could observe and measure these quantities. But one could not fix both quantities simultaneously with an arbitrarily high accuracy". This is what Heisenberg referred to as "relations of uncertainty or principles of indeterminacy". These relations of uncertainty led to the conclusion that the old concepts did not suffice to fit nature (Heisenberg, 1958, pp. 16-17).

The second way of formulating the solution to the seemingly absurd nature exposed by atomic experiments, was Bohr's complementarity principle. Complementarity allowed for both the wave-picture and the particle-picture as complementary descriptions of the same reality. Heisenberg explains that "Any of these descriptions can be only partially true, there must be limitations to the use of the particle concept as well as of the wave concept, else one could not avoid contradictions. If one takes into account those limitations which can be expressed by the

⁵³ This is going back to Kant's analytical relation of the subject—without the "I think", there is no (possible) representation for me. Each and every representation belongs to me in an analytical relation.

uncertainty relations, the contradictions disappear” (1958, p. 17). This is how the Copenhagen Interpretation came to be in the spring of 1927.

From what I understand, the paradoxes that emerge from atomic experiments, concerning wave-particle duality, stems from descriptions used within a classical physics framework. What is seen as a paradox in one framework is not necessarily a paradox in another, i.e., the quantum physics framework. Hence, a paradigm shift concerning the fundamental concepts of reality was needed so we can better understand the new situation revealed to us via atomic experiments. This paradigm shift is what led to the development of quantum theory.⁵⁴

With this said, Heisenberg starts off chapter three in his book as such, “The Copenhagen Interpretation of quantum theory starts from a paradox” (1958, p. 18). This is so because it is the language from the classical framework of physics which is used to describe the experimental arrangement and quantum phenomena. The problem is that there are limitations when we use classical description, which then leads to a paradoxical description. The difference between a theoretical interpretation in classical physics and quantum physics is this: While classical physics measures position and velocity, quantum physics give us a probability function, “which represents the experimental situation at the time of measurement, including even possible errors of the measurement” (Heisenberg, 1958, p. 19). The probability function represents partly a fact and partly our knowledge of a fact. Heisenberg explains this when he writes,

It represents our knowledge in so far as another observer could perhaps know the position of the electron more accurately. The error in the experiment does—at least to some extent—not represent a property of the electron but a deficiency in our knowledge of the electron. Also, this deficiency of knowledge is expressed in the probability function (1958, p. 19).

From this, we see that a theoretical interpretation in quantum physics takes into account the uncertainty relations, which is lacking in classical physics. Quantum theoretical description emphasizes the ‘possible’ rather than the ‘actual’. This emphasis of the ‘possible’ correlates with our discussion earlier in this chapter regarding Kant’s “pool of all possible predicates” and Feynman’s “sum over all histories”. The connection here on emphasizing the “possible” rather

⁵⁴ As Samir Okasha explains, Thomas Kuhn revolutionized the way we think of about ‘objective truth’. Kuhn suggested that “the facts about the world are paradigm-relative, and thus change when paradigms change” (2016, p. 78). This led Kuhn to believe that no paradigms are fully ‘objective’.

than the “actual” is that, from the Kantian perspective, it is the ‘possible’ that *conditions* the ‘actual. Without the possible predicates or the possible paths of the particles, there could be no objective reality for *us*, i.e. particles taking form when we observe them. In physics, when the act of measurement is implemented on the experimental arrangement, one of the possibilities then becomes the actuality for the observer implementing the measurement. In Kantian terms, the subject applies his/her apriori framework of space and time, along with utilizing the other aspects of the apparatus of the mind, to gain knowledge of the representational reality that constitutes our phenomenal world.

Since the quantum theory of reality lies outside the limits of a classical description, Bohr’s utilization of the complementarity principle helps us to better understand this quantum level of reality. The two pictures (one of waves and one of particles) are complementary to each other. By going back and forth from these pictures(interpretations) Heisenberg writes that “we finally get the right impression of the strange kind of reality behind our atomic experiments.” Furthermore,

The knowledge of the position of a particle is complementary [in the normal sense of the word (TM)] to the knowledge of its velocity or momentum. If we know the one with high accuracy, we cannot know the other with high accuracy; still, we must know both for determining the behavior of the system (1958, p. 23).

Knowing the position and velocity correspond to the space-time description of the atomic events and determining the behavior of the system gives us the atoms’ deterministic description.

The Copenhagen Interpretation of quantum theory, which allows for classical descriptions on quantum behavior, gives rise to a major concern: The problem of subjectivism—that is, how objective is our objective knowledge, *really*? Heisenberg asks, what *really* happens in an atomic event? He elaborates, in quantum theory,

what one deduces from an observation is a probability function, a mathematical expression that combines statements about possibilities or tendencies with statements about our knowledge of facts. So, we cannot completely objectify the result of an observation, we cannot describe what “happens” between this observation and the next (1958, p. 24).

Here, Heisenberg is addressing the space between observations. After giving an example of how the double-slit experiment works, he points out that “the probability function does not allow a

description of what happens between two observations. Any attempt to find such a description would lead to contradictions; this must mean that the term “happens” is restricted to the observation” (1958, p. 26). Here, when we think about the space ‘outside of observation’, I specifically see a correlation with Kant’s noumenal objects, in that they ‘exist’ outside of our observation because they are outside the apriori framework of space and time, which is the framework of experience from the human standpoint. Hence, our reality is restricted to the phenomena of our observation, and in turn, our observation which determines the phenomena.

This brings us to analyze the role of observation. Heisenberg explains that in natural science, we are not interested in the universe as a whole, but rather, just a limited part of the universe. It is important, also, for us to separate ourselves from the object of study. Therefore, by “objective”, we mean that which is independent of an observer. Our *knowledge* of the systems is what will be defined as “subjective” because this knowledge can vary for different observers. A probability function within quantum physics combines both objective and subjective elements. “In ideal cases,” Heisenberg writes, “the subjective element in the probability function may be practically negligible as compared with the objective one” (1958, p. 27). This is when physicists speak of a *pure case*, or an ideal case. When moving from one observation to the next, the object must be in contact with the experimental arrangement including the measuring instrument either before, or during the moment of observation. Now, we take into account the influence of the interaction between the object and measuring instrument. Heisenberg explains,

This influence introduces a new element of uncertainty, since the measuring device is necessarily described in the terms of classical physics; such a description contains all the uncertainties concerning the microscopic structure of the device which we know from thermodynamics, and since the device is connected with the rest of the world, it contains in fact the uncertainties of the microscopic structure of the whole world. These uncertainties may be called objective in so far as they are simply a consequence of the description in the terms of classical physics and do not depend on any observer. They may be called subjective in so far as they refer to our incomplete knowledge of the world (1958, pp. 27-28).

Given this interaction between the object and the measuring instrument, the probability function now contains “the objective element of tendency and the subjective element of incomplete knowledge, even if it has been a ‘pure case’ before” (Heisenberg, 1958, p. 28). Unlike in

Newtonian mechanics, the probability function describes all the possibilities of events. When the observation takes place, one of these possibilities is selected. It is at this point, with the act of observation, that we go from possibility to actuality. Heisenberg also describes this as the “quantum jump”—there is a discontinuous change in the mathematical representation (meaning, the probability function) *because* of the observation. Hence, our knowledge can change suddenly based on what observation takes place, and Heisenberg believes this justifies the term “quantum jump” (1958, p. 28).⁵⁵ Let us here also define “act of observation” as the moment the object interacts with the measuring device, and thereby with the rest of the world (Heisenberg, 1958, p. 29). Note that this means it is not dependent on the observer’s mind registering the result. However, the act of registering is crucial for our *knowledge* (not the result of the experiment, but our interpretation, and, hence, *knowledge* of it).

Let us return now to the problem of attaining a completely objective description of the world. The ideal of objective description has been the primary criteria for scientific description. The Copenhagen Interpretation of quantum theory complies with this ideal “as far as possible”, according to Heisenberg. We must remember the paradox that the Copenhagen Interpretation starts from, “It starts from the fact that we describe our experiments in the terms of classical physics and at the same time from the knowledge that these concepts do not fit nature accurately” (Heisenberg, 1958, p. 30). It is in this manner that we can reach objective scientific description only as far as possible. To borrow a quote which Heisenberg has used from Carl Friedrich Freiherr von Weizsäcker, “Nature is earlier than man, but man is earlier than natural science” (1958, p. 30). From this we can understand why mankind cannot escape the paradox of quantum theory, because classical concepts have to be included even in this theory. Classical physics seeks complete objectivity, and yet classical physics has been constructed by man, which then forces out the objectivity in our knowledge of natural science. As we have mentioned, knowledge is the subjective element contained in the probability functions of atomic experiments, as in it is dependent and can change based on the observer performing the observation. This brings us to redefine what we think of as ‘objective description’, which I will expand upon in the conclusion of this thesis. Ultimately, Heisenberg brings us back to our earlier

⁵⁵However, I do not believe that because our *knowledge* changes in such a case, so does the *reality*. In this case, we see reality as existing as a state of possibilities. The possibilities do not change, but our knowledge of them does in that one of the possibilities becomes an actuality.

conclusions we arrived at with Kant and Bohr. He reminds us that “what we observe is not nature itself, but nature exposed to our method of questioning” (1958, p. 32). The measuring device has been constructed by the observer, and it is the interaction between this measuring device and the object under study (we can also call this interaction ‘the act of observation’) that grants us knowledge. Because of this, to separate the subject from our knowledge of the object remains impossible.

2. Relativity and Quantum Theory

Physicists such as Albert Einstein, Hendrik Lorentz and James Clerk Maxwell performed experiments on electromagnetic fields and light waves, which eventually led to the theory of special relativity. Heisenberg writes, “...a discussion of these patterns that had been raised and partly solved by the theory of relativity belongs essentially to our treatment of the philosophical implications of modern physics” (1958, p. 84). One of the most crucial discoveries from the theory of special relativity was the new properties of space and time (as mentioned under the “Simultaneity” section earlier in this chapter). Heisenberg explains that this new situation in physics concluded that “The primary reality is the field and not the body”, which then goes against Newtonian mechanics (1958, p. 85).

Without going into the mathematical formulations and complications of the change in the relationship between space and time, I will here summarize, with the help of Heisenberg, how the new interpretation of the structure of space and time came to be.⁵⁶ In 1904, Lorentz suggested a mathematical transformation which implied that “in different schemes of reference there are different ‘apparent’ times which in many ways take the place of the ‘real’ time” (Heisenberg, 1958, p. 87). However, the year later, in 1905, Einstein made a revolutionary move, “in which he established the ‘apparent’ time of the Lorentz transformation as the ‘real’ time and abolished what had been called ‘real’ time by Lorentz (Heisenberg, 1958, p. 88).⁵⁷ Heisenberg further explains:

⁵⁶ As a preliminary note, I will point out that it has been argued that “Einstein’s early reading of Kant’s philosophy... provides a likely explanation for Einstein’s adoption of the worldview... that enabled him to discover the theory of relativity (Palmquist, 2010, p. 46). For example, I have lightly touched upon their similarity about replacing the absolute sense of time in the “Simultaneity” section in part B of this chapter.

⁵⁷ This is perhaps similar to how the subjective representations of reality must become our objective reality—meaning this is as objective as reality can be for us. Similarly, on the empirical level of description, the ‘apparent’ time becomes the ‘real’ time.

It is very difficult to describe this change in the words of common language, without the use of mathematics since the common words “space” and “time” refer to a structure of space and time that is actually an idealization and oversimplification of the real structure. But still we have to describe the new structure and we can perhaps do it in the following way: When we use the term “past” we comprise all those events which we could know at least in principle, about which we could have heard at least in principle. In a similar manner we comprise by the term “future” all those events which we could influence at least in principle, which we could try to change or to prevent at least in principle. It is not easy for a nonphysicist to see why this definition of the terms “past” and “future” should be the most convenient one. But one can easily see that it corresponds very accurately to our common use of the terms. If we use the terms in this way, it turns out as a result of many experiments that the content of the “future” or “past” does not depend on the state of motion or other properties of the observer. We may say that the definition is invariant against the motion of the observer. This is true both in Newtonian mechanics and in Einstein’s theory of relativity (1958, pp. 88-89).

The difference, however, between classical theory and the theory of relativity, is that in the former, it is the present moment which acts as an infinitely short time interval separating the past and future. In the latter, “future and past are separated by a finite time interval the length of which depends on the distance from the observer” (Heisenberg, 1958, p. 89). We can conclude, then, that an observer cannot influence any event at a distant point which takes place between two specific times. The “present time” is that finite time interval between the one time and the second time (past time and future time) in which the observer belongs or stands at the instant of observation. Here, at this present time, “Any event taking place between the two characteristic times may be called ‘simultaneous’ with the act of observation” (Heisenberg, p. 89-90).

However, within the theory of relativity, we learn that “when two events are simultaneous for one observer, they may not be simultaneous for another observer, if he is in motion relative to the first observer” (Heisenberg, 1958, p. 90). The term of ‘simultaneous’ however, lacks precision in our language corresponding to daily life. For this reason, Heisenberg writes, “In the theory of relativity the physicists have tried to change the meaning of the words of classical physics, to make the terms more precise in such a way that they fit the new situation in nature”

(1958, p. 91). As we see here, the theory of relativity, like quantum theory, shines light upon the new situation in physics, which cannot be accounted for by the classical framework.

Moving on from ‘time’ to ‘space’, let us now examine the correlation and effects of the theory of relativity onto the idea space. Heisenberg states that the hypothetical substance of “ether” (the idea of absolute space in its own nature without regard to anything external) had “been abolished by the theory of relativity”. However, we must be careful as to how we interpret this statement, because “it would be wrong to say that space has now lost all its physical properties”, as Heisenberg points out (1958, p. 94). Through an analysis of this consequence (of ether being “abolished”), Einstein extended the theory of relativity to the theory of “general relativity” in 1916. The theory of general relativity tells us that “the mass of a body as a source of gravity is exactly proportional to the mass as a measure for the inertia of the body”. Einstein further turned to “the hypothesis that the gravitational forces also are due to properties of empty space”. As a consequence of this, Heisenberg continues, “We know that the forces of gravity are produced by masses. If, therefore, gravitation is connected with properties of space, these properties of space must be caused or influenced by the masses” (Heisenberg, 1958, p. 95). Because the attention here is now drawn to the properties of space, the question of geometry comes in.

From ancient Greece to the 19th century, Euclidean geometry was regarded as the foundations of mathematical geometry. Then, in the 19th century, other mathematicians discovered that other geometries could be invented with the same mathematical precision as that of Euclid. “[T]herefore,” Heisenberg writes, “the questions as to which geometry was correct turned out to be an empirical one”. The theory of general relativity was concerned not only with three-dimensional space, but also with the four-dimensional manifold of space and time. This four-dimensional realm brought up old philosophic questions in the new form of space and time. These are questions such as: 1) Is space finite or infinite? 2) What was there before time, and will be after time? 3) Or is there no beginning or end? (Heisenberg, 1958, p. 97).

Heisenberg gives us different answers to these questions from various philosophers, including Kant. He explains that in Kant’s philosophy, these questions belonged to Kant’s “antinomies” because they are questions that cannot be answered.⁵⁸ According to the antinomies, space cannot be finite because we cannot say there is an end to space due to our limited human

⁵⁸According to Kant, the questions themselves must be posed at another level of justification (description) (B449).

standpoint. Space also cannot be infinite because it is impossible for us to fathom infinity—we have formed the word “space” as something imaginable, from the human standpoint. As a conclusion, Heisenberg states “Kant’s result is that a rational answer to the question whether space is finite, or infinite, cannot be given because the whole universe cannot be the object of our experience” (1958, p. 98). To extend even this thought, I would say that the concept of the ‘whole universe’ remains unfathomable to us.

After presenting and evaluating some of the philosophical attempts to answer these questions, Heisenberg gives us a partial answer from the theory of general relativity, on an empirical basis. He answers as such, “If the connection between the four-dimensional geometry in space and time and the distribution of masses in the universe has been correctly given by the theory, then the astronomical observations on the distribution of galaxies in space give us information about the geometry of the universe as whole. At least one can build ‘models’ of the universe, cosmological pictures, the consequences of which can be compared with the empirical facts” (1958, p. 99). My own contention with this attempted answer is that it is still very limited—the attempted answer is limited to the picture of the universe, as in, it is a model-dependent answer within our model-dependent reality. That is to say, we are dependent once again on the paradigm (we can think of this as the model-dependent answer) we are working within. Our knowledge is shaped (one can even say, it is “doomed” to be shaped) by the conditions given by our framework, on both metaphysical and scientific levels.

Coming back to another reoccurring theme in this thesis regarding space and time, Heisenberg also points out how Newton’s classical concepts of space and time act as ‘apriori’ concepts not only for the empirical sciences, but also for Kant’s transcendental philosophy. Heisenberg takes note of this when he writes,

The philosophy of Kant later on drew attention to the fact that the concepts of space and time belong to our relation to nature, not to nature itself; that we could not describe nature without using these concepts. Consequently, these concepts are ‘a priori’ in some sense, they are the *condition for* and not primarily the result of experience” (my emphasis, 1958, p. 101).

As we see here, Heisenberg is on the same page as Kant’s transcendental interpretation of space time acting as the conditions for our experience of reality.

Overall, the theory of relativity has helped us to better get a grip of quantum physics, and it has at the same time “warned the physicists against the uncritical use of concepts taken from daily life or from classical physics” (Heisenberg, 1958, p. 101). Meaning that the lessons we learn from the theory of relativity and quantum physics is that the old framework of classical physics cannot provide us with an unambiguous account of the new situation of reality found within the atomic experiments.

3. Lessons from Modern Physics

Heisenberg concludes his book with a chapter on the role of modern physics in human thinking. He explains here that the most important lesson we have learned from modern physics is that there had to be a change from the “rigid frame of concepts from the nineteenth century” (1958, p. 172). Quantum physics has revolutionized our narrow concepts of reality, such as space, time and causality. Heisenberg writes about the two distinct stages in the dissolution of the classical framework:

- 1) Through the theory of relativity, we realized that even fundamental concepts such as space and time “could be changed and in fact must be changed on account of new experience” (1958, p. 173).

- 2) The concept of matter being influenced by the experiments concerning atomic structure:

The new experience altered the “rigid frame” of the reality of matter (1958, p. 173).

As a parenthetical third stage, I would like to add that these concepts (space, time, causality, matter) were not altered in our everyday language, but rather in their scientific description, as the latter could no longer be explained through the classical framework. It is this change in the scientific language/description that led to the paradigm shift of quantum theory and physics.

Heisenberg continues with his “serious warning against the somewhat forced application of scientific concepts in domains where they did not belong.” He goes so far as to state, “The application of the concepts of classical physics, e.g., in chemistry, had been a mistake.” As a lesson, this has taught us to “try to keep the doors open for the entrance of new concepts even in those parts of science where the older concepts have been very useful for the understanding of the phenomena” (1958, p. 173). Keeping the doors open does not necessarily mean that we have to close all older doors, i.e., dispose of classical concepts all together. Rather, we can be open to

new concepts which may ultimately prove to be complementary to older concepts, as is the case with quantum physics and classical physics.

An important distinction which Heisenberg touches upon is between that of natural language and scientific language. Natural language is closer to reality in that the concepts of natural language are a means to represent reality and daily life. Scientific language (concepts), on the other hand, is an idealization: The refined experiments, tools, axioms and definitions are a “process of idealization” in which “the immediate connection with reality is lost” (Heisenberg, 1958, p. 174). This emphasizes the idealizations and reductionism as methodological strategies in the natural sciences. In my own reading of these lessons, I will say that reality—or as far as we know it, the representation of reality—is not ideal.

One final lesson (which is of concern to our investigation in this thesis) from the studies of quantum physics, is that of contradictions. We know now that contradictions cannot be avoided in even the most precise parts of science, such as mathematics. Heisenberg gives an example, “For instance, it is well known that the concept of infinity leads to contradictions that have been analyzed, but it would be practically impossible to construct the main parts of mathematics without this concept” (1958, p. 175).⁵⁹ One could also interpret these mathematical contradictions as paradoxes, similar to the Kantian antinomies—meaning we still employ these concepts in mathematics and reality of nature, regardless of their logical contradictions.

Considering the concept of “infinite” as discussed above, I would like to argue for its congruency with the concept of “unknown” on the epistemological level. I would argue this because I believe that the human ability to understand, could, in a sense, be unlimited.⁶⁰ This thought correlates to when Heisenberg writes, “But the existing scientific concepts cover always only a very limited part of reality, and the other part that has not yet been understood is infinite. Whenever we proceed from the known into the unknown we may hope to understand, but we may have to learn at the same time a new meaning of the word ‘understanding’ (1958, p. 175). As we have seen, the concept of ‘infinite’ is a mysterious one; one in which we can have no known answer in terms of knowledge or experience. In this sense, I feel that the part of reality

⁵⁹ Perhaps this is also why Kant argues for the illusory aspects of pure reason—such as infinity and God. These are the unconditioned concepts of Pure Reason. Can we say that these are also Ideal? If so, then I will argue in my conclusion that perhaps the idea of “objectivity” is itself an Illusion and an Ideal—it is unattainable, but it is thinkable.

⁶⁰ As Kant has argued, reason gives us the ability to imagine what is empirically unknowable to us; and that reason can think all possibilities without any boundaries (A xii).

not yet covered by scientific concepts is unknown to us, correlating with Heisenberg's use of the word "infinite". Ultimately, however, the understanding must be based on natural language, because this is our medium for our representation of reality to one another.

Due to the essential relationship between natural language and our understanding, Heisenberg argues,

Hence we must be skeptical about any skepticism with regard to this natural language and its essential concepts. Therefore, we may use these concepts as they have been used at all times. In this way modern physics has perhaps opened the door to a wider outlook on the relation between the human mind and reality (1958, p. 176).

On this point, Heisenberg affirms the apriori role that classical concepts play in our new framework of reality, which for the time being is quantum physics. Stated another way, our outlook on the relation between the human mind and reality is wide enough as to where we can (or rather *must*) still keep some classical concepts in place within our new framework for our knowledge of reality.

Concluding Thoughts

With the new framework of knowledge within physics, which is complementarity, and includes quantum physics, we now have a new definition of *objective*. ‘Objective’, as far as *our* knowledge is concerned, must include the subject performing the observation. In a way, this is to say that absolute objective knowledge in the classical description of physics is impossible. Another way of looking at it is as such: objective description represents a paradox because the objectivity criteria must include the subjective observer, or else, the subject. This is taking into consideration Heisenberg’s definition of ‘objective’, in page 73 of chapter three in this thesis, which states that ‘objective’ is that which is independent of an observer.

Furthermore, Heisenberg’s *uncertainty principle* tells us that no exact state of an atom can be measured, quite like absolute necessary existence cannot be measured (as we saw in chapter two of this thesis). In fact, it is the *uncertainties* of our knowledge which we can call truly objective, because these uncertainties are independent of the observer (as discussed in chapter three of this thesis when also discussing possibilities and probabilities). These uncertainties can at the same time be the *possibilities* of reality that are needed for us to gain knowledge of an *actuality* of reality. For this reason, I can argue that it is the ‘possible’ that *conditions* the ‘actual’. In addition, I argue that perhaps when we apply ‘knowledge’ as a description, this automatically becomes a sort of filter for pure objective reality (‘pure objective’ in the sense that the object is independent of an observer). We must also keep in mind that knowledge of one’s observation can be different from knowledge of another’s observation (cf. Einstein’s theory of relativity).

Since we are looking into the parallels between the two levels of description (scientific and metaphysical), let us ask, what would be the equivalent of the noumenal object (within Kant’s metaphysics) on the empirical/scientific level? I will answer that it would be the atoms’ ‘existing’ in a state of possibility. This state of possibility (one might even consider it as a ‘flux’) is unobserved by the subject (meaning *us*, the human observers), just as noumenal objects cannot be observed by us from the human standpoint. This brings us into a curious consideration of the *ideal*. Heisenberg mentions that reality is not ideal, and rather it is art that is an ideal, which could also be transferred to science being an ideal (1958, p. 174). If science is trying to

somehow, paradoxically, capture the description of nature without the observer, then I would argue that yes, science itself represents an ideal. We cannot have a *description* of nature if there is no observer or observation to describe it. Therefore, I will argue that perhaps the notion of ‘objectivity’ in the classical definition of science is an ideal and an illusion in a Kantian sense—in that it is unattainable as knowledge, but it is still thinkable.⁶¹

To answer Kant’s main question which he is concerned with in the *Critique*, “How is synthetic apriori cognition possible?”—I will now answer that it is possible and demonstrated through the natural sciences such as physics and quantum physics. Kant defends this answer as well when he writes in his B-edition “Introduction” to the *Critique*: “Natural science (Physics) contains within itself synthetic apriori judgments as principles...”; and he goes on to give an example, “such as the proposition that in all alterations of the corporeal world the quantity of matter remains unaltered” (B18). He demonstrates here, as I have argued for in this project, that the laws of natural science are dependent on synthetic apriori cognition, or in other words, certain metaphysical principles.⁶²

I wish to also acknowledge the problem of subjectivism that arose in this thesis—that is, how objective is our objective knowledge, *really*, considering the subject must be included as a part of the observation of the object—as in, is there *pure* objectivity? Related to this question, we can also ask: What are the limits to objectivity? I will first answer that no, we cannot have *pure* objective knowledge; and this is because pure objective description of nature is a paradox—there can be no pure objective description without an observer giving the description. Regarding the limits of objectivity, I have argued that the limit is *us*, in the form of the transcendental subject, and from the human standpoint. I believe the situation of being constituted as both the spectator and the actor within our reality, is the realization of the transcendental subject being found at the boundaries of reality. As such, the transcendental subject serves as a condition of the possibility of our representation of the object, and hence, the objective world.

We have also learned from this project that classical physics seeks complete objectivity, and yet classical physics has been constructed by man, which then forces out the objectivity in our knowledge of natural science. In other words, the sciences, which are constructed from the

⁶¹ Kant speaks of transcendental illusion in the *Transcendental Dialectic* within his *Critique*.

⁶² Kant also writes at B18, “...and thus metaphysics, at least as far as **its end is concerned**, consists of purely synthetic *a priori* propositions.”

human standpoint, impose objectivity criteria on what we describe as nature. Also, we are using classical descriptions for quantum phenomena, and a description of quantum phenomena actually requires more than what the classical framework is capable of explaining. Thus, a description from the framework of classical physics does not fit nature accurately. Because of this limit, it is the case that we can reach objective scientific description *only as far as our descriptions make possible*. After all, we are reminded by Carl Friedrich Freiherr von Weizsäcker that nature comes before man and man comes before natural science, as was referenced in chapter three, page 74.

This project has also pointed out the blurred lines of the subject-object distinction, in that we cannot describe an object without the subject. In Kantian terms, this blurred line of the subject-object distinction is due to the subject being the condition for the represented object, which again brings us to the transcendental subject serving as the condition for our experience, and in turn, the representation of our reality.

The apparatus of the mind is another factor which limits our cognition of objects. It is limiting in that it provides us with the apriori conditions for our experience of reality. Ultimately, we, the subjective observer, have to be considered and included for what we know to be objective reality. This is perhaps why Kant includes the ‘empirical real’ within his philosophy of transcendental idealism. The empirical real is a way to account for what we know to be objective reality *from* the human standpoint. Outside this standpoint, and outside of the boundaries of our reality, we cannot speak about. Hence, this thesis represents our *striving* to break free of these boundaries, with attempts such as physics within the natural sciences. However, we find that ultimately, we are bound by a limited objective reality, which is encapsulated by the transcendental subject, and these are the limits which we cannot know beyond.

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