Kant's Theory of Simultaneity

Ageel Al-Fadli

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Department of Philosophy
University of Ottawa

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Abbreviations

For the works of Kant, I use the English translations of Kant's writings as available in the Cambridge Edition of the Works of Immanuel Kant. The pagination of Kant's works follows the standard German edition of Kant's works, Kant's *Gesammelte Schriften.*

Isaac Newton

Principia *The Principia: Mathematical Principles of Natural Philosophy*.

Christian Wolff

DM *Rational Thoughts Concerning God, the World, and the Human Soul* (Commonly referred to as the *Deutsche Metaphysik*)

Christian August Crusius

DPS *Philosophical Dissertations on the Use and Limits of the Principle of Determining Reason, commonly called the Principle of Sufficient Reason*

Abstract

In this thesis, I examine Kant's conception of simultaneity in relation to the idea of the empirical determinacy of time. I begin by introducing the concepts of time and simultaneity in Newton and Leibniz, and demonstrate how these two modern conceptions of time contributed to Kant's understanding of simultaneity and cosmological unity. It will be argued that Kant's conception of simultaneity was intended to account for the possibility of the rational determination of time, and that for this purpose, Kant sought to reinterpret the Principle of Sufficient Reason in his early writings by linking it to the simultaneity-relation between substances in reciprocal interaction, thus arguing for the possibility of coexistence between substances. This provides a way to understand how the unity of the world is fundamental to Kant's understanding of the rational determination of time and space. In Kant's critical period the relation of simultaneity is analysed as empirically realized through mutual interaction, but the pure manifold of time is thought to be intuitional, which requires the implementation of relational categories in order to be reproduced in experience. In the Third Analogy of the First *Critique*, the concept of mutual interaction is analysed in terms of balanced forces, which provides a means of describing the evolution of a dynamical system over time. It provides the process by which the connection between different dynamical systems is possible, and also for the synchronization of different clocks.

Introduction

The classical understanding of a space-time manifold assumes absolute simultaneity as an essential property of the structure of space-time. In the early twentieth century, Albert Einstein's Special Theory of Relativity (1905) called the classical notion of absolute simultaneity into question. Einstein criticized a crucial aspect of the classical conception of absolute time: the idea of a universal and common time, in which there is a universal "now" everywhere. This intuitive idea of a "universal now" was implicit in the Newtonian model of classical mechanics, and was correctly assumed to follow from the idea of universal connection between all parts of the world. However, this conception of universal connection through instantaneous communication between distant spatial points was threatened by the setting of a limit to the speed of causal propagation between distant places, as proposed by the Special Theory of Relativity.

The assumption that the notion of absolute simultaneity was not subject to philosophical debate before Einstein must be challenged. This assumption has been proven false by the examination of early modern philosophers who explored the conditions necessary for the cosmological unity of the world. The idea of the cosmological unity of the world was of interest to eighteenth-century German philosophers such as Leibniz and Wolff, who considered it as part of rational cosmology. Newton as well, in his experimental philosophy, incorporated the idea of cosmological coexistence in his Universal Law of Gravitation, which served as the empirical correlate to absolute simultaneity in his theory of time. Thus, the question of articulating the conditions under which all parts of the world can coexist in one world was presented as a philosophical problem that deserves to be addressed.

The concept of simultaneity involves an identity of time between spatially separated points. Even though these points are spatially separated, they agree in registering the same time. The agreement on the same time between spatially separated points requires an explanation, in which the possibility of extending the identical and local "now" into different spatial coordinates, and of unifying all these spatial points under a single and universal time, must be grounded. The ground of simultaneous coexistence must involve a real connection, in which the transmission of information is reciprocal. The nature of the reciprocal connection requires elucidation, but it shows that the relation of simultaneity depends on a real and causal connection between spatial points, namely, it requires a dynamical and synthetic determination of time. The empirical and synthetic nature of determining the simultaneous coexistence of events in a single time coordinate was discussed by Immanuel Kant in his theory of coexistence and community. It is the objective of this thesis to examine Kant's theory of simultaneity in relation to the concept of empirical determinacy of time.

Immanuel Kant belongs to the philosophical tradition that has a long-standing interest in the subject of simultaneous coexistence, as evidenced by his early engagements with the problem of the cosmological unity of the world. Kant's philosophical project, already in his early writings, aimed to reconcile different philosophical trends of his time by accommodating the Newtonian conception of gravity with the demand of rational determination. The Newtonian model of science, which provides a relational conception of causal interaction through the theory of universal gravitation, was significant for Kant because it promotes the idea of causal unity between the parts of the world. However, this poses a problem for the Leibnizian account of the universal harmony of the world, which relies on the concept of an ideal and monadic interaction between substances. According to Leibniz, substances are the active principles upon which the

temporal relation of succession or simultaneity are based, and therefore should be causally closed, with no causal influence from outer interactions. Kant, throughout his philosophical career, finds this notion of a closed system or immanent causation objectionable. For this reason, he incorporates the idea of mutual and real interaction as the ground for the unity of the world.

Building on the transcendental theory of experience in the *Critique of Pure Reason*, which posits that possible experience must conform to the a priori structure of the forms of intuition and the categories of the understanding, Kant argues that the dynamical categories of successive causality and mutual interaction (*Wechselwirkung*) are the relational categories that structure the possible relations of appearances. This conception of experience depends on the synthetic determination of the manifold of intuition and is pursued through a reconsideration of the pure intuitive forms of space and time, which are shaped by the understanding through the figurative synthesis of the imagination. In this case, the pure temporal relations of persistence, succession, and simultaneity are a priori determined in relation to objects of experience. For example, in the Second Analogy, Kant reconsiders the category of causality, arguing that it requires a relation of succession where a cause must precede its effect in time, thereby fulfilling the task of rationally determining experience. Similarly, the Third Analogy examines the category of community (*Gemeinschaft*) or the coexistence of substances, and in this Analogy, the concept of causality is interpreted as involving a reciprocal and bidirectional form of causality.

Kant's theory of simultaneity concerns the "empirical determinacy" of time. In this study of Kant's conception of simultaneous coexistence, the concept of simultaneity will be reconstructed as involving the empirical determinacy of time. In his account of simultaneous coexistence, Kant provides the reasons for considering pure time-relations, such as persistence, succession and simultaneity, as empirically realized. This notion of the empirical determinacy of time, where the

pure time manifold is reproduced in experience, fulfills the rational demand for time determination. It achieves this rational demand by subjecting the pure time manifold to the relational and dynamical categories of experience, where the relations between appearances must be schematized in a priori temporal relations. This approach transforms the classical space-time manifold into an object of experience without postulating an absolute structure of space-time or reducing it into a system of mere relations between objects. The concept of simultaneous coexistence plays an essential role in the causal determination of the time-manifold, since, according to Kant, the universal coordination of time is contingent on the mutual interaction between substances in one space. It provides the empirical means to verify whether an object belongs to the universal connection between the parts of the world, thus giving content to the idea of causally linking all substances in the world. To fulfill this condition, an object must be both the recipient and the active agent of causal activity.

The core of Kant's theory of simultaneity is presented in the Third Analogy of Experience of the *Critique of Pure Reason*, where Kant argues that mutual interaction, as a causal relation, provides the dynamical correlate of simultaneity. But the argument of the Third Analogy requires clarification. According to the interpretation of that argument advanced in the following pages, Kant's general idea is as follows: the concept of a causal bidirectional connection that underlies the simultaneous presence of objects in space involves reconsidering the causal connection as a connection between two material points. Furthermore, Kant holds that the absolute conception of inertial force must be abandoned in favour of a purely relational account of forces in equilibrium. This balance of forces permits the reciprocal and mutual swapping between two material points without the loss of the conserved energy. Kant's model of mutual interaction allows for the instantaneous transmission of information and, therefore, the synchronization of clocks at distant

points. This is made possible by the mutuality of the reciprocal determination, which ensures the equality of the sending and receiving of information between the distant points. In light of this reconstruction, Kant provides an empirical and relational way to articulate the concept of simultaneity relation in experience. This empirical method is dictated by the mathematical structure of the space-time manifold, given in the pure manifold of intuition.

In the following pages, I develop my reading of the Third Analogy and its larger role in Kant's work by means of the following analyses. In Chapter 1, the views of Newton and Leibniz on time and simultaneity are discussed. It will be argued that both accept the concept of objective simultaneity and offer scientific and philosophical explanations for this concept. Newton relies on his mathematical conception of absolute time and space to ground simultaneity. The mathematical structure of space and time is shown to be necessary for understanding his conception of simultaneity and also by introducing forces into the theory. The role of forces in this respect is significant, as Newton developed different types of forces with his theory, and they provide causal explanation for different physical phenomena. For Newton, action-at a distance serves the purpose of providing a causal explanation of universal connections between distant parts of the world through instantaneous communication.

Leibniz, on the other hand, objected to Newton's conception of absolute time and space, and argued for a relational conception, in which space and time are considered as relations between objects and have no independent reality. The objections raised by Leibniz against Newton mainly concerned an incompatibility between the absolute structure of time and space and Leibniz's Principle of Sufficient Reason. This objection was also directed against Newton's action-at a distance, which involves no contact. Leibniz offers a different interpretation of simultaneity, which requires the compossibility of substances through universal harmony. This principle of

harmony, when applied concretely in Leibniz's theory of dynamical interaction, demands that there be two forces involved in local collision, passive and active. It demonstrates that Leibniz's account of causality includes an accommodation between the interacting substances with no real interaction.

In Chapter 2, Kant's early views on causation and coexistence are explored. It will be argued that Kant's views on these particular problems were shaped by the debates and controversies regarding the limits of the Principle of Sufficient Reason. The discussion of Kant's views in this period will be restricted to some of his works from the *New Elucidation* (1755) to *Dissertation* (1770). In this period, Kant proposed restrictions on the use of the Principle of Sufficient Reason, and he attempted to incorporate Newton's theory of attraction in his causal theory of coexistence without endorsing Newton's absolutism. This led to a reconsideration of the nature of the causal action of substances and the mathematical structure of space and time. The concept of coexistence, as grounded in mutual action, emerged as a principle for the cosmological unity of the world. In his 1770 *Dissertation*, Kant distinguished between the coordinating laws of sensible intuition and the principles of intelligible world. This distinction was a result of Kant's reflection on the nature of mathematical and metaphysical cognition.

In Chapter 3, Kant's theory of time as presented in the Transcendental Aesthetic and Transcendental Deduction of the *Critique of Pure Reason* is discussed. It will be argued that Kant's objective is to present time as a determinable manifold, in which pure time is offered as a synthesizable content that must be structured and determined in relation to objects of experience. This results in Kant's project of "empirically determining" time, where the categories provide the ground for its lawful determination. The nature of pure time, as a determinable manifold, requires reproducing the temporal relations of persistence, succession, and simultaneity in experience.

In Chapter 4, the nature of causal interaction in Kant's Analogies of Experience of the *Critique* is discussed. In the Second and the Third Analogies, the dynamical and relational determination of the manifold of intuition is pursued by the application of the relational categories. Different interpretations of the two Analogies will be discussed and assessed. It will be argued that the objective in Kant's Analogies is to provide empirical determinability of the relations of time, and this presupposes the presentation of the manifold of time as a determinable content. Finally, in Chapter 5, an alternative interpretation of the Third Analogy is presented. Its purpose to reconsider the claims of the Third Analogy with respect to the empirical cognizability of simultaneity as a relation of time.

1. Newton and Leibniz on Time and Simultaneity

In this chapter, we will explore the views of Newton and Leibniz on the nature of time and simultaneity. It will be argued that both of them articulated an absolute conception of simultaneity, in which the cosmological unity of the world plays a crucial role in accounting for the structure of time-space, as well as the unity of the concepts of space and time. However, Newton endorsed an absolute conception of time that contradicts Leibniz's relational conception of time. Therefore, the explanations offered for simultaneity differ on both accounts, and it is important to examine them separately. These explanations of the cosmological unity, or the simultaneous coexistence of the parts of the world, would have significant impact on Kant's understanding of causation and simultaneity.

1.1 Newton on Time and Simultaneity

The concept of absolute simultaneity in Isaac Newton's natural philosophy cannot be treated in isolation from his theories of absolute time and his theory of forces. The concept of absolute time plays an important role in his dynamical theory, specifically in the relation of forces to the causes of motion. It will be argued that examining the concept of simultaneity in Newton's natural philosophy is necessary to determine the extent to which the mathematical treatment of forces presupposes his theory of absolute time.[2]

The absolute nature of time, according to Newton, includes both the uniformity of its flow and absolute simultaneity. Newton explicitly refers to simultaneity in his early text *De Gravitatione,*

[2] I Intend to use the term "absolute" in contrast to the relational theory of space-time. Absoluteness refers to the structure of time-space as being independent of the relations between objects that are located in this absolute manifold of space-time. On the other hand, relationalism denotes the system of relations between objects as that which defines the content of space-time manifold. For more on this distinction, Friedman (1983, 62-64), examines the different usages of "absoluteness" in the classical debate on the nature of space-time.

where he states that "the moment of duration is the same at Rome and at London, on the Earth and on the stars, and throughout the heavens."[3] This early text spells out an understanding of time as "ubiquitous" or "everywhere". An absolute conception of simultaneity is not only present in some of Newton's definition of time, but his "rational mechanics" also embraces the absolute nature of simultaneity. This definition of simultaneity pertains to the possibility of uniquely slicing of the world into instantaneous spatial planes. In Newton's definition of absolute time, all temporal relations are to be uniquely determined, including simultaneity. Since there is a well-defined trajectory of motion in Newtonian space-time, it is possible to identify simultaneity relation in the Newtonian space-time structure as being "simultaneous in absolute time". Newton presents several arguments to show that the motion of bodies cannot be accounted for by relative motion, and consequently, that there is a need for an "immobile space" to identity true motion. These arguments are directed against the relationalist conception of motion.

1.1.1 The Nature of Absolute Time

In the introduction to the Scholium of his *Principia,* Newton argues that it is impossible to account for mathematical quantities through sense-perception and that in order to eliminate preconceptions about these quantities, he finds it "useful to distinguish these quantities into absolute and relative, true and apparent, mathematical and common" (*Principia,* 408). In this distinction, Newton proceeds to argue that it is necessary to abstract from sensible measures or relative quantities if we intend to identify true motion. In the first paragraph of the Scholium, Newton applies the distinction of absolute and relative quantity to time, and he presents his conception of absolute time as follows:

[3] (Newton, 2004, 26)

> Absolute, true, and mathematical time, in and of itself and of its own nature, without reference to anything external, flows uniformly and by another name is called duration. Relative, apparent, and common time is only sensible and external measure (precise or imprecise) of duration by means of motion; such a measure—for example, an hour, a day, a month, a year—is commonly used instead of true time. (*Principia*, 408)

The absolute time contains a uniform flow of moments, and such uniformity does not depend on "anything external," i.e., an empirical measure from which it can be abstracted. On the other hand, relative time is sensible and external, and it is not identical to absolute time. Rather, it is a bounded and limited part of absolute time and does not replace it as true measure time.

In presenting the properties of absolute time, Newton aims to show that these properties cannot be grounded in relative time, justifying the positing of an absolute structure of time. To further illustrate the properties of absolute time, particularly its independence from sensible and relative measures, Newton refers to the "equation of common time" in astronomy as an indication of this independence:

> In astronomy, absolute time is distinguished from relative time by the equation of common time. For natural days, which are commonly considered equal for the purpose of measuring time, are actually unequal. Astronomers correct this inequality in order to measure celestial motions on the basis of a truer time. It is possible that there is no uniform motion by which time may have an exact measure. All motion can be accelerated and retarded, but the flow of absolute time cannot be changed. The duration or the perseverance of the existence of things is the same, whether their motions are rapid or slow or null; accordingly, duration is rightly distinguished from its sensible measures and is gathered from them by means of an astronomical equation. (*Principia*, 410)

For Newton, this structure of absolute time remains unchanged, while manifests a uniform order, making it a universal and normative measure of time. In this sense, physical processes that intend to express a periodic flow of time, such as clocks, cannot register this uniform flow. In other words, the periodic flow of time can be approximated through successive procedures. Time is a mathematical quantity that is independent of the events and is an independent structure by which

temporal succession can be objectively determined without reference to the temporal positions of events in relative time. This structure allows for ascertaining whether temporally successive events are before, after, or simultaneous with one another in a unique and determinate way. Thus, the temporal positions of events are absolute, irrespective of their relative changes in time.

Newton acknowledges that these absolute measures of time and space are not perceptually presented. He argues that we tend to rely on "sensible measures" to account for these absolute mathematical quantities. However, Newton posits that absolute time (and space) can be inferred by introducing absolute motion. Newton's argument proceeds by acknowledging that a body can only be predicated of one true and unique motion and that the laws of motion implicitly recognize this fact.[4] According to Newton, the true motion of a body is its absolute motion, that is to say, its motion as measured by mathematical space and time. His argument aims to demonstrate that true motion cannot be reduced to relative motion but must be referred to an absolute spatial and temporal structure.

Newton's arguments for ascribing absolute positions to events in space and time are directed against the relationalist theories of time and space. The relationalist holds that space and time are defined through the relations between objects in space and time and that there is no absolute space or time. In this relationalist conception of space and time, motion is always and only the motion of bodies relative to their surrounding bodies. According to Newton, this relationalist conception of motion fails in many respects when understanding the true nature of motion. Newton argues that, according to the laws of motion, a true motion must be objectively determined, and the relationalists cannot account for the implicit true motion in the laws of

[4] Rynasiewicz (1995,134-135) explore the idea of predicating a body of true motion in the history of debate on the nature of motion.

motion that they endorse. Newton's arguments proceed by defining true rest and true motion, and asserting that the relationalist's theory of time and space cannot, according to Newton, provide a coherent and plausible explanation of the concepts of true motion or true rest.

According to Newton, absolute motion, implies the motion of bodies in absolute space, that is, the translation of one body from one absolute place to another. Equally well, true rest is defined as rest in absolute space. The challenge Newton poses to the relationalist, by singling out the properties of absolute motion and absolute rest, is to retain these properties without falling into inconsistencies. For instance, consider the scenario where there is a body in space far away from a local interaction between a pair of bodies. Suppose we assume that both bodies in the local frame are at rest with respect to each other. In that case, it becomes difficult to determine from this local and rest frame whether the distant body is truly at rest in its relative position, or the pair of bodies are at true rest. This characterization does not adequately rule out the possibility of true rest in both frames, even though that one body in the relative frame is in motion with respect to that distant body. As a result, the local interaction does not specify whether one body in this local interaction is in motion or at rest relative to that distant body. Hence, true rest cannot be inferred from the motion or rest of bodies in relative space.[5] This straightforward argument aims to show the insufficiency of the relationalist construal of these key physical quantities, such as true rest.

In a similar manner, Newton further specifies that true motion consists of the parts participating in the motion of the whole. This argument implies that whenever the whole body is in motion, its individual parts also participate in this motion. The purpose of this conceptual

[5] "It is a property of rest that bodies truly at rest are at rest in relation to one another. And therefore, since it is possible that some body in the regions of the fixed stars or far beyond is absolutely at rest, and yet it cannot be known from the position of bodies in relation to one another in our regions whether or not any of these maintains a given position with relation to that distant body, true rest cannot be defined on the basis of the position of bodies in relation to one another" (*Principia*, 410).

clarification by Newton is to point out that a body is considered to be at rest relative to other moving bodies, it can still participate in the motion of these moving bodies. Thus, similar to the property of true rest, it becomes difficult to reduce true motion to relative motion, and the reason, according to Newton, is:

> …when bodies containing others move, whatever is relatively at rest within them also moves. And thus true and absolute motion cannot be determined by means of change of position from the vicinity of bodies that are regarded as being at rest. For the exterior bodies ought to be regarded not only as being at rest but also as being truly at rest. Otherwise all contained bodies, besides being subject to change of position from the vicinity of containing bodies, will participate in the true motions of the containing bodies and, if there is no such change of position, will not be truly at rest but only be regarded as being truly at rest. (*Principia*, 411)

This argument regarding the property of true motion is directed against Descartes' formulation of true motion, as evident from Newton's reference to the receding from the axis of rotation in orbital motion. According to Newton, Descartes accepted in his vortex theory that each planet, such as the earth, is swirling or carried around the sun by a material vortex and is at rest relative to the neighbouring bodies. However, according to Newton, Descartes also accepted that planets can recede from the sun or the axis of rotation, which shows the inconsistency of Cartesian motion. This is because Cartesian motion imputes two contradictory predicates to planetary motion. This calls for referring true motion to an immovable frame in order to account for the true trajectory of motion. The relational conception of motion, which relies on relative points of reference, cannot adequately describe true motion.[6]

The subsequent two arguments that Newton presents are about the causes and the effects of motion. In the argument from the causes of motion, Newton emphasizes that true motion requires

[6] This argument also appears in Newton's *De Gravitatione* where he articulates it in clear opposition to Descartes' understanding of motion. (Newton, 2004, 20-21)

the presence of forces in order to define true velocity or acceleration. However, relative motion can be predicated of bodies without the presence of impressed forces, as it can be generated through geometrical displacements or changes of bodies without the involvements of external forces. It can also be applied to other bodies while maintaining the same relations, and still preserves the same relations while producing true motion.[7] In the argument from effects, Newton turns to rotational motion and provides an example from the motion of the bucket. He demonstrates that the receding of the body from centre (axis) indicates that rotational motion is independent of its relative surroundings. Such rotational motion indicates that true motion can be predicated of a body without including relational facts regarding its environment.[8]

This concludes Newton's arguments from the properties, causes, and effects of true motion, which prove that true motion cannot be ascribed to relative motion, but rather be considered an absolute motion. This ultimately leads Newton to posit a uniform and immovable structure of space-time to provide a coherent description of absolute motion.

1.1.2 Forces and Absolute Time

Taking time as a measurable quantity is essential to Newton's project in the *Principia,* as exploring the relationship between forces and the quantity of motion presupposes the mathematical structure of time. The intrinsic metric of time for Newton serves the purpose of correcting and guiding relative measures, such as local clocks, which are imperfect in measuring

[7] This argument can also be directed against Descartes, and it is not necessarily a strong argument against Leibniz's dynamical theory of relative motion.

[8] Newton states the reason for the failure of relative motion to qualify as true motion with respect to the introduction of external action of forces as follows: "…true motion is always changed by forces impressed upon a moving body, but relative motion is not necessarily changed by such forces. For if the same forces are impressed upon a moving body and also upon other bodies with which it has a relation, in such a way that the relative motion is maintained, the relation that constitutes the relative motion will also be maintained. Therefore, every relative motion can be changed while the true motion is preserved, and can be preserved while the true one is changed, and thus true motion certainly does not consist in relations of this sort." (*Principia*, 412)

time. Additionally, accounting for accelerated phenomena requires the structure of absolute time, which provides an independent framework to explain velocity differences. This is clearly stated in Newton's first law of motion: "Every body preserves in its state of being at rest or of moving uniformly, except insofar as it is compelled to change its state by forces impressed." (*Principia,* 416) This law is the empirical correlate to the uniform and equal succession of time asserted in Newton's concept of absolute time. The intrinsic metric of time indicates the equality of time interval: time flows equably. This feature of mathematical time does not depend on the means of measuring time through physical motion but is intrinsic to time itself.

This mathematical structure of time is necessary to provide a *causal* explanation of motion. The presence of forces indicates true motion, and these forces provide a causal explanation for any deviation and acceleration from uniform motion or equal succession of moments. In the relationalist's conception of motion, according to Newton's depiction of the relationalist position, the causal role of forces to explain motion is absent. In the relationalist framework, the relative replacements of bodies without the presence of forces are sufficient to explain motion. But this suggestion fails to explain the *causes* of true motion. Therefore, the introduction of forces is needed to properly define true motion.

The intrinsic uniform flow of time, however, does not only refer to the equal succession of moments in time but also includes simultaneity, or the agreement of temporal flow in different spatial locations. This shows that the means of measuring time, such as separated clocks, must agree on reading a universal time. It is about extending local time coordinates to a larger frame, in which an instantaneous shift between different spatial points does not affect the simultaneous unity of time across space. However, this agreement between separated clocks on registering the same flow of time depends on instantaneous gravitational interactions between distant points.

Therefore, the uniformity of time, as stated in the First Law of Motion, is not sufficient to guarantee the spreading of time across space. It requires the inclusion of the Second Law of Motion, where external forces are introduced to explain the causal role of forces with respect to the uniform flow of time. Thus, there is a causal basis for the simultaneous time flow in different spatial locations. In this respect, the concept of force plays a determinate role in making the spread of time at distant spatial points possible. In Newton's mechanics, the concept of force contains an infusion of causation and mathematical quantity.

Thus, it is essential to emphasize that simultaneity in Newton depends upon two levels of description: mathematical and causal. In mathematical simultaneity, absolute time requires the supposition of intrinsic temporal flow *everywhere,* and the mathematical composition of forces to explain simultaneity presupposes this intrinsic flow of time.

On the nature of forces, according to Newton, there is an intrinsic inertial mass in every matter that explains the matter's ability to persist and resist. This internal force of matter is given a definitive statement in Newton's First Law of Motion, which explains the natural and uniform motion of bodies by positing an internal force. This force is absolute, and it indicates the matter's ability to resist the external forces, and consequently explains the cause of a uniform motion, as stated in the First Law. However, assuming that there are two states, a state of motion and a state of rest, Newton argues that the causal principle that explains both states is internal to matter. In this way, he intends to provide a causal explanation of both states.

This inherent force explains the body's persistence in uniform motion along a straight line. Also, it explains the body's ability to resist the external action of other bodies acting upon it. Newton presents this notion of inherent force in Definition 3 and further enunciates that such force is invariantly operative in different states of the body:

> This force is always proportional to the body and does not differ in any way from the inertia of the mass except in the manner in which it is conceived. Because of the inertia of matter, every body is only with difficulty put out of its state either of resting or of moving. Consequently, inherent force may also be called by the very significant name of force of inertia. Moreover, a body exerts this force only during a change of its state, caused by another force impressed upon it, and this exercise of force is, depending on the viewpoint, both resistance and impetus: resistance insofar as the body, in order to maintain its state, strives against the impressed force, and impetus insofar as the same body, yielding only with difficulty to the force of a resisting obstacle, endeavors to change the state of that obstacle. (*Principia*, 404)

Thus, it is the manner of conceiving this force as it is actualized in either resistance or uniform motion that manifests different ways of exercising this force. A body *reacts* to the impressed force and to bring body into a different state, this force of inertia must be taken into account as it resists the impressed force. Therefore, despite Newton's ascription of this internal force to a single body in space, it is conceivable without interactions with other bodies, because it pertains to the uniform motion or rest of a body in absolute space. In causal interactions, it presupposes the existence of this internal force in bodies, since such a force plays a role in resisting the impressed force imposed upon it.

The impressed force consists of episodic actions imposed on other bodies and lasts only for the duration of the action. However, the internal force explains the persistence of the body before and after an interaction or the presence of impressed forces acting on the body. In Newton's Second Law of Motion, he states that a change in motion is proportional to the motive force impressed. He takes this law to allow for the mathematical composition of forces, as made explicit in Corollary 1, or the Parallelogram Rule. This Rule states that a body can experience two forces acting on it, which is not different from having the two forces acting separately. The necessity of this Rule is made explicit in the composition of the force of inertia and the impressed force. It leads to the reinterpreting the absolute velocity of a body in space as consisting of the

summation and composition of impulsive and instantaneous forces acting on the body along a straight line.

We can gather from the preceding paragraphs that, for Newton, the presence of impressed force is also explained by this internal force of inertia. In the case of a collision of two bodies, both the resistance to the impressed force and the force of persistence are required for explanation. According to Newton, this twofold action necessitates positing an internal force of inertia. Furthermore, it is important to note that the exercise of impressed forces is not only about pushing another object, but also about the tendency to resist accelerations. This tendency to resist needs inertial mass to be an intrinsic property of natural bodies.

A type of impressed force is the centripetal force, which acts directly at the center of bodies. As a central acting force, it causes inward acceleration.[9] Also, centripetal force, which is a species of impressed force (an action that is directed toward matter), is not only an action through impact or collision, i.e., an impulsive force, but rather it can act instantaneously through a distance. This form of action is used by Newton to explain orbital motion or orbital interactions. He invokes such a centrally directed force to explain the reason for the departure or deflection from the uniform trajectory of bodies.[10] Impressed force is relational as it requires the interaction of two bodies, and is considered impulsive and episodic. However, to bring impressed force into a force that acts continuously, it must be reinterpreted as centripetal force, which is a centrally directed force.

[9] In Definition 5, Newton presents centripetal force as follows: "Centripetal force is the force by which bodies are drawn from all sides, are impelled or in any way tend, toward some point as to a center." (*Principia*, 405)
[10] Newton in Proposition 1 of Book 1, makes it clear of the connection between area law and the inertial motion, and next to demonstrate that the "reason" for such deflection of uniform motion is central forces that draw the body to it. (*Principia*, 444)

Gravity is a centripetal force.[11] It acts at a distance between the centers of bodies. These centers are mathematical points, and gravity is calculated as the inverse square of the distance between these centers of bodies. Gravity thus involves a spatial separation or distance between interacting bodies. Since it is a species of centripetal force, gravity is not essential to matter; it is only proportional to the mass of a body. Also, since gravity is about the causal interaction between a pair of massive bodies, spatial separation is an integral component of construing gravitational interaction.[12] These claims regarding the nature of gravitational action are to be derived mathematically or from the measures of centripetal force. Newton points out that in the measures of centripetal force, such as absolute, accelerative, and motive, there is a center from which the efficacy of the cause propagates to the surrounding region. (*Principia* Definition 6, 406). This is the absolute measure of centripetal force, and it involves a region whereby the bodies are causally affected by the efficacy of the cause, whereas an accelerative quantity refers to the place of the body where a "certain efficacy diffused from the center through each of the surrounding places in order to move the bodies that are in those places" *(Principia*, 407). On the motive quantity of centripetal force, Newton refers to the action of the center in its direction to the body as it is drawn to the center, which is exhibited body's weight.

Gravity is a single action that is distributed between a pair of bodies.[13] This distribution of a single action is governed by a law that explains this distant causal interaction without reference to the essential properties of the matter being described, as the lawful connection between the

[11] In Definition 5, Newton includes gravity as one type of centripetal force with magnetic force: "One force of this kind is gravity, by which bodies tend toward the center of the earth; another is magnetic force, by which iron seeks lodestone; and yet another is that force, whatever it may be, by which the planets are continually drawn back from rectilinear motions and compelled to revolve in curved lines." (*Principia*, 405)
[12] The masses of bodies provide the reason for this gravitational interaction, but gravitational interaction also depends on space between massive bodies, and the distance between interacting massive bodies is relational. The gravitational attractive force is thus reduced as the distance between bodies increases.
[13] Stein (2002, 356-358) explores the relational aspect of gravity.

interacting bodies is sufficient to ascribe one causal activity to both. Here, Newton believes that gravitational action is an extension of the Third Law of Motion. In this way, it is possible to promote the causal action as one single action with a shared contribution from two massive bodies. It requires the presence of another body and its action for the first body to exercise a reactive action, producing this mutual interaction. Newton provides a detailed explanation of the nature of such action in his *Treatise on The System of the World:*

> Since the action of the centripetal force upon a body attracted is, at equal distances, proportional to the matter in these bodies, reason requires that is should be also proportional to the matter in the body attracting. For all action is mutual, makes the bodies mutually to approach one to the other, and therefore must be the same in both bodies. It is true that we may consider one body as attracting, another as attracted. But this distinction is more mathematical than natural. The attraction is really common of either to other, and therefore of the same kind in both. There is a double cause of action, to wit, the disposition of both bodies, as well as a double action in so far as the action is considered as upon two bodies. But as betwixt two bodies it is but one single action. It is not one action by which the Sun attracts Jupiter, and another by which Jupiter attracts the Sun. But it is one action by which the Sun and Jupiter mutually endeavour to approach each other.[14]

In this passage, Newton clarifies that a single action should be attributed to both bodies, resulting in the actualization of their "disposition" in this interaction. In this scenario, the contribution of each pair of interacting bodies is distributed equally, making it an application of Newton's understanding of the Third Law of Motion.

As a centripetal force, gravity cannot be considered an essential property of matter or a single body. It requires mutual and external action between bodies. In this case, Newton emphasizes that the physical basis of gravity is not part of his explanation of this form of interaction, but rather he provides a mathematical explanation of it.[15] Therefore, the challenge of determining the

[14] (Newton, 1728, 38-39)

[15] On the different quantities of centripetal force, including gravity, Newton has emphasized that he is not identifying the physical causes of the centripetal forces, but he is merely considering it as mathematical quantity: "This concept is purely mathematical, for I am not now considering the physical causes and sites of forces." (*Principia*, 407)

physical ground of this gravitational interaction lies in Newton's rejection of attributing this force to the essential properties of matter and leaving its mechanical cause unexplained according to the constraints of mechanical intelligibility. This is clear from his famous pronouncement on the nature of the method, which does not posit an explanation of the causes of such forces:

> Thus far I have explained the phenomena of the heavens and of our sea by the force of gravity, but I have not yet assigned a cause to gravity. Indeed, this force arises from some cause the penetrates as far as the centers of the sun and planets without any diminution of its power to act, and that acts not in proportion to the quantity of the *surfaces* of the particles on which it acts (as mechanical causes are wont to do) but in proportion to the quantity of *solid* matter, and whose action is extended everywhere to immense distances, always decreasing as the squares of the distances.
> I have not as yet been able to deduce from phenomena the reason for these properties of gravity, and I do not feign hypotheses. For whatever is not deduced from the phenomena must be called a hypothesis; and hypotheses, whether metaphysical or physical, or based on occult qualities, or mechanical, have no place in experimental philosophy. In this experimental philosophy, propositions are deduced from the phenomena and are made general by induction. The impenetrability, mobility, and impetus of bodies, and the laws of motion and the law of gravity have been found by this method. *And it is enough that gravity really exists and acts according to the laws that we have set forth and is sufficient to explain all the motions of heavenly bodies and of our sea.* (*Principia*. 943) [Emphasis added]

In this manner, Newton proclaims to ascribe gravitational action to bodies without committing to the true nature of such bodies or the mechanical cause underlying them. Although Newton is not evading the real cause of gravity, it instead reflects the limits of the experimental philosophy method as he understood it in relation to assigning a cause to gravity.

Gravitational interaction originates from the relational nature of impressed force, which requires the presence of two massive bodies for this causal interaction to occur. Also, since this interaction is mathematically measured through the inverse square of the distance and the proportionality to the masses of interacting bodies, Newton finds this mathematical explanation sufficient. According to Newton, reducing this interaction to the inherent features of matter,

where matter can causally influence another matter through its essential properties alone, is not a viable option.[16] For this reason, it is important to emphasize that gravitational interaction is *introduced* to pair bodies rather than assumed to follow from the concept of a body as such, and that the nature of introducing such gravitational force to explain causal interaction hinges on the form of interaction itself, and not on nature of an isolated body.

Newton posits that the passive nature of matter alone cannot explain this action at a distance between massive bodies. There is a need to include active principles, such as the force of gravity, to explain how passive matter can be endowed with causal powers to affect other matter. In order to explain these active principles, Newton does not rule out the possibility of a divine act adding these active powers to matter to account for the force of gravity. In his writings on this issue, Newton attempts to avoid the position of embracing the idea that matter is—in its essential properties—self-moving or self-regulated. This rejection of the idea of essential active power in matter is defended on theological grounds. However, it is also a position taken by Newton to refuse ascribing gravity to matter as an essential property of matter, but with other properties such as extension, they cannot provide a sufficient explanation of the gravitational attraction in accordance with its mathematical laws of proportionality to mass and inverse square law.

Despite the fact that gravity is not considered an essential property of matter, but rather depends on the form of interaction, Newton, by placing constraints on the measures of this attractive force, presumes that this interaction must be accounted for by the massive nature of bodies and the spatial separation or distance between the bodies. Gravity, as a centripetal force

[16] In his letter to Bentley, Newton elaborates on this position further: "It is inconceivable inanimate brute matter should, without the mediation of something else, which is not material, operate upon and affect other matter without mutual contact, as it must be, if gravitation in the sense of Epicurus, be essential and inherent in it. And this is one reason why I desired you would not ascribe innate gravity to me." (Newton 2004,102)

that acts centrally and deflects the uniform motion of bodies, keeps bodies orbiting their center. This assumption is based on the inertial trajectory of bodies as they move in a straight line. The inertial motion of matter realizes the concept of mathematical absolute time, and it is assumed in the explanation of the gravitational attraction, which is a centripetal force that deflects this uniform motion. In other words, gravitational force empirically realizes the mathematical time implicit in the inertial motion of bodies, as without such action, mathematical time cannot be empirically determined. However, as indicated above, this gravitational force is introduced from without as an active principle independent of the essential nature of bodies. It does not reside in the nature of bodies as such.

The concept of absolute simultaneity in Newton, which depends on this form of instantaneous interaction between massive bodies, requires the inclusion of active principles to explain the causal powers of matter. In Newton's understanding, simultaneity cannot solely depend on the absolute and mathematical measures of space and time but causation must be introduced to realize absolute simultaneity empirically. This brought us to Newton's account of causation and its complexity. Since causal powers, which refer to the ability of matter to affect other matter, cannot be directly ascribed to matter but depend on certain conditions, such as the presence of matter and spatial distance, the so-called active principles in Newton play a role in ascribing a causal interaction between two bodies. This makes the empirical realization of mathematical simultaneity contingent upon the condition of having two bodies actualizing their dispositions through mutual interaction.

The mathematical composition of forces in Parallelogram Rule includes the composition of centripetal forces with inertial force. In this Rule, gravity, as a continuous action on a body, implies that its composition requires the structure of absolute time as conceived by Newton.

However, there is a mismatch between the empirical realization of simultaneity and mathematical simultaneity in the composition of forces. This mismatch can be attributed to Newton's rejection of ascribing causal activity to matter itself and the idea that the absolute nature of force allows for the absolute velocity of an isolated body in space without assuming the parallel motions of other bodies. In other words, the composition of forces does not contradict the absolute force of the motion of an isolated body in space.

1.2 Leibniz's Theory of Time and Simultaneity

Like Newton, Leibniz also believes in absolute simultaneity, which implies the existence of the same and unique instantaneous temporal moment everywhere. However, the metaphysical grounds for holding this position are different for Leibniz compared to Newton's reasons. Leibniz rejects Newton's absolute theory of time, which posits a uniform and independent structure of temporal flow from the relations between objects. According to Leibniz, the relational view of space and time must be privileged over the Newtonian absolute space and time because a relational theory of space and time is in line with the demand for intelligibility, which is supplied by the Principle of Sufficient Reason.

On simultaneity, Leibniz argues that the harmonious order of the universe follows from this demand for intelligibility as well. The compossibility of substances in one world indicates the harmonious coexistence of the substances in the world. However, Leibniz posits that this cosmological harmony cannot be articulated due to the physical interaction between substances. Instead, he suggests that each substance is causally isolated from the other substances.

1.2.1 Leibniz's Arguments against Absolute Time

Leibniz put forth several arguments to undermine Newton's absolute theory of time. These arguments were mainly developed in Leibniz's correspondence with Samuel Clarke, who represented the Newtonian position regarding the status of space and time in this philosophical and theological exchange. While Leibniz's arguments were initially motivated by theological considerations regarding God's wisdom and perfection, the theological content of these arguments can be recast in philosophical terms. It is worth noting that in his letter, Leibniz did not delve into his metaphysical views on space and time, which he had expounded in his writings prior to this exchange with Clarke. Instead, he primarily defended a relational account of time and space in opposition to Newton's absolute theory of time and space.

One of Leibniz's main arguments against absolute time is that such an absolute view would contradict the Principle of Sufficient Reason, which holds a central role in his metaphysics and epistemology. According to this Principle, there must be a reason for a specific state of affairs to be obtained, and for the possible alternatives to fail to be realized. In a theological twist, Leibniz argues that there must be a reason for God to choose a particular order over other possible alternatives, and these reasons are to be found in the nature of things. Leibniz posits that something must motivate God's choice to place things in a specific order rather than an alternative one. In contrast to Leibniz's intellectualist view of God's will, Clarke, similar to Newton's position, defends a voluntarist view of God's will. Clarke argues that God's will cannot be motivated by external reasons that would contravene with the supposition of God's freedom. In his letters to Leibniz, Clarke did not reject the Principle of Sufficient Reason, but rather argued that these reasons must be sought in God's will. According to Clarke, for God to act on these reasons does not entail that these reasons somehow compel God's decision to act.

The Principle of Sufficient Reason occupies an important place in Leibniz's argument against absolute time and space.[17] Newtonian absolute theory of time and space posits a uniform and homogenous order that does not allow for distinguishing between different instants of time or places in space. Suppose that God is confronted with such absolute order before placing things in a determinate temporal position or place. In that case, God is presented with no discernible difference between temporal instants in absolute time in order to place things in it. There are two possible ways to deal with this situation: either not to act at all or to place things in time with no determinate reason with respect to the choice of placing things in a specific temporal position. For Leibniz, these two possible ways cannot be imputed to divine will, as it would contradict divine wisdom. In other words, it implies ascribing to God an action with no reason. He argues that if space:

> …was an absolute being, there would something happen for which it would be impossible there should be a sufficient reason. Which is against my axiom. And I prove it thus. Space is something absolutely uniform; and, without the things placed in it, one point of space does not absolutely differ in any respect whatsoever from another point of space. Now from hence it follows, (supposing space to be something in itself, besides the order of bodies among themselves,) that it's impossible there should be a reason, why God preserving the same situations of bodies among themselves, should have placed them in space after one certain particular manner, and not otherwise; why every thing was not placed the quite contrary way, for instance, by changing East to West.[18]

It is also the case with absolute time, as Leibniz argues that to suppose such an absolute time is to fail to provide a reason for God's choice creating the world at one determinate temporal moment rather than another. God's act of creating the world at a specific moment, rather than earlier or later, must be motivated by a reason. However, according to the concept of absolute time, all

[17] Leibniz provides a definition of this Principle: "I mean, the principle of a sufficient reason, viz. that nothing happens without a reason why it should be so, rather than otherwise. (Leibniz's Second Letter." §1,1956, 16)
[18] (Leibniz's Third Letter, §5,1956,.26)

alternative moments in time are equal and homogenous, thus God's act of creating the world in a particular moment seems to lack reason.[19] Hence, this conception of absolute time with an independent structure contradicts God's wisdom and perfection.

An integral component of Leibniz's argument against Newton's absolute time is the principle of the identity of the indiscernibles, which states that a numerical difference entails a qualitative difference. Leibniz finds this principle significant in denying the supposition of having identical and homogenous temporal instants, which Newtonian absolute time requires. For Leibniz, this principle of the identity of the indiscernibles is used in his argument against absolute time to deny the absolute identity or likeness between two or more things, as such a supposition of absolute identity between things in the world would contravene God's wisdom. Therefore, in the case of absolute time, having uniform and homogenous instants in absolute time gives no reason for one possible temporal arrangement over other alternatives where it is possible to have symmetrical shifting of an object's temporal direction. Thus, having identical moments in time or spatial positions is contrary to God's wisdom, as God would not create two absolutely identical situations, nor would he choose among indiscernibles.

However, when pressed by Clarke regarding the epistemological status of the principle of the identity of indiscernibles and whether it follows from the Principle of Sufficient Reason as articulated by Leibniz,[20] Leibniz encounters Clarke's objection by arguing that the principle of the identity of indiscernibles follows from the Principle of Sufficient Reason. Leibniz claims that

[19] (Leibniz's Third Letter, §6, 1956, 27)

[20] Clarke in his Fourth letter to Leibniz, argues that placing things in equal parts of space or time is not an argument against God's ability to choose between equal instants. He argues that God still can act with good reasons despite having homogenous space or time, for "God's placing one cube of matter behind another equal cube of matter, rather than the other behind that; is a choice no way unworthy of the perfections of God, though both these situations be perfectly equal: because there may be very good reasons why both the cubes should exist and they cannot exist but in one or other of equally reasonable situations." (§18, 1956, 49-50)

it is impossible for God to create two absolutely identical things or to choose between equal situations, as both scenarios would contradict the Principle of Sufficient Reason, which states that it is impossible to act indifferently or without a reason.[21]

In encountering Leibniz's argument, Clarke sought to give a different interpretation of the Principle of Sufficient Reason. He argued that external choices cannot determine God's will but rather divine will is the sole ground for attributing a reason to God's actions. While it is true that due to the uniformity of space and time, there could be no external reason for God to choose between equal alternatives, such uniformity does not undermine or obstruct God from exercising his will if this will is to be the sole reason for divine actions.[22] Clarke's reinterpretation of this Principle from a voluntarist perspective was not well received by Leibniz, as he rejected the assumption of voluntarist theology, which, according to him, undermines the intelligibility of the created world. A voluntarist conception of divine action intends to avoid attributing necessity to God's actions, but such a consequence is not possible, as he interprets God's will, like that of any rational actor, to consist of actions that are prompted by a motive. In the case of God's actions, these motives are intended to exhibit divine perfection and wisdom.

In Leibniz's response to Clarke's rejection of grounding God's actions in choosing between external preferences, Leibniz seeks to demonstrate that a Principle of Sufficient Reason with respect to divine will is to be derived from the idea that God chooses the best possible order of

[21] Leibniz recounts his position on this issue in the following way:
"I infer from that principle [identity of indiscernibles], among other consequences, that there are not in nature two real, absolute beings, indiscernible from each other; because if there were, God and nature would act without reason, in ordering the one otherwise than the other; and that therefore God does not produce two pieces of matter perfectly equal and alike." (Leibniz Fifth Letter, §21, 1956, 61)
[22] (Clarke's Third Letter, §5, 1956, 32)

things.[23] So, according to Leibniz, on this Principle of the Best, God chooses among the different possible alternatives. In order to avoid ascribing necessity to God, Leibniz argues that when "…a wise being, and especially God, who has supreme wisdom, chooses what is best, he is not the less free upon that account: on the contrary, it is the most perfect liberty, not to be hindered from acting in the best manner." He continues:

> And when any other chooses according to the most apparent and the most strongly inclined good, he imitates therein the liberty of a truly wise being, in proportion to his disposition. Without this, the choice would be a blind chance.[24]

This answer supposedly tends to undermine Clarke's contention that Leibniz's understanding of the Principle of Sufficient leads to metaphysical necessity. This is evident in the way Leibniz wants to evade Clarke's attribution of necessity to Principle of Sufficient Reason as consisting of being necessarily prompted by external choices rather than being grounded solely on divine will. Leibniz argues that when God chooses the best, the alternatives are also possible, despite being less perfect in comparison to God's perfection. If what God chooses "was absolutely necessary; any other way would be impossible: which is against the hypothesis. For God chooses among possible, that is, among many ways, none of which implies a contradiction."[25] It is the Principle of the Best, as presented by Leibniz, which underlies the Principle of Sufficient Reason. Thus, on Leibniz's supposition of God's choosing to create the world at one moment and that choice must align with God's perfection, God then chooses the best. This undermines the idea of having an actual temporal extension available to God's intelligence before his will is actualized. Leibniz argues that the idea of identical temporal positions before God's creation, as posited by the

[23] Leibniz on this particular exchange seems not to separate the Principle of Sufficient Reason (acting according to motives), and the Principle of the Best.
[24] (Leibniz's Fifth Letter, §7, 1956, 56)
[25] (Leibniz's Fifth Letter, §8, 1956, 57)

absolute conception of time, must be rejected based on his argument from the Principle of Sufficient Reason.

Leibniz's demand for intelligibility thus poses a challenge to Newton's view of absolute time. This demand for intelligibility is about linking the mathematical structure of time and space to rational determination. According to Newton and Clarke, the voluntary acts of God are the sole ground for the intelligibility of the world. But Leibniz views God's perfection differently. According to him, while it is possible to have identical situations or orders, it is not possible on the supposition of God's perfection and wisdom, as it would contradict God's perfection. For this reason, a relational conception of time is preferred, as it respects this demand for intelligibility. He maintains that a relational theory of time does not confront the same challenge as an absolute theory. In a relational view, time becomes contingent upon the relations between objects rather than existing independently prior to the order of succession of objects. This makes it impossible to ascribe identity and difference to an independent reality of time that contains no bodies. With a relational time, it hinders the attribution of identical and indiscernible temporal instants to time, as time is reduced to a system of relations between bodies. Therefore, it does not generate a problem with respect to choosing between identical instants.[26] Unlike Newton, Leibniz argues that time must be founded on something that precedes it in the order of explanation. There is no reference to an intrinsic temporal flow to explicate the temporal relations between objects.

[26] Leibniz illustrates this point using space to demonstrate the symmetrical shifting within space (or time) does not arise in the relational construction of space and time: "But if space is nothing else, but that order or relation; and nothing at all without bodies, but the possibility of placing them; then those two states, the one such as it now is, the other supposed to be contrary way, would not at all differ from one another. Their difference therefore is only to be found in our chimerical supposition of the reality of space in itself. But in truth the one would exactly be the same thing as the other, they being absolutely indiscernible; and consequently, there is no room to enquire after a reason of the preference of the one to the other." (Leibniz's Third Letter, §5, 1956, 26)

1.2.2 Time and Monadic Interaction

In his correspondence with Clarke, Leibniz did not delve deeper into his metaphysical doctrine of time, but he kept the discussion on the phenomenal level, specifically within the world of phenomenal bodies. However, according to Leibniz, there is a metaphysical order of explanation for the relations of space and time in the world of appearances. This level of explanation aims to explicate how time, for example, is founded on a non-temporal monadic interaction. Phenomenal time arises as a result of this monadic appetition and of the monad's representation of the world.

In his correspondence with Clarke, Leibniz provides an analysis of how the concept of space is formed. His main aim is to interpret space as a system of relations between bodies. According to Leibniz, at this phenomenal level of description, space is nothing but a system of relations between bodies. However, constructing space based on these relations acquires an ideal being, therefore, becoming a way of conceiving things as spatially related. Clarke argues against the relational theory of time and space, claiming that it fails to explain how space and time possess metrical properties. On the other hand, Leibniz argues that the metric of time and space can be abstracted from the order of situations. At this level, time and space are merely ideal fictions. He provides further details on how this ideal construction of space and time as relations is possible:

> I will here show, how men come to form to themselves the notion of space. They consider that many things exist at once and they observe in them a certain order of co-existence, according to which the relation of one thing to another is more or less simple. This order, is their *situation* or distance. When it happens that the one of those co-existent things changes its relation to a multitude of others, which do not change their relation among themselves; and that another thing, newly come, acquires the same relations to others, as the former had; we then say, it is come into the place of the former; and this change, we call a motion in that body, wherein is the immediate cause of the change.[27]

[27] (Leibniz's Fifth Letter, §47, 1956, 69)

It is through the order of situations that it becomes possible to generate the "same place," which is abstracted from the changing relations between coexistent things. Contrary to Clarke's suggestion, Leibniz argues that the metrical properties can be ascribed to the order of relations between bodies. This indicates that it is not necessary to postulate an independent existence of mathematical space or time in order to account for such properties.

For Leibniz, time is a system of relations in the phenomenal world that arises from deep monadic interactions. Time in the phenomenal world is not primitive but derivative from the monadic states that ground these relations. In this sense, Leibniz's theory of time is reductionist, aiming to analyze temporal relations into simpler and metaphysically basic relations, making it a "well-founded phenomenon." In this conception of monadic interaction, time becomes an outer phenomenon resulting from monadic change within substances. In this metaphysics, time does not have an independent or separate existence but depends on the monad's perceptual representations of the world. A basic form of change is contained within every monad. In this way, Leibniz seeks to analyze the temporal relations of succession and simultaneity into more basic monadic states.

According to Leibniz, the basic relation of time consists of the relation of succession. He suggests that this relation can be reinterpreted as a relation of succession between the appetitive states of substances. In appetition, substances strive to change from one state to another, and this transition is illustrated as a relation where an earlier state "contains" a reason for the next state. For Leibniz, temporal precedence at the phenomenal level is derived from this basic relation of successive states in the monad. In contrast, simultaneity does not involve successive states containing reasons for the next state. Instead, it is about the compatibility of different states.

Leibniz outlines these basic relations as follows in his text *Initium rerum Mathematicarum metaphysica* (1715):

> If a plurality of states of things is assumed to exist which involves no opposition to each other, they are said to exist simultaneously. Thus we deny that what occurred last year and this year are simultaneous, for they involve incompatible states of the same thing. If one of the two states which are not simultaneous involves a reason for the other, the former is held to be prior, the latter posterior. My earlier state involves a reason for the existence of my later state. And since my priori state, by reason of the connection between all things, involves the prior state of other things as well, it also involves a reason for the later state of these other things and is thus prior to them. Therefore whatever exists is either simultaneous with other existences or prior or posterior.[28]

In the concept of simultaneity, the states of things exclude their contraries and incompatible states. Through the connection between things, Leibniz constructs simultaneity as an equivalence relation that encompasses the momentary states of all monads in the world. It becomes evident that, for Leibniz, simultaneity is defined by the exclusion of succession and change, and can be obtained through the monadic representation of all states of the world. This monadic representation of all states also depends on the relation of compossibility, where possible substances are accommodated into one world.

Simultaneity in phenomenal time expresses the coexistence of substances within one world. It involves the substance's expression of its membership in one cosmological unity and harmony. This expression of universal harmony has conceptual content that is internally articulated in every substance in the world. According to Leibniz, the instantaneous state of the world is founded on this universal harmony at the level of substances. However, this harmony is not based on a real and reciprocal causal relation between substances. Instead, it is about the compatibility

[28] (Leibniz, 1989.b, 666)

and compossibility of all these substances; a consequence of each substance's representation of all states in the world.

To further illustrate this notion of compossibility, it is important to revisit Leibniz's assertion in his correspondence with Clarke that God's action of creating the world is motivated by reason. For this condition to be met, it is not only necessary for possible substances to be non-contradictory when brought together, but also for these possible substances to be compossible. In other words, each substance or monad represents the rest of the monads without incompatibility in order to compose one single world.[29] For Leibniz, there is a deep connection between things, and this "connection" is reflective of the compossibility of substances in the world, such that every perceptual state of a monad contains, from its perspective, either a distinct or confused representation of the world. As a consequence, the simultaneous states of the universe must be represented within each monad, allowing for the possibility of agreement between monads' expressions of the world. However, this possibility of agreement between the expression of different monads in one world does not hinge on real causal interaction. Leibniz argues that this mere perceptual representation within every monad of the state of the world does not require real communication between monads. Rather, it is merely through the internal power of representation that every monad is capable of representing all states of the universe, from its perspective.

[29] In *Theodicy*, Leibniz explains this feature of the divine act of bringing possible substances into one world, and by placing compatibility as a constraint for this divine decree. He addresses this problem in answering Bayle: "To be the best, and to be desired by those who are most virtuous and wise, comes to the same thing. And it may be said that, if we could understand the structure and the economy of the universe, we should find that it is made and directed as the wisest and most virtuous could wish it, since God cannot fail to do thus. This necessity nevertheless is only of a moral nature: and I admit that if God were forced by metaphysical necessity to produce that which he makes, he would produce all the possibles or nothing; and in this sense M. Bayle's conclusion would be fully correct. But as all the possible are not compatible together in one and the same world-sequence, for that very reason all the possibles cannot be produced, and it must be said that God is not forced, metaphysically speaking, into the creation of this world." (Leibniz, 1985, 252-3)

1.2.3. Force and Causation

Leibniz's doctrine of pre-established harmony is best understood as a thesis about the causal powers of substances. In contrast to occasionalism, which asserts the causal impotence of substances, Leibniz develops pre-established harmony in order to account for the relation between substances in the world, including the relation between the soul and body. The occasionalists dismiss the idea of natural causality and argue that substances should not be seen as sources of causal activity in nature. However, Leibniz argues that the absolute denial of substances' causal activity can generate problems regarding the rationality and intelligibility of the created world. The rejection of causal powers of substance can violate the very idea of an intelligible world, as it deprives the created substances of intrinsic powers to act and persist. While the denial of causal powers of substances is not intended to undermine the intelligibility or rationality of the created world, because it asserts that general laws are the guide for God's causal activity, Leibniz believed that this position lacks an essential component in construing the concept of laws of nature. For Leibniz, the laws of nature should be based on the causal powers intrinsic to the substances. Alternatively, Leibniz posits that substances are active and the source of all causal actions; this thesis is referred to as spontaneity. Substances are spontaneous, which entails that all actions originate from within them.

The thesis of spontaneity is the cornerstone of Leibniz's theory of pre-established harmony. The concept of spontaneity pertains to monadic activity and how such activity serves as the underlying basis for extrinsic phenomena. According to Leibniz, every change originates from substance and is the subject of every action. This idea is coupled with the concept of the causal isolation of every substance, as the spontaneity thesis posits that changes or modifications to a substance cannot be attributed to other active substances. Substances are solely responsible for

every change to occurs within them. In this way, Leibniz distinguishes his account of causation from those who defend the notion of influx or "inflow" of being from one substance to another, a position accepted among medieval Aristotelians and defended by Suarez. Leibniz argues that the problem with this notion of the inflow of being in causation is that it misconstrues the relation between a substance and its attributes, assuming that accidents can be shared or transferred between substances. However, according to the spontaneity thesis, this is impossible, as causation through transference can ultimately lead the contradictory position of detaching an accident from its subject. For this reason, spontaneity can be seen as denying both the concept of causal influx and the rejection of natural causality.

Leibniz contends that the laws of nature must be grounded in the intrinsic nature of substances. This view upholds the thesis of spontaneity, which relates to the active self-determination of substances. According to the spontaneity thesis, a substance's active determinations follow an internal law of series that is manifested in successive states of the substance. Leibniz's position implies that God's volitions are not operating in the absence of reasons, as these reasons are inherent to the nature of things. The active force within the substance serves as the source of its active determinations. This active and internal force follows a certain pattern dictated by law. In Leibniz's view, a law of nature assumes that there is an intrinsic and active force within created substances, through which substances can actively determine themselves and be causally active. Thus, a law of nature must be grounded in these intrinsic causal powers.

Leibniz rejected the Cartesian reduction of substance to extension and instead suggested that the activity of substances or bodies must be accounted for by a principle other than mere extension or any other geometrical determinations. According to Leibniz, force serves as the

metaphysical principle that plays a role in making substance the source of action. Leibniz argues that a mere geometrical characterization of motion or interaction does not indicate the causes of motion because it abstracts motion from force and relies only on the geometrical or phoronomical description of motion. In order to account for the causes of motion, force must be introduced. As illustrated above, these active forces are internal to the substances and, therefore cannot be found in the geometrical description of motion. For this reason, while Leibniz accepts the equivalence of hypotheses, he also believes that such equivalence can be broken when the cause is specified. Thus, on the idea of equivalence of hypotheses, Leibniz maintains:

> Since we have already proved through geometrical demonstrations the equivalence of all hypotheses with respect to the motions of any bodies whatsoever, however numerous, moved only by collision with other bodies, it follows that not even an angel could determine with mathematical rigor which of the many bodies of that sort is at rest, and which is the center of motion for the others.[30]

The relativity of motion is based on the inability to determine, through geometrical considerations alone, which body is absolutely at rest and which is in true motion. Invoking the causes of motion demands that a different level of description must be applied, namely the dynamical explanation of motion.[31] Leibniz's dynamics is about the science of forces in nature, and this science is not independent of the metaphysical claims regarding the nature of the substance. Leibniz makes the following claim to clarify this view:

> …because we cannot derive all truths concerning corporeal things from logical and geometrical axioms alone, that is, from larger and small, whole and part, shape and position, and because we must appeal to other axioms pertaining to

[30] *On Copernicanism and the Relativity of Motion.* (Leibniz, 1989.c, 91)

[31] It is here that Leibniz can be taken as providing an alternative way of interpreting true motion. It is Newton's contention that true motion can be defined by causes, and the relationalist theory of motion fails to consider this aspect of true motion as being absolute. Leibniz, in his reply to Clarke, made it clear that it is possible to identify true motion through causes without postulating an absolute motion; "…I grant there is a difference between an absolute true motion of a body, and a mere relative change of its situation with respect to another body. For when the immediate cause of the change is in the body, that body is truly in motion; and then the situation of other bodies, with respect to it, will be changed consequently though the cause of that change be not in them." (Leibniz, Fifth Letter, §53, 1956, 74)

> cause and effect, action and passion, in terms of which we can explain the order of things, we must admit something metaphysical, something perceptible by the mind alone over and above that which is purely mathematical and subject to imagination, and we must add to material mass a certain superior and, so to speak, formal principle. Whether we call this principle form or entelechy or force does not matter, as long as we remember that it can only be explained through the notions of forces.[32]

As the principle of causal explanation lies within the science of dynamics, which in turn invokes the principle of active force within substances, it becomes possible to ground the science of motion in something more basic. This is Leibniz's ultimate objective: to provide a coherent and stable foundation for mechanical explanation in physical science.

In providing a causal explanation of motion, Leibniz, as has become clear, argues that we must turn to the active forces within substances. However, the problem arises in defining the true cause, given the equivalence of hypotheses in the geometrical characterization of motion. Leibniz suggests that a cause is a substance that contains a clear expression of the reason relative to other substances. He makes this claim in his correspondence with Arnauld:

> It is customary to attribute the action to that substance whose expression is more distinct and which is called the cause, just as when a body is swimming in water there are an infinity of movements of the particles of water in such a way that the place which the body leaves may always be filled up in the shortest way. This is why we say that this body the cause of the motion, because by its means we can explain clearly what happens.[33]

The import of this claim is that a distinct expression of reason within a substance can allow us to attribute causality to that substance rather than attributing it to other bodies relative to the cause. This involves a sort of accommodation between substances, whereby one substance can be perfect compared to others as long as it expresses reason more clearly, while other substances

[32] *A Specimen of Dynamics.* (Leibniz, 1989.b, 125)
[33] *Correspondence with Arnauld.* (Leibniz, 1989.a, 150)

become limited.[34] In explaining limitation by other substances, Leibniz uses another force in his dynamics, namely, passive force. This passive force explains the ability of substances to resist the penetration and motion of other moving bodies. It is distinct and independent from the active force, which is about the activity of striving bodies to move other bodies.

Since Leibniz denies that substances are in mutual interaction and that monadic spontaneity entails that a substance must internally bring about its changes, the concept of being limited by other substances or passive force becomes puzzling. This notion requires that a substance be limited by itself; by its own activity. In this respect, the law of action-reaction in Leibniz's dynamics acquires a different interpretation. It requires that two different forces must be at play in this physical interaction: the active force and the passive force. The passive power or force remains constant, and its ability to rebound after impact is proof of its internal passive force, which demonstrates that its limitation originates from within the body rather than treating this interaction as consisting of an influx of force from one body to another. He explains the nature of impact or collision in *A Specimen of Dynamics* as follows:

> …every passion of a body is of its own accord, that is, arises from an internal force, even if it is on the occasion of something external. I understand here the body's own passion, the passions that arises from collision, that is, the passion that remains the same, whichever hypothesis we finally adopt, that is, to whatever things we ascribe absolute rest or motion in the end. For, since the impact is the same, wherever the true motion in the end belongs, it follows that the effect of the impact is equally distributed between the two, and thus that in impact, both bodies are equally acted upon, and equally act, and that half of the effect arise from the action of the one, and half from the action in the other, it is also sufficient for us to derive the passion in the one from its own action, and we do not need any influx of the one into the other, even if the action of the one provides the occasion for the other to produce a change in itself.[35]

[34] This idea is explained in section 15 of *Discourse on Metaphysics*, where Leibniz states:
"The action of one finite substance upon another consists only in the increase in the degrees of the expression of the first combined with a decrease in that of the second, in so far as God has in advance fashioned them so that they shall act in accord." *Correspondence with Arnauld.* (Leibniz, 1989.a, 26)
[35] (Leibniz, 1989.c,134-135)

For Leibniz, therefore, this interaction cannot be reduced to an exchange of one force but is about the ability of the active body to exert as much force as possible to move the resistant body and for the resistant body to match such action. In the rebounding, both bodies are thought to be communicated with no transfer or flow of *something* into the other. Thus, in contrast to Newton's unified notion of force, Leibniz develops two forces to account for the inertial power or ability to resist, namely the passive force and the active force, which gives the body the power of persistence.

2. Kant's Early Philosophy of Simultaneity and Causation

In this chapter, we will examine Immanuel Kant's early writings prior to his critical period. The first section will only cover the period between Kant's *New Elucidation* (1755) and the *Inaugural Dissertation* (1770). During this period, Kant countenanced specific claims regarding the structure of space and time and simultaneous coexistence. These claims can be taken as a reflection of Kant's pursuit to articulate a coherent position on the problems of causation and the nature of space-time structure through his mediation between different interpretations. Regarding simultaneous coexistence, these different interpretations agree on the absolute nature of simultaneity and the possibility of conceiving the cosmological togetherness of substances in one world. However, the metaphysical explanations given for this togetherness in these accounts differ.

The disagreement lies in the relation of time to the causal powers of substances and the role of the Principle of Sufficient Reason in determining space-time relations. Objections were raised against Leibniz's theories of pre-established harmony and individual substance. Some of these objections were articulated by pietist philosophers and those who adhered to the views of the experimental philosophy of the Newtonian program. On the other hand, Christian Wolff pursued the rationalist program of Leibniz, and the reception of Leibniz's view was shaped to some extent by Wolff's reconstruction of this program. In his early philosophical career, Kant appropriated some tenets of the philosophical tradition of his time to present a unique perspective on the role of the Principle of Sufficient Reason and its limits, the unity of the world, the causal powers of substances, and the space-time structure.

2.1 *New Elucidation* 1755

Kant's *New Elucidation* examines the role of the Principle of Sufficient Reason in metaphysical cognition. In its first part, this work aims precisely at examining possibility of deriving a supreme principle of thought, contrasting it with Wolff's derivation of the Principle of Sufficient Reason from the principle of contradiction. Wolff's attempt to derive this principle of reason from the law of contradiction was met with criticisms from the pietist philosopher Christian Crusius. Kant sets the task of demonstrating the limits of Wolff's rationalist project while addressing Crusius's criticisms of pursuing complete rational determination. The objective of Kant's work is to modify some elements of the rationalist project to answer the pietist philosopher's objections. The relevance of this early work by Kant to the concept of simultaneity will become evident as it is later demonstrated how the principle of simultaneous coexistence supplements Kant's view of the rational determination of the space-time structure.

After Leibniz, Wolff sought to prove the Principle of Sufficient by deriving it from the principle of contradiction. The justification of the Principle of Sufficient Reason was not one of Leibniz's major concerns, and sometimes he found it justifiable by experience. However, in some of Leibniz's writings, there were attempts to demonstrate the connection between the Principle of Sufficient Reason and his theory of truth, which is expressed in his conceptual containment theory.[36] Wolff finds Leibniz's reliance on experience to justify this principle insufficient, and it becomes necessary for him to base this principle on a firmer ground (*DM*, §30).[37] Regarding philosophical method, Wolff argues that a proper philosophical method must

[36] Whether Wolff was aware of Leibniz's justification of the Principle of Sufficient Reason, it requires more examination. For more on Leibniz's justification and Wolff's access to Leibniz's text, (B.C Look, 2011)
[37] Wolff refers to Clarke's questioning of Leibniz's justification of the PSR as an indication of Leibniz's negligence of this problem. This, however, does not deny the role of experience in Wolff's philosophy. Unlike classical rationalism, Wolff finds "interdependence" between rational cognition and the deliverances of experience. For more

imitate the mathematical method of constructing concepts and that the rules of philosophical method should not differ from those mathematical demonstrations. For Wolff, the principle of contradiction is the guiding rule for conceiving the possibility of existents, and in order to conceive of the possibility of something existent, it must be free of contradiction (*DM*, §12). However, Wolff affirms that such an absence of contradiction does not entail the existence of things because, in addition to possibility, actuality is required to establish the existence of things (*DM*, §13-14).

Wolff's proof of the Principle of Sufficient Reason proceeds as follows: Since it becomes clear that the principle of contradiction is the principle through which we necessarily affirm or deny the possibility of things, we can define nothing as that which contains a contradiction. From this inference, Wolff continues to claim that something cannot come to be from nothing, as it would also violate the principle of contradiction by allowing the impossible to become possible (*DM*, §28). Building on these claims, Wolff further applies them to demonstrate that the Principle of Sufficient Reason follows from the rule that something cannot come from nothing, and equally to establish that everything must be grounded on positive ground. Otherwise, it would run contrary to the previous implication of the principle of contradiction, which entails that things cannot come from nothing. Hence, for something to be, it must be grounded on a *reason* for it to be; otherwise, it would be grounded on nothing, violating the principle of contradiction. Wolff defines the Principle of Sufficient Reason as follows:

> Were it the case the something could be, or take place, in a thing without a reason why it should occur being met with either in that thing itself or something else, then it would come to be from nothing. Since, however, it is impossible that something could come to be from nothing, *everything that is must have a sufficient*

on Wolff's conception of the role of experience, Dyck (2014, 20-27) explores how Wolff understood the role of experience in his philosophical system.

> *reason why it is*. We will call this proposition the *principle of sufficient reason*.' (*DM,* §30)

As presented, this proof seems to lack clarity regarding Wolff's use of the concept of nothing, which is defined through the logical principle of contradiction. However, Wolff makes it clear that this principle can be extended to include the possible existence or non-existence of things. Nevertheless, this prompted criticism of the proof and Wolff's rational ontology.

Crusius finds the rationalist Principle of Sufficient Reason to be unrestricted in its application and argues for setting limits to this principle. Crusius' guiding thought here is the distinction between logical grounds and real grounds; the latter is about the possibility of something taken in its real possibility rather than its logical possibility. He argues that this principle must be labelled as a "principle of determining reason" rather than sufficient reason, because "to determine means to suppose only way of existing when it comes to know how a thing either is or can be under the posited circumstances" (*DPS,* §III). This qualification is necessary as it clarifies Crusius' approach to the Principle of Sufficient Reason. Such a distinction would allow for including the posited circumstances in the description of free actions that produce certain effects without being determined through the unrestricted Principle of Sufficient Reason. In making the distinction between real grounds and conceptual or ideal grounds, Crusius wants to argue that the concept of reason, as the rationalists used it, was not clear enough to show the difference between grounds of cognition and knowledge and grounds of being or efficient causation. Wolff's derivation of the Principle of Sufficient Reason from the principle of contradiction is an example of this confusion of the logical sphere with the real grounds. Making this distinction shows that causation involves a real relation between cause and effect, and the principle of contradiction as a logical principle, therefore, cannot infer this causal relation from the analysis of a logical relation because it is conceivable to consider the concept of the cause without leading into a certain effect. This

possibility as such would not violate the principle of contradiction. According to Crusius, we are not asking about the arrangement of concepts but about how these concepts stand with respect to things (*DPS,* §XIV).

For Crusius, Wolff's demonstration of the Principle of Sufficient Reason trades on confusion between the different uses of the notion of nothing. It also begs the question by assuming that nothing comes to be from nothing (*DPS,* §XI). Pointing out these defects in Wolff's demonstration is not intended to undermine our faith in the usefulness of the Principle of Sufficient Reason, according to Crusius. However, with careful reinterpretation of its content, this principle can be used with certain constraints. In this sense, the Principle of Sufficient Reason is reinterpreted as a "principle of sufficient cause," whereby it asserts that "whatever begins to exist comes to be from another being that had the faculty sufficient for its production and which was set into action and was not impeded" (*DPS,* §XX). The principle of sufficient cause provides a reinterpretation of the rationalist Principle of Sufficient Reason without being committed to its logical overdetermination with respect to existence, since this version, as defended by Crusius, gives space for a voluntarist conception of action or the principle of indifference. Due to Clarke's influence, Crusius finds the extreme rationalist principle of reason to threaten the freedom ascribed to divine actions.

In the *New Elucidation,* Kant discusses these two positions on the justification and limits of the Principle of Sufficient Reason. He praises Crusius for his criticism of Wolff's justification of the principle. However, Kant charts his own way of tackling this problem. He begins by asserting that no unique principle encompasses all truths, as this principle is supposed to subsume all propositions under its general content. Kant finds that articulating one universal proposition is not possible because such a universal proposition must be either affirmative or negative. If

affirmative, it would not be able to subsume negative propositions, and vice versa for a negative proposition in relation to the affirmative propositions (1:388). Kant argues that the principle of identity is the absolute first principle, but it is composed of two parts: one asserts the truth of the affirmative *whatever is, is*, and the other is negative truth, *whatever is not, not* (1:389). Kant uses a simple predication to illustrate the role of identity between the concepts of subject and predicate in a true proposition. Here, Kant argues that the principle of identity takes precedence over the principle of contradiction (1:390), because contradiction cannot be used to determine the truth of a proposition unless it is posited in conjunction with another maxim, which asserts that everything of which the opposite is false, it is true (1:391). Kant posits that the principle of contradiction presupposes the two components of the identity principle in the hierarchy of truths.

Next, Kant turns to examining the Principle of Sufficient Reason, and in this part of the *New Elucidation*, he intends to clarify its content with respect to the logical principle of contradiction. On the nature of the Principle of Sufficient Reason, Kant gives the following definition:

> That which determines a subject in respect of any of its predicates, is called the *ground. Grounds* may be differentiated into those which are antecedently determining and those which are consequentially determining. An *antecedently* determining ground is one, the concept of which precedes that which is determined. That is to say, an antecedently determining ground is one, in the absence of which that is which is determined would not be intelligible. A *consequentially* determining ground is one which would not be posited unless the concept of which is determined by it had not already been posited from some other source. You can also call the former the reason why, or the ground of being or becoming, while the latter can be called the ground that, or the ground of knowing. (1:392)

In this definition, Kant emphasizes the idea of ground in relation to predication. An act of predication must bring the subject into determinacy and intelligibility through a ground that connects or links the subject to the predicate, excluding other predicates. Kant, following Crusius, recognizes the distinction between grounds of becoming and grounds of knowing, which

rationalists like Wolff ignored. According to Kant, both of these grounds fall under the analysis of determining reason, as each has a different role in bringing determinacy either into becoming or knowledge. In the case of becoming, the antecedently determining reason is presupposed in the determination of connecting the subject with the predicate. In contrast, a consequently determining reason indicates that the truth of a proposition is grounded on a prior determination, and that the proposition, therefore, *follows* from these prior determinations. Kant gives an example of consequently determining reason: recognizing the truth of the proposition that light is propagated successively with a determinate velocity. This proposition is recognized through prior determinations and relations obtained between Jupiter and its satellites and the occurrence of eclipses grounds the consideration of the velocity of light as true (1:392).

Kant later expands on the implication of this principle of determining reason to demonstrate that this principle makes it impossible for something to be true without a ground. Since it is necessary for every positing of a predicate to exclude its opposites in the subject, this exclusion of opposite predicates must be based on the principle of contradiction (1:393). Kant infers that a true proposition is to be determined by the truth that is contained in the concept, which excludes opposite predicates, and that this truth is grounded on a determining reason. This line of argument by Kant is intended to explain that the principle of determining reason is equivalent to the principle of contradiction because the exclusion of conceptually incompatible predicates through the contradiction obtained between the possible predicates is also grounded in reason. This equivalence between the principle of determining reason and the principle of contradiction is significant in so far as it shows that a derivation of one principle from another is unwarranted, and consequently, Wolff's demonstration to derive one principle from another seems to ignore this equivalence.

The idea that every true proposition is grounded in reason through the exclusion of its opposite predicates must be examined in relation to things that exist contingently. Those who argue that this rule of determination through reason is not applicable to existence ignore the fact that existence itself is determined. It is claimed that the existence of a thing includes a determination of the thing without the use of the principle of determining reason. However, this claim still refers to the concept of existence, which implies the exclusion of its opposite (non-existence), and is therefore determined. So, if it is the case that existence can contain the ground of its existence by excluding its opposite, then the non-existence of a contingent thing cannot be thought of, and this would convert contingent existence into necessary existence, which would be a contradiction. Therefore, contingent existence must be determined by an antecedently determining reason (1:396). Kant utilizes this argument to undermine Crusius' claim that the Principle of Sufficient Reason cannot be proven. Crusius argues that free actions are not determined by antecedently determining reason, but rather their mere actuality is sufficient for determination because the actuality of free actions can exclude the opposite of their determinations without being determined by a prior reason. Kant does not agree that the actuality of free action excludes the opposite of its existence and lacks determination by reason. He argues:

> The act of free will exists, and this existence excludes the opposite of this determination. But since at one time it did not exist, and since its existence itself does not itself determine whether or not it existed at some earlier time, it follows that the existence of this volition leaves the question whether it already existed beforehand or not indeterminate. (1:397)

For this reason, the mere existence of an action cannot alone bring about the determinacy for an action unless an antecedently determining reason is posited. Therefore, freely determined actions

also require reason, and their mere actuality does not show the limits of the Principle of Sufficient Reason.

Kant's formulation of the debate surrounding the justification and the limits of the Principle of Sufficient Reason is significant in showing his early engagement with the pietists and the rationalists. It is clear that he agrees with the rationalists on the necessary use of the principle of determining reason, but as will be later shown, he maintains that, with respect to the succession or time-relations, the possibility of rational determination of succession and time must be accounted for through the incorporation of the causal activity of substances in a dynamical whole of substances. He contends that the application of the internal principle of determining reason, as it pertains to the grounds of existence, cannot alone account for the causal activity of substances; the causal activity must not be reduced to the mere existence of substances. Rather, suppose we want to consider the possibility of changes in substances. In that case, it is necessary to assume that substances are causally "open" to each other and that there must be an interactive form of causality between substances to provide a rational determination of the possibility of change or succession in substances.

Kant introduces two principles in the last part of *New Elucidation*. These two principles are the principle of succession and the principle of coexistence. I will be discussing these two principles here. Since Kant retained these two principles in his critical period, it is important to examine how these two causal principles were first introduced in his early writings. The role of simultaneous coexistence in Kant's theory of causation and time determination will become apparent as the discussion of this second part of the *New Elucidation* progresses.

The principle of succession states: "No changes can happen to substances except in so far as they are connected with other substances; their reciprocal dependency on each other determines

their reciprocal changes of states" (1:410). The succession of states of a substance depends on its interaction with other substances. A substance cannot bring change to its states from within; it rather needs the presence of different substances acting on it. This principle is directed against certain formulations of the doctrine of pre-established harmony, which posits an ideal form of interaction between substances without real or causal interaction. The pre-established harmony between substances assumes that a substance can bring out its successive states without being in causal relation with the rest of the substances in the world. In this part of the *New Elucidation*, Kant not only posits this principle of succession, but he also presents different arguments to the effect that succession or time itself depends on this interactive causal relation between substances. For the causal isolation of a substances deprives them of change, whether this change is external in relation to other substances or an internal change in the substance.

The first argument aims to demonstrate that the mere existence of a substance cannot, by itself, bring these determinations to a substance. Existence, as demonstrated before by Kant, involves the exclusion of its opposite and is based on a rational determination by the antecedently determining ground. This internal ground of contingent existence demands that contrary or incompatible states be excluded from the substances, so the possibility of change cannot be founded on this internal ground. There must be an external ground to bring about change in substances. This shows that inner grounds cannot play a role in the successive states of substances; their role is limited to being responsive or receptive to external actions by other substances.[38] Kant goes further to argue that these inner grounds of substances are simultaneous

[38] Kant explains this idea as follows: "Suppose that some simple substance, the connection of which with other substances had been cancelled, were to exist insolation. I maintain that it could undergo no change of its inner state. The inner determinations, which already belong to the substance, are posited in virtue of inner grounds which exclude the opposite. Accordingly, if you want another determination to follow, you must also posit another ground. But since the opposite of this ground is internal to the substance, and since, in virtue of what we have presupposed,

with whatever is posited or determined by these determining grounds. There is no temporal gap between them, as these grounds must necessarily bring their own determinations with them simultaneously. Nevertheless, Kant contends that the idea of change implies the temporal succession of determinations and that the temporal succession is constitutive of change. Therefore, the inner determining grounds are not able to bring about changes of states in substances (1:411). This indicates that the logical and metaphysical principles governing the internal structure of substances are not sufficient to explain the possibility of successive determinations of substances, but the presence of other substances in a causal connection with each other can explain the successive change of states within the substance. It is not that a substance cannot exist alone, but this causal isolation cannot bring determinacy into the temporal position of the states of a substance in the world or allow it to be predicated of a temporal relation.

The principle of succession allows for the recognition of the dependency of substances on each other as the ground for ascribing temporal determinations to substances. Logical principles, such as the principle of contradiction,[39] are not capable alone of grounding the temporal succession of substances without the inclusion of external grounds. This is clearly spelled out in Kant's rejection of inner grounds as the basis for having incompatible states in substances. Supposing inner grounds as the basis for successive and incompatible determinations implies that these inner principles ought to be changing as well, and this would amount to a contradiction.[40]

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no external ground is added to it, it is patently obvious that the new determination cannot be introduced into being." (1:410/411)

[39] This principle is implicit in the antecedently determining ground

[40] He elaborates on this idea:

"Suppose that a change takes place under the conditions specified. Since it begins to exist when it was not present previously, that is to say, when the substance was determined to the opposite, and since no grounds, apart from those which are internal, are supposed to be involved in determining the substance from any other source, it follows that

Kant's idea of renouncing inner grounds as the basis of change runs in opposition to the rationalist metaphysics of Wolff, who intended to explain this relational and mutual dependency between substances through the metaphysical principles derived from logical grounds. For Wolff, an internal principle of active force explains the motion and causal power of substances, and external determinations must be grounded on this internal force.

The argument presented by Kant in the *New Elucidation*, which intends to undermine the idea of the causal isolation of substances, also shows that time and succession must be determined by causal and interactive relations between substances. Therefore, the way of explaining the succession cannot be dependent on internal active forces alone. Kant shares with Wolff and Leibniz the idea of the rational determination of time and succession through the Principle of Sufficient Reason; however, he maintains there are limits to their rationalist project. These limits are evident in their failure to account for the causal activity of substances by explaining the successive changes of a substance through internal force, where substances are thought, according to Leibniz, to be able to determine themselves without causal interaction with other substances. On the contrary, Kant argues that the rational determination of time and succession demands that substances be causally open to each other.

A challenge is presented against Kant's argument for the principle of succession, which is how a change of inner grounds can be accounted for by the change of external relation with other substances. Kant's principle of succession asserts that inner grounds cannot explain the change within substances; instead, the successive determinations of substances are to be explained by the change in their external relations with other substances. Thus, inner grounds are only responsive

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the same grounds, by which the substance is supposed to be determined in a certain way, will determine it to the opposite and that is absurd." (1:411)

to these changes in external relations. However, do these noncausal relations, such as distance, have a role to play in Kant's account of causation? In expounding on the nature of succession, Kant points out that a mere connection is not sufficient; a change of relations between substances must be included:

> …even were this simple substance to be included in a connection with other substances, if this relation did not change, no change could occur in it, not even a change of its inner state. Thus, in a world which was free from all motions (for motion is the appearance of a changed connection), nothing at all in the nature of succession would be found even in the inner states of substances. (1:410).

For Kant, concerning the presence of multiple substances, the connection contains different relations, which could possibly be included in describing the nature of this connection and in causing change within substances. In this construal, Kant's early commitment to a rationalist metaphysics of inner grounds might pose a challenge, yet the admission of the inner grounds of substances in *New Elucidation* is intended to accommodate the relational nature of causal action that Kant seeks to incorporate in his early metaphysics while accepting the rationalist demand for positing inner grounds. The challenge presented to us is about the possible change of inner grounds in response to external action by other substances. This challenge aims to explicate the true nature of the causal openness between substances that Kant might have envisioned in the early stages of his philosophical development, and the limits of this early project.

One possible response to this challenge is provided by Eric Watkins, who argues that inner grounds are involved in causal interaction through the activation of different inner grounds in substances depending on the situation of the causal interaction. For example, when a moving body causes a motion in a second body, the latter body resists the action of the first body. This causal interaction would involve the activation of different inner grounds in both bodies, with the first body being active and the second being passive. This also leads to Watkins' suggestion that

Kant can avoid circularity in his account of change by admitting that contingent and mutable features are involved in this causal interaction, such as the spatial relation between substances. Such relations are supposedly noncausal and do not require the positing of changes in the inner grounds in order to explain them. Thus, by admitting these mutable and contingent features in the relation between substances, Kant avoids the Leibnizian and Wolffian attempt to deny these contingent relations.[41]

Watkins is correct in pointing out certain aspects of Kant's account of causal interaction. However, his explanation does not sufficiently clarify how these contingent and mutable features can play a determinate role in causal interaction. While it is true that certain features are involved in causal interaction, in order for them to appear as *reasons* that lead to changes of the inner grounds of substances, these features must be characterized differently than as contingent or accidental. Relational aspects, such as relative spatial positions, are consequences of the causal connections between substances as well. A spatial position is determined by a dynamical and causal relation between substances, and the contingency of the spatial relations between substances referred to by Watkins is a result of possible spatial combinations of substances that God might bring about without being constrained by the internal principles of substances. This idea of possible combinations of different worlds is discussed by Kant in his argument for the principle of coexistence. The mere existence of a substance cannot determine its spatial position, as a spatial position cannot be derived from the internal grounds of a substance. The ground of this spatial position must refer to other substances in the dynamical whole and the position of other substances relative to one substance. Therefore, the rational determination of successive states of a substance and its temporal location are defined relative to other substances in the

[41] (Watkins, 2005, 131-134)

world. These spatial and temporal relations between substances involve an interactive form of causal relation.

It is true that these are contingent relations, yet they are ordained by divine understanding; there is an intelligible ground for them in divine understanding. The point that Kant wants to emphasize is that these dynamical relations are not consequences of the existence of substances and their internal grounds, which involve logical principles such as the principle of contradiction. This brings us to Kant's second causal principle, namely, the principle of coexistence.

The principle of coexistence in the *New Elucidation* states that substances are in a state of reciprocal harmony, provided that divine understanding can bring them into this reciprocal relation. Substances do not stand in relation to each other by virtue of their existence alone, but an intelligible ground must bring about this external relation with other substances:

> Finite substances do not, in virtue of their existence alone, stand in a relationship with each other, nor are they linked together by any interaction at all, except in so far as the common principle of their existence, namely the divine understanding, maintains them in a state of harmony in their reciprocal relations. (1:413)

Kant's argument aims to establish that the relation between substances must be anchored in a principle other than the inner rational grounds that determine the existence of substances. Since the existence of substances does not include any relations with other substances, the possible causal interaction with other substances is also not included in it. According to Kant, this relation with other substances must depend on a "communality of cause," which is God. The divine act of establishing the existence of substances is conceptually distinct from the act of bringing these substances together into one world. So, "the self-same scheme of divine understanding" which is

the reason for the existence of substances, is also the divine scheme for connecting these substances in one dynamical whole by establishing their reciprocal relations.[42]

The ground of this connection between substances, therefore, stems from an intelligible basis, which is the dependence on God. For this reason, Kant argues that the act of establishing the existence of substances is not sufficient for connecting them. Space is constituted by the dynamical relations and reciprocal action between substances. The external connections between substances, which provide the basis for the concept of space, are sanctioned by God in accordance with his choice; such space is merely a schema of a representation conceived in terms of relations in the divine intellect. In this case, space is not constituted by the mere existence of substances, it is a matter of God's ability to conceive of the possible relations of substances. God can conceive possible configurations of substances in different worlds without being constrained by the logical principles underlying the existence of these substances.[43] The possible configurations of spatial relations between substances are brought by the action and reaction between substances. For Kant, the external appearance of this action-reaction is Newtonian attraction, which he characterizes this way:

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[42] This is clarified by Kant as follows:
"But it does not follow from the fact that God simply established the existence of things that there is also a reciprocal relation between those things, unless the self-same scheme of divine understanding, which gives existence, also established the relations of things to each other, by conceiving their existences as correlated with each other." (1:413)

[43] In this important passage, Kant explains the relation between spatial relations and reciprocal determinations, which is sanctioned by a divine intellect:
"Since place, position, and space are relations of substances, in virtue of which substances, by means of their reciprocal determinations, relate to other substances which are really distinct from themselves and are this way connected together in an external connection, and since, furthermore, our demonstration has shown that the mere existence of substances does not in itself involve connection with other substances, it is obvious that, if you posit a number of substances, you do not at the same time and as a result determine place, position, and space, this last being compounded of all these relations. But, since the reciprocal connection of substances requires that there should be, in the effective representation of divine intellect, a scheme conceived in terms of relations, and since this representation is entirely a matter of choice for God, and can therefore be admitted or omitted according to His pleasure, it follows that substances can exist in accordance with the law which specifies that *they are in no place* and that they stand in no relation at all in respect of the things of our universe." (1:414)

> If the external appearance of this universal action and reaction throughout the whole realm of the space in which bodies stand in relation to one another consists in their reciprocally drawing closer together, it is called attraction. Since it is brought about by co-presence alone, it reaches to all distances whatever, and is *Newtonian attraction* or universal gravity. It is, accordingly, probable that is attraction is brought about by the same connection of substances, by virtue of which they determine space. (1:415)

This passage is significant in demonstrating how Kant conceives the principle of universal action between substances, which is illustrated by a physical model. He proposes that Newtonian attraction is the model for this action, which determines space.

The reason behind this Kant's claim is to associate causal activity with the spatial and temporal connection between substances. In contrast to the rationalist tradition of his time, Kant wants to provide causal content to the mathematical structure of space and time by not reducing causal activity to a monadic form of interaction between isolated substances. According to Kant, Newtonian attraction plays a role in determining space by providing dynamical content to it, and the interaction of substances is modelled after this Newtonian attraction. It is important to note that Kant does not reject the principle of rational determination as applied to the inner principle of the existence of substances. However, he argues that this rational principle, involving the inner grounds, cannot be extended in its application to space and time since they involve a relational structure that assumes the presence of dynamical interaction between substances. As construed by rationalist metaphysics, the rational principle of determination is, therefore unable to account for the relations of space and time, for it fails to capture the relations between interacting substances.[44]

[44] Schonfeld (2000, 153-4) suggests that Kant, by accepting Newtonian gravity or action-at distance at face value and not associating it with the intrinsic properties of substances, can avoid the metaphysical problems that were

As a result, Kant posits that different configurations of substances are possible, and space and time are merely contained in the consequences of these dynamical relations between substances. Kant tends to locate causal activity outside the sphere of logical principles that require the principle of contradiction or antecedently determining reason. The causal content of space and time, for Kant, is only provided through the simultaneous coexistence of substances in one world. The principle of succession alone is not sufficient to capture the causal content of space and time; it must be coupled and paired with another principle of coexistence, a principle that asserts the simultaneity of different substances through the dynamical interaction that constitutes dynamical space.[45]

Kant claims that the unity of space-time is provided by this physical form of causal interaction, taking Newtonian attraction or universal gravity as the model for this causal interaction. The relational nature of Newton's theory of gravity, which involves the reciprocity of mutual action between interacting bodies, is significant in this regard. Kant wants to incorporate this form of causal interaction into the project of rational determination of time and space by taking Newtonian attraction as an example of a dynamical relation. Kant's approach to the rational determination of time and space through causal interactions does not necessarily follow the rationalist tradition of determining time—based on logical principles such as the principle of contradiction. Instead, it aims at exhibiting the causal content of mathematical time-space. By

brought by Newton's gravity. It also avoids accepting Euler's idea of a cosmic ether as the medium for gravitational interaction.

[45] Laywine (1993, 35) argues that the principle of succession in *New Elucidation* captures Newton's three laws of motion; (1) no body can cause itself to accelerate, (2) change must be a result of an action by another body, (3) a change is mutual. This is a correct characterization in so far as the principle of succession is taken in conjunction with the principle of coexistence, for this latter principle includes the plurality of substances, and it implies the relational determination of force to be constitutive of the construction of space-time dynamics, namely, the causal content of space-time. For without this dynamical content of space-time, the Newtonian space and time are empty. Thus, the metaphysical principles of succession and coexistence are the conditions for space and time.

demonstrating the causal content of the mathematical space-time, Kant can also mediate between the relationalist and absolutist positions on the nature of time and space. For absolutists like Newton and Clarke, mathematical time and space are an absolute structure and an emanative offshoot resulting from the absolute existence of God. However, since it is an absolute structure with no causal content, Newtonian conception of time and space was subjected to criticism by rationalists who argued that such an absolute structure of time violates the rational determination of reason.

Kant accepts such a line of reasoning presented by the rationalists against the Newtonian absolute theory of time and space but with certain reservations concerning the unlimited scope of the Principle of Sufficient Reason. In the *New Elucidation*, Kant demonstrated the limits of this principle when applied to the structure of space and time. He argues that reciprocal and mutual interaction as a form of causation can provide the causal content of space and time without invoking the unlimited scope of the Principle of Sufficient Reason. In this way, he is able to satisfy the rationalist demand for the rational determination of time and show that the causal content of time is achieved through causal interaction modelled on Newtonian attraction. In this respect, the principle of simultaneous coexistence helps to capture the reciprocity involved in the causal content of mathematical space-time. Thus, instead of conceiving this structure as lacking causal content, the simultaneity relation refers to the coexistence of different objects in one space-time, and Kant takes this fact about the nature of coexistence in mathematical space-time to be reflected in the dynamical relation between substances in the world. Since the principle of succession is not enough to capture the causal content of space-time, the principle of coexistence

is needed for this purpose, as it singles out a world where a real causal connection between substances is obtained.[46]

2.2 *Physical Monadology* 1756

In his other work during this period, *Physical Monadology*, Kant pursues a similar objective of analysing the relation between mutual causation and the structure of space and time. However, in this treatise, he poses the question regarding the infinite divisibility of space and whether the simplicity of substance is threatened by this geometrical divisibility. Similar to the *New Elucidation*, Kant mediates between the different philosophical schools of his time in answering this challenge. The metaphysical simplicity of substance or monad is considered incompatible with the infinite divisibility of mathematical space since such divisibility admits the existence of parts, which would undermine the supposed simplicity of substances. Kant suggests a compromise whereby the claims of metaphysics regarding the simplicity of substances can be reconciled with the geometrical nature of space. The proposal is to deny that physical monads, which are metaphysically simple, can fill space through extension or parts. Instead, these physical monads are able to fill space through a "sphere of activity" that determines space.

Force plays an important role in determining space, and since Kant rejects the idea of space as an imaginary or ideal entity abstracted from monadic interaction, he takes space to be an external appearance of the causal activity of physical monads. The "sphere of activity", as he calls it, fills

[46] In this way, Kant is able to defend the rational determination of space-time without being committed to the principle of the best, as presented by Leibniz in his defense of the Principle of Sufficient Reason. For Leibniz, God chooses the best, and he is prompted by his wisdom in choosing the best configurations of substances among different possible worlds. For the compossibility of substances is constrained by the logical compatibility of different substances, and God is therefore must select the world in which such harmony is possible. In his espousal of the principle of coexistence, Kant wants to argue that coexistence as such requires a real interaction, and the world is where such causal interaction occurs. Watkins (2005,148) also makes a similar suggestion, but he believes Kant here is addressing Crusius's conception of the world as being sufficiently connected by the mere existence of substances.

space through repulsive and attractive forces, and therefore, these forces are deduced from geometrical considerations concerning the nature of space. The causal content of geometrical space becomes explicit in this deduction of central forces. There is no doubt that in *Physical Monadology,* Kant is motivated by his desire of reconciling the claims of metaphysics with the mathematical nature of space. However, this project is possible by reconceiving causal interaction as determining space. In this case, Kant reaffirms the same arguments as in the *New Elucidation,* that the mere positing of substances does not entail filling space, but there must be an interaction between substances. Space is not dependent on the inner determinations of substances; space is determined by the external relations of substances. Reciprocal determination, which grounds space, allows for the possibility of filling space through causal interactions. "The monad therefore", Kant claims, "which is the fundamental element of a body, in so far as it fills space, certainly has a certain extensive quantity, namely, an orbit of activity" (1: 481 Prop. VI). The monad represents the center of this sphere of activity, from which the causal activity radiates (1: 481 Prop. VII).

The sphere of activity implies that causal activity underlies the spatial relations between substances. However, this causal content is manifested in the ability of bodies to resist penetration by other bodies, and they are impenetrable by virtue of exercising repulsive force. Nevertheless, this repulsive force is insufficient as long as volume is ascribed to bodies since bodies need to be limited by another force, which is the attractive force. In order for bodies to have a cohesive structure, attraction is a force that acts in opposition to the repulsive force, and through this balancing interaction, it determines the limit of the volume of the body (1:484 Prop. X). Therefore, Kant takes causal activity to be necessarily associated with monad as long as it fills a space. For the Newtonian idea of attraction here becomes attached to the monads because

it provides a balancing and opposite force to produce the cohesive structure of the body. A monad can fill space through causal activity, or its sphere of activity through these two forces. The two forces are also subject to the geometrical structure of space, as the intensity of the repulsive force diminishes with the increase in the spatial sphere where the effects of its action are manifested. The attractive force also follows a similar pattern by being subjected to the geometrical laws of space, where the attractive force decreases with respect to the inverse square of distances, but the repulsive force decreases according to the inverse cube of distances. Thus, the repulsive force decreases at a greater rate compared to the attractive force. However, there must be a point where both forces are equal to each other in order to provide bodies with impenetrability (1:485).

By ascribing causal activity to monads through the filling of space, Kant wants to demonstrate that causal and dynamical content must be associated with space and that central forces can indeed be deduced from the geometrical laws governing space. It is not that space is a substance, but rather the dynamical structure of space, which is determined by causal interaction between substances, entails that space being constituted by such causal activity. The idea of mutual causation from *New Elucidation* is operative in this account of space, and in the equal distribution of forces in the dynamical space. For Kant, attractive force must limit repulsive force in order to account for impenetrability; the ability of bodies to resist other bodies, and such ability is grounded in mutual and reciprocal interaction with other bodies. A dynamical interaction of this sort allows for conceding the independence of space from substances without denying its reality.[47]

[47] Schonfeld (2000,167) makes a similar suggestion by denying that Kant wants by accepting a relational determination of space to embrace the Leibnizian notion of ideal relative space. For Kant, as it is made clear in the

Admitting attractive force to act instantaneously across space is to employ Kant's second causal principle of coexistence in the *New Elucidation,* where the idea of connecting substances through reciprocal causation is required. The idea behind reciprocal causation is that a relational determination of space guarantees the simultaneous coexistence of substances in the world. In *Physical Monadology*, this relational determination of space is used to account for the ultimate constituents of physical bodies without resorting to the monadic determinations of substances. The sphere of activity determines the spatial volume and the extensive magnitude of the body, and the causal activity underwrites these physical and outer facts about the body. In this sense, Kant brings forth Newtonian attraction as the model for determining the dynamical content of space, and he accepts that such attraction can underwrite the relational properties of monads, which are taken to be the physical seats of causal action.

2.3 *New Doctrine of Motion and Rest* 1758

In Kant's *New Doctrine of Motion and Rest*, he examines the kinematical concept of motion and the concept of inertial force. Kant suggests a new definition of motion that is neither dependent on Newton's absolute motion nor the relationalist doctrine of true motion. As shown before, Newton defines motion as motion in absolute space, and the relationalists consider true motion to be a relative motion or motion with respect to other surrounding bodies. For Kant, such attempts to characterize motion ultimately fail because it is well understood that motion and rest are relative concepts that are interchangeable. He suggests that in order to escape indeterminacy in the ascription of true motion, we need instead to consider a mutual action between two moving bodies.

New Elucidation, these dynamical relations, which constitute space, are not associated with the inner properties of substance; but dependent on a divine schema that sustains them.

Concerning absolute motion, it is impossible to distinguish the parts of absolute space that are not occupied by bodies. For this reason, the idea of absolute space does not serve the purpose of empirically discerning true motion. To clarify this claim, true motion must be predicated of the motion of a body relative to other bodies. However, this relativity of motion does not render this predication of one body as moving a true predication since the state of surrounding bodies, which were taken to be at rest, may possibly be moving. Kant asserts that establishing absolute rest is difficult and that whenever we extend our frame beyond what is moving to find a "rest frame", these continuous amendments cannot be empirically adequate, as it is still permissible to ascribe motion to these supposed rest-frames. Referring to James Bradley's findings that the entire system is moving in relation to the fixed stars, Kant claims that it is impossible to determine whether a spatial frame is moving or at rest and, thus, to know its velocity. Therefore, Kant makes the following claim:

> Now I begin to realize that something is lacking in the expression 'motion and rest'. I ought never to use it an absolute sense but always relatively. I ought never to say: a body is at rest, without adding in relation to which things it is at rest, and I should never say that it is moving without at the same time naming the objects with respect to which it is changing its relation. (2:17).

Kant adds a constraint to this definition of the relativity of motion and rest. The motion of one body towards another must involve a reciprocal determination of the two bodies together. For example, a moving body A moves towards body B, which is considered at rest relative to its surrounding bodies. In order to attain a correct characterization of this interaction, B must not be considered in relation to other external objects; rather, its state must be re-described as moving towards A in its sphere. The sphere of B must be equally taken to be moving with respect to A. Kant arrives at this description of his doctrine of motion:

> It will be acknowledged that, if we are talking about the effect both bodies have on one another when they collide, the relation to other external objects is irrelevant. (2:18).

Kant's relational description of motion involves the equal distribution of one motion between two bodies. The mistake of both the absolutists and the relationalists is to ascribe motion to one body rather than ascribe it to both bodies moving toward each other. True motion, in this sense, contains a privileged view of where this reciprocal interaction is taking place. So, when body B is considered in relation to the surrounding bodies, it can be taken to be at rest relative to them, but Kant insists that, in this case, B is in true motion relative to A *prior* to the moment of collision with A. This privileged perspective contains the equal distribution of motion between the two interacting bodies. The mutual determination of both moving bodies entails that the symmetrical distribution of motion is justified because it is not possible to ascribe rest or motion to one body over another. Rather, motion, taken as a mathematical magnitude and dynamical interaction, is ascribed to both bodies. After defining true motion, Kant provides a statement of two laws of motion:

> (1) Any body, with respect to which another body is moving is itself moving with respect to the other body, and so it is not possible for a body to collide with another that is at absolute rest.
> (2) In the collision of bodies, action and reaction are always equal (2:19)

The first law is implicit in his account of true motion, whereby relativity of motion is extended to a pair of bodies rather than one body. Since it is impossible for the equal distribution of motion to occur when one body is at absolute rest, the equality of action-reaction consequently follows, as this causal interaction or collision requires a mutual and equal effect on each body. Kant then uses this account of motion, along with the two laws of motion, to correct some misconceptions about impact and collision that were present in his time. It has been shown previously that despite the differences between them, Newton and the followers of Leibniz ascribed to the body

a natural force that resists the motion of other bodies moving towards it. For Newton, it was the force of inertia, and for the followers of Leibniz, it was the interplay of active and passive forces. Both accounts considered that a body must possess a natural and internal force that explains its persistence. Given Kant's account of true motion, he finds such internal or inherent force ascribed to bodies incoherent.

On Kant's first law of motion, the motion of one body is encountered by the motion of another moving toward it, and the latter body is not assumed to be at absolute rest. There is no need to posit such a natural force, as it does not play any role in this account of impact since the relational description of motion only captures the interaction of two bodies and does not seek to ascribe true motion only to a single body. Hence, this inertial force assumed to be inherent in the body is not required. However, Kant develops two arguments to show that such a natural force is incoherent. The first argument states that assuming such internal force, when a body is at rest, these forces must be in equilibrium with one another. But when another body is moving toward it, and the body at rest is supposed to resist this moving body, it must shift its state of equilibrium to offer resistance. According to Kant, if its internal forces were thought to be in a state of equilibrium, then "it would have nothing with which to offer resistance" (2:21). The second argument is that during impact, where the supposed sudden change occurs, there is an equal cancellation of the effect between the two bodies, and a passive body does not gain any new momentum as a result. The body must regain its state of equilibrium immediately after impact since this inertial force is considered a natural force in the bodies, and "the body acted on would have to be at rest again immediately after the impact" (2:21).

Kant's arguments to deny the existence of an internal force that explains the motion of bodies contradict the Leibnizian and Wolffian tradition, which posits this internal force as a ground to

explain the natural motion of bodies. This is also the case with Newton's force of inertia, which is assumed to be the reason for the body's natural tendency to act and resist. The argument advanced by Kant here against the concept of internal force is also directed against his earlier commitment to such internal principle in his explanation of the causal activity of substance. Despite Kant's insistence on locating the causal activity of substances in the relational framework of coexisting substances in his earlier works, such as *New Elucidation* and *Physical Monadology*, in these earlier works, Kant still refers to the internal principle as relevant to explain the monadic simplicity of substance. However, in this treatise on motion, Kant drops any reference to the internal principle of bodies to explain the causal activity of substances or their metaphysical simplicity.

However, the concept of mutual action still retains its significance in Kant's theory of causation. Mutual and reciprocal action requires that a causal action be analysed as reciprocal action between two active substances and that causal isolation of substance is not possible. Mutual causation allows Kant to define motion without relying on an internal principle within the body, and it also allows for dispensing with any absolute conception of space or time. The principle of simultaneous coexistence, which is implicit in mutual interaction, is able to capture the causal content of space-time without postulating an absolute structure of time and space. The problem with Newton's absolute time is that it is not empirically determinate because its causal content is only realizable in the absolute conception of an inertial and uniform motion of bodies. However, this internal force of bodies does not sufficiently explain the simultaneous coexistence of substances or the community of substances.

Kant's aim is to argue that the causal powers of substances are only possible within a community of substances. For this reason, Kant reinterprets the inertial motion of bodies to

include the mutual interaction of two bodies and the symmetrical distribution of one motion between them. Therefore, the dynamical and the causal content of the mathematical structure of time-space becomes fully realizable in this scenario of mutual interaction, according to Kant. Based on this definition of true motion, it requires the participation of other bodies in the description of true motion, and isolated bodies do not possess causal powers. Additionally, the principle of simultaneous coexistence reflects the mathematical principle of relativity in the classical structure of space-time, referring to the possibility of instantaneous causal links between different bodies in space. Mutual interaction captures this fact regarding the simultaneous coexistence of bodies in one dynamical space. The demand for fully determining time, which Kant shares with the rationalists, is possible through mutual interaction, and it captures the essential features of time without the postulation of internal force or monadic action within bodies.

2.4 *An Attempt to Introduce the Concept of Negative Magnitude into Philosophy* 1763

Kant's critique of rationalist metaphysics continues in *An Attempt to Introduce the Concept of Negative Magnitude into Philosophy*. In this essay, he examines the concept of negative magnitude in relation to its applications in different areas in philosophy. The usefulness of this concept becomes evident when constructing physical concepts relevant to causation and motion. Kant introduces this concept through the contrast he draws between logical opposition and real opposition. Logical opposition is defined by the logical relations between contradictory predicates that are ascribed to the subject. The logical opposition is when the consequence of combining the two predicates is nothing. In this logical opposition, the logical law of contradiction is used to indicate the opposition or incompatibility of the two predicates, and it refers to a conceptual and logical incompatibility that is asserted in this logical opposition. For

instance, when it is asserted that a body is in a state of motion and simultaneously asserted that it is also not in motion, the combination of these two predicates produces nothing, for it is not indicating or referring to something positive. Kant argues that the co-presence of these two predicates in one subject, according to the logical opposition model, produces nothing.

On the other hand, real opposition refers to a situation where the two asserted predicates are not incompatible through the logical law of contradiction, but the opposition is real rather than logical or conceptual. The difference in this model of real opposition is that bringing these two predicates together in one subject does not produce nothing, but rather the consequences are positive or something cognizable. Kant illustrates this model of opposition in the motive force of a body:

> The motive force of a body in one direction and an equal tendency of the same body in the opposite direction do not contradict each other; as predicates, they are simultaneously possible in one body. The consequence of such an opposition is rest, which is *something*. It is nonetheless, a true opposition. (2:171) [Emphasis added]

Thus, the ascription of these two predicates to the same body does not amount to a logical contradiction; rather, it constitutes a real opposition with positive consequences. Kant points out that such content in real opposition is possible without the use of the conceptually analytic content. In real opposition, the positive result arises from the cancellation of the consequences or effects of each predicate. In logical opposition, one predicate negates the other, with one being affirmative and the other negative. However, this is not the case with real opposition or real repugnancy. In this form of opposition, both predicates have positive grounds. When one predicate is posited, the other is not negated, but rather the consequences of both predicates are equally cancelled out.

In this context, Kant introduces the concept of negative magnitude through the idea of real opposition. A negative magnitude is a relative concept that requires reciprocal relation with another magnitude that is posited in relation to it. Negative magnitude involves real opposition between two positive predicates where both affirm something about the same subject. This depends on the combination of these magnitudes. Kant provides the following example: The distance a sailing ship takes from one direction can be measured either in its direction to the east or the west. The distance it traverses can be calculated through the addition of these magnitudes, which are posited as negative or positive, depending on the relative position of the ship. However, the addition of these mathematical (and physical) quantities does not involve the negation of negative magnitudes; these negative magnitudes ultimately refer to positive grounds as well. He explains this as follows:

> This is the origin of the mathematical concept of negative magnitudes. A magnitude is, relative to another magnitude, negative, in so far as it can only be combined with it by means of opposition; in other words, it can only be combined with it so that the one magnitude cancels as much in the other as is equal to itself. Now this, of course, is a reciprocal relation, and magnitudes which are opposed to each other in this way reciprocally cancel an equal amount in each other' (2:174).

The point of this clarification is to demonstrate that the term "negative" in this context does not indicate a negation but rather is grounded on a positive basis. This is because the combination of magnitudes depends on the reciprocal determination between them.[48] As explained before, negative magnitudes require real opposition, and as reciprocal magnitudes require positive grounds. The combination of the two predicates occasions the reciprocal cancellation of the consequences. It is not that these two predicates negate each other when considered separately, but rather that their combination in one subject produces real opposition. Kant posits a

[48] This idea of reciprocal determination between forces promotes the idea of the relativization of forces, and is directed against the absolute conception of force, whether in Leibniz or Newton.

fundamental rule for conceiving of this model of opposition, which is that a real repugnancy occurs when the two things, as positive grounds, cancel each other's consequences. He again employs motive force as an example of such a real positive ground. According to Kant, in order to think that this force can be in real opposition, there must be another motive force connected with it that can reciprocally affect it (2: 176). This opposition must occur in one subject. For this reason, Kant maintains that these motive forces, when taken separately or taken by themselves, are positive, but when brought together into one subject, the consequence is zero.

Kant explains impenetrability through this concept of negative magnitude. For impenetrability can be construed as a true motive force, similar to other forces of nature. It is by virtue of its impenetrability that a body can resist the motive force of another body moving towards it, and by virtue of this force, it also occupies space. For instance, since an attractive force can be regarded as the causal power of setting a body in motion or constraining other bodies, Kant considers impenetrability to be a *negative* attraction. The point of this characterization is to demonstrate, using the concept of negative magnitude, that impenetrability, which is thought to be a repulsive force, is also a motive force and a positive ground for cancelling the effects of another motive force (2:180). These two forces of attraction and repulsion are, therefore, positive grounds that can determine and limit space.

Kant extends the use of negative magnitude to explicate two types of opposition that he believes involve the idea of real repugnancy. A real opposition occurs when two moving bodies collide in space, resulting in the equal and reciprocal cancellation of their effects. But, according to Kant, there is also potential opposition, in which the two moving bodies are not yet in a collision or are moving in the opposite direction in a straight line. In this potential opposition, no communication of force can take place, and the two bodies "stand in potential opposition"

(2:193-4). Kant uses this distinction between actual and potential opposition to illustrate a principle he proposes to explain the physical change. This principle states that "In all natural changes which occur in the world, the sum of that which is positive is neither increased nor diminished, provided that the sum is calculated by adding together positings which agree with each other (not opposed to each other) and subtracting from each other positings which are really opposed to each other" (2: 194). The purpose of this rule of explaining change or succession is to demonstrate that a positive change must include either real opposition or potential opposition. For example, both the coming-to-be and the passing away require positive ground, and both equally involve the potential or real cancellation of their opposites. Kant illustrates this idea in the following way:

> The state of the world prior to this change [coming-to-be] is, in respect of this posting, equal to zero = 0 and the real effect = A exists in virtue of this coming-to-be. I maintain, however, that if A arises, then, in a natural change occurring in the world, -A must also arise. In other words, no natural ground of a real consequence can exist without its being at the same time the ground of another consequence, which is the negative of the first (2:194-5).

The idea is illustrated in the following way: a natural change involves a positive ground, as is the case with the cancellation of the coming-to-be. The coming-to-be also contains the actual or potential cancellation of its effect. Kant adds to the last point, "…no natural ground of a real consequence can exist without its being at the same time the ground of another consequence, which is the negative of the first" (2:195). To clarify the meaning of this claim, Kant provides an example in the footnote. The example he uses is the collision of two bodies, where the production of a new motion occurs at the same moment as the cancellation of another motion that is equal to it and precedes it. This indicates Kant's point that, in natural change, the sum is neither increased nor decreased.

This principle expresses a conservation law when applied to physical change and succession. Kant intends to employ this principle as the basis for inertial motion. The idea of real and potential opposition is employed here to explain the nature of succession, which is the basis for inertial motion. To explain the nature of inertial motion, Kant uses his ideas of real and potential opposition to explain its basis, and this demonstrates that inertial motion cannot be articulated through the model of logical contradiction or the unrestricted use of the Principle of Sufficient Reason. Furthermore, in the real opposition model, as shown above, the relative and reciprocal nature of negative magnitudes demonstrates that each side of this reciprocal relation can coexist in the subject. The nature of this co-presence of different predicates does not amount to a logical contradiction since both predicates are based on positive grounds. This concept allows for capturing the relational nature of force and, consequently, causal relations. It assumes that the inertial motion of a body cannot be causally isolated and requires interaction with other bodies in space. In other words, uniform and inertial motion is about the balance of forces in the interaction with other bodies. In his *New Doctrine of Motion and Rest*, Kant argued against the concept of an internal force that causes "natural" and uniform motion of a body. We find here an extension of this argument against the concept of internal force that causes uniform and inertial motion. For example, the motion of the body must be embeddable in a community of interacting bodies in order to be possible. Thus, to demonstrate the causal content of space-time, we cannot articulate it using the model of logical opposition. Instead, it requires a model of a real opposition distinct from the logical principle of the law of contradiction. This entails that the representation of uniform succession cannot be articulated through the model of logical opposition.

2.5 Inaugural Dissertation 1770

In his *Inaugural Dissertation* (1770), Kant takes a therapeutic approach to the method of metaphysics. In this work, Kant designates and limits the areas of cognition proper to each type of cognition, especially mathematical cognition. The significance of the 1770 *Dissertation* is that it represents the culmination of Kant's early reflections on the problem of metaphysical concepts and their relation to mathematical concepts before the inception of his critical philosophy. The *Dissertation* contains a discussion of the limits of each cognition, but it also introduces the concept of form for the first time. This concept in the *Dissertation* refers to the form of the world, and Kant distinguishes between two worlds, each requiring a different mode of cognition. The sensible world is the proper object of mathematical cognition, where space and time are taken to be a priori conditions of its possibility. On the other hand, the intelligible world is the world where metaphysical concepts are available for cognition.

The form, according to Kant, refers to the laws of coordination between the elements of the world (2:390). The unity of the world stems from this form, which is not an ideal unity but rather depends on actual and reciprocal relations between its parts. For the sensible world, the formal conditions and principles of this world are space and time, and sensibility or receptivity is the proper mode of cognizing this sensible world. Cognition is sensible as long as it is subject to the laws of sensibility, and intellectual if the laws are the laws of intelligence. This demarcation of different rules of cognition guards against dialectical error that occurs when in subjecting metaphysical concepts to sensitive laws or sensible concepts to intellectual concepts. Kant assigns to the understanding the role of cognizing the concepts of metaphysics, which he refers to as the real use of the understanding. This is contrasted with the logical use of the understanding, which is concerned with the employment of logical rules such as the law of contradiction.

The aim of this distinction between the understanding and the sensibility is to challenge the rationalists' notion that the sensibility presents the concepts of the understanding in a confused manner. Kant, in the *Dissertation,* addresses this distinction between the objects of sensibility and the objects of the real use of the understanding. In this distinction, Kant does not credit sensibility with the ability to cognize things in themselves; instead, sensibility is the receptivity of things insofar as they fall under the laws of sensibility (2:393). In this respect, Kant argues that space and time are the laws of sensibility, and the sensible world is their proper object. Space and time are subjective conditions that constitute the inherent laws of the mind, a term that Kant uses to clarify the role of space and time. The idea is that anything that falls under the conditions of these subjective and sensible laws must be represented as belonging to the sensible world. Kant further characterizes these formal conditions:

> These formal principles of the *phenomenal universe* are absolutely primary and universal; they are, so to speak, the schemata and conditions of everything sensitive in human cognition. (2:398/13).

Taking space and time as the schemata of everything that falls under the sensible laws of cognition demonstrates Kant's shift towards examining the conditions under which time and space are represented. According to Kant, such an intuitive representation of time and space includes normative rules that govern the physical laws. In this respect, the rules of representation in sensible intuition are independent from the rules of the understanding, and confusion between these rules of the understanding and the sensory and intuitive representation generates problems regarding the nature of time and space. It, therefore, appears that Kant's "solution" to the debate on the absolute or relational nature of time and space is through the analysis of the limits of

metaphysical cognition and the diagnosis of this type of cognition as it tends to "subordinate" the laws of sensible intuition to its intellectual laws of composition.

Regarding problem of representing time, Kant is also concerned with another problem that is not entirely independent from the absolutist and relationalist debate, and that is the empirical determinacy of these mathematical forms, especially time. Empirical determinacy is about subjecting time to rules of determination that exhaustively exhibit the manifold of time in experience. According to Kant, as long as the manifold of time can be exhibited in experience, it can be objectively determined. The metaphysical concepts of the understanding alone, according to Kant in the *Dissertation,* fail to achieve this empirical determinacy of time. Instead, it requires that mathematical time be intuitively represented in accordance with the coordinating laws of sensibility. In the *New Elucidation* and *Physical Monadology*, Kant ascribes causal content to time and space, whereby the mathematical forms of pure time and space are taken to exhibit such causal content through the interaction of repulsive and attractive forces that dynamically determine space and time. The failure of this project prior to *Dissertation* was to mix the metaphysical cognition of pure understanding exemplified by the interaction of substances with the intuitive and mathematical forms of space and time. The *Dissertation* aims to isolate these mathematical forms from the "intervention" of the concepts supplied by pure understanding. Yet, Kant still retains the idea of a universal connection in the sensible forms of time and space, and that time and space are the forms of the phenomenal world, in which the concept of the form contains the laws of universal connection proper to the world.

In this respect, the relation of simultaneity belongs to the sensible intuition of time, and the laws that govern sensory cognition should be applied to the representation of simultaneity. Kant's earlier works on causation and motion revealed that the empirical representation of

mathematical time (including the relation of simultaneity) is furnished by the reciprocal determination between two positive grounds. This account of time was intended to resist the monadic reduction of time to the conceptual and internal representation of substances. Kant's relocation of time in the dynamical interaction between substances allowed him to "externalize" time from this monadic conception of time and succession. In this analysis of time, the simultaneous presence of other time-lines is not taken for granted. Instead, there must be an explanation of how the empirical unity of time is produced through the connection of these different time-lines. The idea of positive grounds in *An Attempt to Introduce the Concept of Negative Magnitude into Philosophy* as articulated by Kant prior to the *Dissertation,* signals Kant's attempt to account for such possibility of producing an empirical unity of time through a reciprocal connection of the real grounds. In this case, the idea of subjecting time to "laws of connection" becomes relevant since the production of empirical unity of time must be guided by coordinating laws provided by the forms of the sensible world. This demonstrates Kant's overall aim of reproducing mathematical simultaneity into experience, namely, the articulation of the universal connection between the parts of the world in experience.[49]

The form of sensibility is governed by laws that Kant assigned to the receptive power of the mind. The sensory laws under which the sensible world is presented to the mind include laws of coordination. According to the passage before (2:398/13), these laws are intended to be the *schemata* for everything sensible. In the *Dissertation,* Kant provides an exposition of the concept of time where he seeks to articulate the concept of time, provided the distinction of sensibility

[49] This aligns with Leibniz's account of universal connection, whereby a Leibnizian's conception of universal harmony is reproduced through Kant's theory of real and positive grounds. For such universal connection is accounted for here by real grounds instead of an ideal connection between isolated substances. It is an extension of Kant's discussion of real or potential opposition in *An Attempt to Introduce the Concept of Negative Magnitude into Philosophy* which provides an explanation of dynamical relations of space and time (conservation laws, mutual and reciprocal determination) outside of the logical opposition model.

and the understanding, and the distinction between their objects and methods. For Kant, time is not given along the senses; the senses presuppose it (2:398-9). It is on the presupposition of time as pure intuition that the relations of succession and simultaneity are represented to the senses. For it is through the priority of time in this respect that such temporal relations are given in the sensible representation. Equally, time is neither a general concept nor a discursive concept given as the intellectual representation of concepts. Time is the enabling condition for receiving sensations; thus, time cannot be borrowed from experience. For this reason, Kant takes time to be a pure intuition, which is not mixed with sensory content. As he has clarified, such laws of pure intuition are not to be extracted from experience. The a priori necessity of time is to be located within sensibility, for such necessity is significant in so far as the clear representation of the sensible content of experience is possible. The a priori sensibility contributes independently of the understanding, intuitive content, and not a confused representation of the concepts of the understanding.

Time is, therefore, a subjective and necessary condition of coordinating the sensible things in accordance with a law. Kant associates this claim with the status of time as merely a subjective condition for representing the sensible manifold. However, this conclusion is drawn *after* the exposition of the epistemological and representational role of time, namely, the a priori necessity of time located in sensibility. Hence, time as such precedes the ontological categories of substance, accident, and relation. This claim is intended to "relocate" the debate between substantialism or relationalism regarding time. Instead, Kant turns to analysing the conditions under which time can be represented or play a role in making the sensible cognition of things possible. This change in the debate regarding the metaphysical nature of time in different ways,

and opens the possibility for Kant to retain the a priori necessity of time without committing to placing it in an ontological category. He addresses these two positions on the nature of time:

> …the concept of time, as the principle of form, is prior to the concepts of substance and accident. But as for relations or connection of any kind: in so far as they confront the senses they contain nothing which tells us whether they are simultaneous with or successive to each other, apart from their positions in time, and those positions have to be determined as being either at the same or at different points in time. (2:400)

Kant argues against the relationalist conception of time, which "reduces" time into relations that are abstracted from the senses. In his conception of time, time cannot be reduced to relations between substances. Kant notes that those who tend to "subsume" time under an ontological category of substance or relation have failed to recognize time as a form of sensible intuition. Metaphysical categories are provided by the pure understanding, while time belongs to the sensible laws of intuition. By distinguishing between pure understanding and the laws of sensibility, Kant aims to avoid confusion regarding the nature of time.

When addressing the relationalist position on time, Kant argues that such a position is untenable as it presupposes the representation of time by abstracting the relations of time from a monadic law of succession. In his objections to Leibniz's relationalist theory of time, Kant also points out what he takes to be the complete negligence of simultaneity. He adds a footnote to his criticism of the relationalist conception of time, which captures most of Kant's objective in this conceptual exposition of time:

> Simultaneous things are not simultaneous because they do not succeed one another. For if succession is removed, then some conjunction, which existed in virtue of the series of time, is, indeed, abolished; but *another* true relationship, such as the conjunction of all things, does not instantly spring into existence as a result. For simultaneous things are joined together at the same moment of time, just as successive things are joined together by different moments. Accordingly, though time has only one dimension, yet the *ubiquity* of time (to speak with

> Newton), in virtue of which *all* the things which can be thought sensitively are at *some time*, adds a further dimension to the magnitude of actual things, in so far as they hang, so to speak, from the same point of time. For, if you were to represent time by a straight line extended to infinity, and simultaneous things at any point of time drawn perpendicular to it, the surface thus generated would represent the *phenomenal world* in respect both of substance and accidents. (2:401)

According to Kant, simultaneity is not a relation obtained by the mere cancellation of succession; it is instead a relation constitutive of time and equally significant as the succession of moments in the definition of time. He argues that mathematical simultaneity involves adding a magnitude to the "actual things" when they are taken to be at the same time. This representation of simultaneity is not possible through the logical hierarchy model or conceptual containment. Rather, it is the sensible law in pure intuition that allows for the representation of simultaneity as a constitutive relation of time. The mistake that Kant attributes to Leibniz in his theory of time is that temporal succession is considered to be contingent on relations between substances, which ultimately would make time-magnitude depend on laws of motion or any model (such as succession of ideas) that exhibits succession. In contrast, Kant takes time to be a pure intuition that makes such a pure succession possible. The role of simultaneity in this argument is evident, as it permits Kant to reject the relationalist conception of time by supposing that the simultaneity relation in time cannot be analysed as a negation of time. Mathematical simultaneity is built into the structure of mathematical and pure time.

The classical notion of time includes objective simultaneity, where the simultaneity relation implies the subsumption of all instantaneous and local moments under one global time. The relationalist conception of time, which limits the definition of time to the concept of succession, is insufficient to capture this content of classical time because it treats simultaneity as a negative notion, a negation of succession. This view assumes that the *agreement* of separated and different clocks on measuring time at one instant is an accidental feature and not included in the definition

of time. In this footnote, Kant rejects this interpretation of time as it assumes that objective simultaneity is an external relation and a negative criterion in the definition of time.

For Kant, the negation of succession of moments implies a negation within the content of time, in which the withdrawal of the successiveness of temporal moments does not result in the emergence of simultaneity[50] because simultaneity requires a positive ground, a connection, or a conjunction within time just as succession demands a positive ground in time as well. Thus, simultaneity does not contradict succession because an object can stand in the two relations of simultaneity and succession. Kant affirms this idea when he states, "For simultaneous things are joined together at the same moment of time, just as successive things are joined together by different moments". The co-presence of these two temporal relations in one spatio-temporal object demonstrates that the temporal series of this object can coexist with other temporal series as well. In this sense. Kant emphasizes the notion of universal connection, or the "conjunction of all things," indicating that a single succession is inseparably linked with other temporal series. A proper representation of time, according to Kant, must include the "ubiquity" of time, which means the extension of one local time into spatially separated points to achieve the sensible unification of space and time in this universal connection of all things.[51]

Once the concept of simultaneity is not defined negatively as the absence of temporal relation or the disconnection between things, objective simultaneity, according to Kant, must be grounded in a positive basis, namely, the conjunction of all things in time. Theoretically, absolute

[50] This refers to Leibniz's definition of simultaneity through the negation of succession; simultaneity is thought to be a result of the absence of succession.

[51] Simultaneity relation plays a role in demonstrating that time must be injected into space. The simultaneous coexistence in the mathematical structure of space and time is a consequence of the Galilean manifold, where the concept of a universal time is preserved by the idea of coexistence between objects in the Galilean manifold and by the symmetrical nature of the connection between space and time, in which a privileged foliation of the space-time manifold is possible. For more on this classical representation of simultaneity in the Galilean manifold, Balashov (2010, 48-50) examines the implication of the geometrical structure of this classical representation of space-time.

simultaneity allows for the instantaneous and absolute slicing of time and for instantaneous shifting between coexisting time-series without undermining the unity of time across space. Kant believes such a theoretical possibility is grounded in something positive, the connection of all things in time. He also regards universal connection as subjecting and determining time through rules or law-like connection. For example, local time-coordinates are supposed to be subsumed under a global time-coordinates. To explain it further, since succession does not exclude simultaneity, every local succession is construed as belonging to a universal frame of time. However, for the local time-line to be part of a universal time, it must be structured in a way that allows it to be subsumed under rules of determination. A local time-line must be positioned in relation to the universal flow of time, which entails the following consequence: the mathematical laws contained in this universal time are applicable to spatially separated local time-lines as well. For this reason, simultaneity involves a law-like temporal connection built into the structure of mathematical time.

Kant's early writings, particularly the *New Elucidation* prior to the 1770 *Dissertation*, indicated that the spatial and temporal nexus between substances cannot be subsumed under the logical rules of contradiction since these rules are unable to account for the causal relations between a community of substances. Through such community, the spatial and temporal determinations of substances can arise. However, in the *Dissertation*, Kant locates the mathematical structure of time and space within sensibility and construes them as a priori manifolds of sensible intuition. Since the sensible world is only presented within the formal structure of space and time, the application of logical rules such as the law of contradiction also presupposes these a priori and intuitive laws of the mind. Kant affirms that the a priori intuition of time is the universal law of coordinating the sensible content of intuition. It discredits any

attempt to derive the representation of time from other sources, such as the succession of thoughts or the motion of bodies. Instead, these motions are referred to structure of pure time in the a priori intuition.

Since the simultaneity relation cannot be represented through discursive concepts and presupposes the intuitive laws of sensible representation of time,[52] Kant argues that sensibility delivers the proper rules of representing the unity of the phenomenal world. Sensible simultaneity contains such laws that coordinate the world of senses, and Kant asserts this claim in the footnote when he writes, "For, if you were to represent time by a straight line extended to infinity, and simultaneous things at any point of time drawn perpendicular to it, the surface thus generated would represent the *phenomenal world* in respect both of substance and accidents." Assigning the laws of representing simultaneity to sensibility entails that the a priori intuitional manifold includes these a priori temporal laws. This might indicate Kant's "philosophical overinvestment" in sensibility,[53] which leads to his claim that sensibility alone contains these laws of universal connection in the phenomenal world. The form of universal connection or the form of the phenomenal world refers to these temporal and spatial laws, and through them, the idea of "mixing"[54] time and space becomes possible without employing the rules borrowed from the real use of understanding. This mixing of space and time produces the simultaneity relation assumed to be available within the mathematical structure of pure intuition of time. For this

[52] "Time, therefore, is an absolutely first *formal principle of the sensible world*. For all things which are in any way sensible can only be thought as either simultaneous or as placed after each other, and, thus as enfolded, as it were, by a period of one single time, and as related to one another by a determinate position in that time. Thus, there of necessity arises as a result of this concept, which is primary in respect of everything sensitive, a formal whole which is not a part of another whole; that is to say, there arises the *phenomenal world.*" (2:402)
[53] I take this term from Laywine (2003, 447)
[54] Laywine (2003, 454) refers to this unification of space and time in the representation of the phenomenal world as a "mixing" of space-time.

mixing to take place, it indeed depends on the ability of sensible intuition to present the phenomenal world through these universal laws of coordination.

This is about the formal structure of the sensible world. For the simultaneity relation, which involves the coexistence of different parts of the world, it follows that the reciprocal relation between the parts of the phenomenal world must be constitutive of this world as such. Later, Kant would extend this formal structure of coordination to the intelligible world, which also contains reciprocal and mutual relations between its parts. Time and space are the formal principles of the phenomenal world, and they depend neither on logical relations nor empirical content. Rather, they depend on intuitive form, which involves a representation of the whole according to the rules of sensibility. When speaking of the intelligible world, Kant also credits the formal structure of the intelligible world with this representation of its unity in accordance with the laws of coordination between its parts. This is referred to as the "real use of the understanding," whereby concepts of the understanding are about objects and relations that are not abstracted from the senses. These are the metaphysical concepts that cannot be mixed with concepts derived from sensibility. The intelligible world falls under the concepts of real use of the understanding, and the principle of unity of this world is constituted by the interaction of different substances.

Kant's concern is to address the structure of the intelligible world by exploring the possibility of linking different substances into one world. However, this question, cannot be answered through the sensible laws of intuition since these laws of sensible are ultimately about the form of the phenomenal world, concerned only with the coordination of the sensible presence of objects within the forms of intuition. The attempt to reduce the interactive unity of substances to

the structure of the given and sensible space does not succeed in explaining such cosmological unity because it confuses the sensible laws of intuition with the real use of the understanding:

> Accordingly, the following question, which can only be solved by the understanding, remains untouched, namely: *what is the principle upon which this relation of all substances itself rests, and which, when seem intuitively, is called space?* The hinge, then, upon which the question about the principle of the form of the intelligible world turns is this: to explain how it is possible *that a plurality of substances should be in mutual interaction with each other,* and in this way belong to the same whole, which is called a world. (2:407. 16)

According to Kant, when viewed under the intuitive laws, the principle of the unity of the intelligible world is nothing other than space, but it is essentially about the interactive unity of different substances and their composition into one whole. In this section of the *Dissertation*, Kant reintroduces his principle of coexistence, which was discussed before in *New Elucidation*. However, at this stage of his thought, Kant does not maintain that this principle of coexistence itself generates spatial and temporal connections between substances; instead, these mathematical structures are to be located in the laws of sensibility, while the principle of coexistence is now elevated into a formal structure that concerns the unity of the intelligible world.

This cosmological unity of the world is a subject that was debated among the continental rationalists in Kant's time, and in the *Dissertation,* Kant discusses it in light of his newly developed account of causation and the manifold of space and time. He proceeds by outlining the structure of the intelligible world, which consists of a plurality of substances, and explains that such a plurality must be subsumed under one principle. According to Kant, this unity of the world cannot be brought about through the mere existence of substances; rather, mutual influence between them renders this unity actual. Kant also denies that necessary substances can be combined into one whole, as necessity excludes the mutual relation between the interactive substances in the one world. The idea that Kant wants to further develop in his argument here is

that no necessary substance can be connected with a world unless this relation is construed as a relation of a cause with what is caused. For this reason, the cause of the world cannot be present within the interactive unity of the world; its presence, according to Kant, is rather virtual (2:408).

For this interactive and causal relation to be obtained between substances, there must be a unity between them; therefore, these substances must be linked causally. However, if we suppose a plurality of necessary beings, each of which causes different substances, the interactive unity of these substances is excluded because "the effects, of which the causes are free from any reciprocal relation, would not be in interaction" (2:408). Therefore, the conjunction of all substances must be based on the dependence of all substances on one being. Kant also establishes in this argument that it is possible to have multiple worlds existing outside each other, with each world being caused by a different necessary being. However, these different worlds cannot be connected with each other as every world must be isolated from the others. It was previously asserted that no necessary substances can be in an interactive relation with each other, and each world has one principle for its unity. Kant argues, contra Wolff, that the impossibility of having different worlds does not rest on concepts alone, but is denied through the impossibility of having different necessary beings.

Kant uses the principle of coexistence to address concerns about the interactive and causal relation between substances and to argue that the rationalist Principle of Sufficient Reason must be reshaped to account for this relation. He suggests that this principle cannot be articulated through the principle of the best, but requires a different ground that entails the idea of a world in which its parts are reciprocally determined by each other. This involves real and reciprocal causation.

The foregoing argument by Kant demonstrates that the formal principle of the intelligible world, much like the formal principle of the phenomenal world, demands that its principles contain a ground for the interactive and connective relations between its components. These principles might be called universal laws of coordination. In the *Dissertation,* Kant distinguishes the formal principles of the phenomenal world from those of the intelligible world. He finds that the intuitive laws of sensibility and the concepts of the real use of the understanding contain real import. Although Kant warns against reducing either principle to the other, he articulates a position according to which these principles are neither empirical nor logical. These principles are synthetic in nature, as they assert real connections between the parts of each world. However, the conclusion that Kant wants to draw in the *Dissertation* is that the confusion between the rules of each world will produce a metaphysical error. The problem that Kant later confronted post-*Dissertation* regarding this distinction is to explain the nature of the possible relation between these two rules of representation: intellectual rules and the sensible laws of space and time. He shows his dissatisfaction with the strict division between these two rules in his letter to Marcus Herz of 1772, in which he wrote:

> In my dissertation, I was content to explain the nature of intellectual representations in a merely negative way, namely, to state that they were not modifications of the soul that were brought about by the object. However, I silently passed over the further question of how a representation that refers to an object without being in any way affected by it can be possible. I had said: The sensuous representations present things as they appear, the intellectual representations present them as they are. But by what means are these things given to us, if not by the way in which they affect us? And if such intellectual representations depend on our inner activity, whence comes the agreement they are supposed to have with objects—objects that are nevertheless not possibly produced thereby? (10: 130-1)

Kant's point in this letter to Herz can be reconstructed as follows: since the real use of the understanding involves reference to objects, it must involve a referential relation to objects of

experience. Furthermore, since these objects of experience are delivered by sensible and passive receptivity, there is a possible way to reconceive the relationship between understanding and sensibility other than the way it was articulated in the *Dissertation,* in which the understanding can determine the content of the sensible intuition.

In the *Dissertation,* the rules of representing mathematical simultaneity are placed in the formal structure of sensibility. Kant argues that this representation of mathematical simultaneity requires an a priori intuition of time but does not involve the real use of the understanding. It only involves the laws of coordination in sensibility. The intuitive a priori time, which includes objective simultaneity, shows that the possibility of connecting different time-lines depends on their reciprocal determination. For this to be possible, the causal connection is determinative of producing a universal time. However, for Kant, this connection is constitutive of pure time, and the structure of the sensible laws of intuition in the *Dissertation* makes this connection possible. A mathematical structure of this sort must be reproduced in experience. To do so, Kant believes that certain rules and laws must guide the reproduction of mathematical simultaneity in experience. He assigns this role to sensibility alone, without the intervention of the pure concepts of the understanding. Consequently, sensibility is promoted in this respect, and the reason for this overinvestment in sensibility originates from Kant's rejection of the conceptual containment model of cognition in representing the law-like temporal connections that are to be reproduced in experience, especially mathematical simultaneity.

2.5 Conclusion

Kant's early writings demonstrate his continuous engagement and revisions on the nature of space-time and causation. Kant's early position on the nature of the simultaneous coexistence of substances is defined by Kant's effort to account for the cosmological unity of the world through the relations of space and time. He believed that the rational determination of space and time is to be accounted for through the concept of reciprocal determination between substances in one space. Through his analysis of the relation between the space-time manifold and causation, Kant arrived at the end of his pre-critical period at the position where the rationalist model of time determination cannot be fully accepted. For this reason, the positing of internal principle to account for relational action must be renounced. This led Kant to articulate that space-time manifold must be viewed as a peculiar form of representing the sensible world. Through the unification of space and time, the form of the sensible world is made possible. This structure of the sensible world contains a coordination of universal time through a law-like connection or formal structure that captures the coexistence of the parts of this world without the use of the concepts of the understanding.

3. Simultaneity in the *Critique of Pure Reason*: The Empirical Determinacy of Time

In Kant's critical period, there is a transition to a new way of treating the concepts of space and time and the relation of the dynamical categories of substance, causation, and community to the manifold of pure time. This reflects a revision of Kant's conception of the role of the understanding in shaping and structuring the manifold of sense. In the following section, the idea of the empirical determinacy of time is pursued first by examining Kant's concept of time in the Transcendental Aesthetic, then turning to the role of categorical synthesis in determining the manifold of time in the Transcendental Deduction. It will be argued that the empirical determinacy of the manifold of pure time is brought about by the categorical determination of the manifold of intuition. Given the determinable content of the intuitive manifold of time, a conceptual determination must be a synthetic determination through the relational categories.

3.1 Transcendental Aesthetic

In the last chapter, it was established that prior to the publication of the *Critique of Pure Reason*, Kant, in the 1770 *Dissertation* espoused a model of cognition that delineates the proper objects of sensibility and isolates sensibility from pure understanding. However, in the *Critique*, Kant would reject this model of cognition that denied the role of understanding in determining sensibility. In the Transcendental Aesthetic, Kant retains the same content regarding the forms of intuition, arguing for their a priori necessity in order to account for the representation of temporal and spatial relations in experience. The intuitive nature of time is offered as an answer to the question of the nature of the presentation of pure time, and its possible empirical representations. The Transcendental Aesthetic is significant to Kant's theory of simultaneity because, in this first part of the *Critique*, Kant asserts the a priori nature of sensibility and the

synthetic content of sensibility in so far as it is determinable, and how the original temporal relations of succession and simultaneity are presented in this way.

Kant's method in the Transcendental Aesthetic has given rise to many debates and commentaries concerning the way in which he sought to isolate sensibility from the understanding, in order to examine its a priori content without the guidance of the conceptual role of the understanding.[55] Although it is challenging to decipher Kant's overall intention in this stage of the *Critique of Pure Reason*, according to his pronouncements, the science of sensibility in the Transcendental Aesthetic treats of the *a priori* structure of internal and external sense. In order to pursue this end, the isolation of sensibility is a necessary step towards reorienting the exposition of the form of time, and examining the a priori contribution of the intuitive form of time to the experience of temporal relations, such as the relations of successiveness and simultaneity.

In the following section, mathematical simultaneity will be examined in relation to intuitive time. As foreshadowed in Kant's *Dissertation*, the presentation of mathematical simultaneity prepares a structure of temporal relations through law-like connections that are in some sense demanded by the form of intuition. It will be argued that only the synthetic nature of time can account for the representation of this mathematical structure of simultaneity in experience, and

[55] Falkenstein (1995, 55-56) argues that what he refers to as the blindness objection poses a threat to Kant's analysis of experience. This objection is about Kant's claim in the Transcendental Doctrine of Elements that "Thoughts without content are empty, intuitions without concepts are blind" (A51/B75), which makes it impossible, according to Falkenstein, to characterize intuitions without invoking concepts, and such an attempt by Kant is hopeless. But the blindness objection does not pose a threat to Kant's analysis, for in the Metaphysical Exposition of Space and Time of the *Critique*, Kant is interested in tracing the a priori content of the concepts of time and space to pure intuition. In doing so, he is explaining the non-conceptual origin of these intuitive relations. As Kant himself admits that any reference to space or time involves a reference to a particular representation of either space or time, and therefore it includes a conceptual content, still, this does not rule out that the a priori necessity of space and time is based on a pure intuition, and for this reason, it is possible to give an exhaustive characterization of these relations by referring them back to pure intuition.

that it captures the a priori necessity of the intuition of time by offering time as a synthesizable manifold that can be subjected to the rules of understanding, namely, as a determinable manifold. It will be shown that the relational determination of pure time, which requires the ordering and the synthesis of time through law-like connections, underlies Kant's exposition of time in the Transcendental Aesthetic.

3.1.1 The Synthetic Method of the *Critique*

In the Transcendental Aesthetic, Kant asserts the existence of a priori structures of sensibility. It is the examination of the principles of a priori sensibility (B/36), that isolates sensibility and uncovers its a priori contribution to the cognition of objects. In the 1770 *Dissertation,* these forms of sensibility were credited with the ability to coordinate sensible content without the involvement of pure understanding. Now, in the *Critique,* Kant does not assign this coordinating role to pure sensibility; rather, he retains the intuitive content of the forms in which the manifold of external sense is received and arrayed in accordance with the a priori forms of space and time.

Kant distinguishes between the form and matter of appearance. The pure form of sensibility refers to the way in which the matter of appearance is received and structured. This distinction pertains to the intuitive manifold and its content, where sensation constitutes the matter or the content of appearance, and the pure form of intuition is the structure of its appearance. The matter of appearance is informed by this a priori form of sensibility, and through the a priori forms of intuition, the matter of appearance is structured and combined:

> I call that in the appearance which corresponds to sensation its *matter*, but that which allows the manifold of appearance to be ordered in certain relations I call the *form* of appearance. Since that within which the sensations can alone be ordered and placed in a certain form cannot itself be in turn sensation, the matter of all appearance is only given to as *a posteriori*, but its form must all lie ready for

> it in the mind *a priori*, and can therefore be considered separately from all sensation. (A20/B34).

The idea is that this faculty of receptivity has an a priori form, such that the material given through this passive faculty is exhibited only in accordance with its a priori form. An analysis of experience must account for the passive and receptive content of experience and must articulate the conditions under which cognition relates to objects of experience. Therefore, Kant's analysis of the forms of receptivity is a first step in his intended analysis of *experience*. However, several questions that can be raised already concerning the method Kant uses to discern the formal features of receptivity, that is, regarding the isolation and abstraction from the content of experience.

The objection has often been made to Kant's method of abstraction from the sensational content of receptivity that this method of abstraction is not justified.[56] Kant does not address this challenge directly, but it can be addressed by following the way that Kant carries out this method of analysing experience. Kant gives an analysis of the pure form of intuition by separating it from other content that is contributed by other cognitive powers such as the understanding:

> …if I separate from the representation of a body that which the understanding thinks about it, such as substance, force, divisibility, etc., as well that which belongs to sensation, such as impenetrability, hardness, color etc., something from this empirical intuition is still left for me, namely, extension and form. These belong to the pure intuition, which occurs *a priori*… (A21/B35).

To reach this pure and intuitive manifold, Kant pursues this isolation and separation of the content that is contributed by the actions of the understanding and the material component of sensation, in order to demonstrate the a priori content of intuition. Such a process of isolation is part of Kant's *synthetic* method in the *Critique of Pure Reason*, and it is contrasted by Kant to the

[56] As mentioned earlier, Falkenstein makes this objection (1995, 55-56).

analytic method in his work *Prolegomena to Any Future Metaphysics*. Unlike the analytic method, which seeks out the implicit conditions of the existing knowledge, the synthetic method grounds it constructively by the separation and the isolation of different cognitive powers and recognizing their unity. The analytic method assumes the availability and legitimacy of synthetic a priori knowledge in analysing the forms that constitute experience. The idea of isolating a priori sensibility is required by the synthetic method, which does not assume the existing scientific and mathematical knowledge, but it intends to explore the a priori principles of sensibility itself, which yields the synthetic a priori knowledge.[57]

This same method of isolation and abstraction of the a priori forms of sensibility is also employed by Kant in the Transcendental Analytic, where he demonstrates the necessity of determining the temporal manifold by means of the categories. He now argues on the same grounds that *unification* of the temporal manifold is only possible through the synthetic action of the understanding. This elucidates the core of the synthetic method which Kant declares that he is deploying in the *Critique*; the synthetic method is about isolating and uniting the cognitive powers ascribed to the mind, in order to identify their a priori sources. This method of the

[57] Kant characterized the difference between the method of the *Critique* with *Prolegomena* in answering the question of the possibility of metaphysics in the following way:
"In the *Critique of Pure Reason* I worked on this question *synthetically*, namely, by inquiring within pure reason itself, and seeking to determine within this source both the elements and the laws of its pure use, according to principles. This work is difficult and requires a resolute reader to think himself little by little into a system that takes no foundation as given except reason itself, and that therefore tries to develop cognition out of its original seeds without relying on any fact whatever. *Prolegomena* should by contrast be preparatory exercises; they ought more to indicate what needs to be done in order to bring science into existence if possible than to present science itself. They must therefore rely on something already known to be dependable, from which we can go forward with confidence and ascend to the sources, which are not known, and whose discovery not only will explain what is known already, but will also exhibit an area with many cognitions that all arise from these same sources. The methodological procedure of *Prolegomena*, and especially of those that are to prepare for a future metaphysics, will therefore be *analytic*." (4:274-4:275)

synthetic analysis of experience is guided by a projected idea of the unity of reason, that is to say, that these supposedly independent cognitive powers are to be operative within one reason.[58]

The a priori forms of receptivity show that cognition must be open to outer constraints, which derive from the presence of material objects in space. The passive and receptive faculty of sensibility is necessary to account for such openness toward the external influence of outer objects. It grounds the necessary and a priori relation of the understanding to the form of intuition of outer objects. Since this necessary relation is built into the form of experience, Kant argues that space and time are the necessary a priori forms of intuiting objects. This relation thereby shows that space and time as forms of intuition are structured to play this role of constraining the activities of the understanding. But it is also the case that such a relation involves a determination of the spatial and temporal content through the understanding, namely, the forms of space and time are presented to be determined by a higher cognitive function exercised by the understanding. For this reason, by locating space and time at the level of receptivity, Kant is committed to the idea that such a formal and intuitive manifold must be presented to be restructured and recomposed in an a priori way by the rules of the understanding.

3.1.2 Metaphysical Exposition of Time

The notion of *exposition* in the Transcendental Aesthetic is defined by Kant as the analysis of the content of a given concept, and it thus presumes prior knowledge of this concept. Kant states that exposition is "the distinct (even if not complete) representation of that which belongs to a concept" (A23/B38), and a *metaphysical* exposition offers the analysis of the content of a

[58] Merritt (2006, 534-36) argues that Kant, in the proposed synthetic method of the *Critique*, aims at examining the unity of reason in its theoretical capacity. In this examination, Merritt contends that there must be a projected unity of reason, which is by isolating the different a priori contributions of each faculty, a synthetic method entails that a unity of these separate cognitive representations, such as sensibility and understanding, is achieved.

concept as given a priori. In this case, although the Metaphysical Exposition provides a conceptual analysis of time, the time in question is asserted to be a pure intuition, which is the object that satisfies a priori content of the concept of time in the Metaphysical Expositon.[59]

Since his purpose is to present the pure form of time as a "candidate" for determination by the rules of the understanding, Kant also intends to trace all temporal relations that we can think of, such as simultaneity and succession, to the pure intuition of time. But such relations are not generated or produced through the synthetic determination of the understanding, rather, such intuitive relations are intrinsic to the pure manifold of time. Kant's intention in the Metaphysical Exposition of Time is to explain the intuitive "origin" of such a representation of temporal relations. This is evident in Kant's Metaphysical Exposition of time, where the purpose is to outline and present the content of the a priori content of the concept of time. It is about demonstrating the adequacy of the form of intuition to account for the necessary features of the concept of time. For Kant, this exposition must consequently be exhaustive in this respect as it intends to demonstrate that the necessary temporal relations are to be traced to an intuitive origin. For this reason, simultaneity will be traced to the intuitive manifold of time, which cannot be conceptual in its origin.

Given that the properties of time in question are known prior to the Exposition, the question naturally arises whether they are known a priori or posteriori. On this question, Kant's answer is what one expects:

[59] Both Falkenstein (1995, 73) and Merritt (2010, 17) argue that Kant's objective is to provide pure intuition as the object which satisfies the a priori given content of the concept of time (or space) in the Metaphysical Exposition. This is a correct analysis of Kant's aim in the Exposition, but it must be added that the first and second parts of the Metaphysical Exposition are presumably playing a role here before the introduction of pure intuition as the proper object which satisfies these characterizations of the concept of time, and role consists in accounting for the apriority of time as such, and such a priori necessity is not captured by the relational construction of time, whether such relational construction of time is conceptual or empirical.

> Time is not an empirical concept that is somehow drawn from an experience. For simultaneity or succession would not themselves come into perception if the representation of time did not ground them *a priori*. Only under its presupposition can one represent that several things exist at one and the same time (simultaneously) or in different times (successively). (A30/B46)

Evidently, Kant is arguing against any position that assumes our knowledge of temporal relations to be empirical. The idea behind this exposition is that the determinacy of the time representation cannot be accounted for or articulated through the empirical model of concept acquisition, for such a position would be circular. Therefore, it is important to consider these temporal relations as being first acquired not through the process of empirical abstraction. Rather, the pure form of time must be assumed as subsisting before any perception of material change and, therefore, prior to any knowledge of these temporal relations in experience. Although a representation of any temporal relation such as succession or simultaneity is supposed to be *in* time, particular representations of temporal relations in time are taken to vindicate the priority of time in experience.

In the second Exposition of Time, Kant continues to clarify the concept of time by analysing the epistemological status of the presentation of time. He argues that appearances can only be imagined in time:

> Time is a necessary representation that grounds all intuitions. In regard to appearances in general one cannot remove time, though one can very well take the appearances away from time. Time is therefore given *a priori*. (A31/B46)

This claim assumes that it is possible to isolate the content of the appearance from the form of the appearance and that time can be shown to be an a priori given form. This contention seems controvertible at first glance since it postulates such a process of isolation and separating the matter of appearance, which seems to be infeasible. But it was shown above that Kant is pursuing a synthetic method whereby such isolation is justified in light of his

analysis of experience. The idea is that it is impossible to perceive temporal relations within appearances without the a priori given form of time and that the a priori form of time cannot be acquired from the sensory and a posteriori content of appearances because their temporal relations are dependent on the form of givenness itself.

Both of these two expositions indicate that the presentation of time does not depend on relational concepts that characterize temporal relations, such as successivity and simultaneity. Unlike relational concepts, the *a priori* representation of time entails that objects are represented in time, and that the apriority of time is a necessary condition on representing temporal relations. Thus, the apriority of pure time for Kant concerns the presupposition of a pure given manifold of time without the use of relational concepts to acquire the representation of time.

The construction of relational concepts, especially those of empirical origin, involves the presupposition that the terms of the respective relation are predicated of the relational concept by virtue of standing in such a relation. It requires, among other things, that the terms or objects of the relation possess a qualitative feature that admits of this comparative relation, such as being taller or shorter than another. But in temporal relations, objects are represented *in* time, which implies that time is not a qualitative concept and does not function as an intellectual or empirical concepts. It is not a qualitative concept because being a term in a relational concept involves the necessary reference to the object or term of the relation; however, the a priori manifold of time does not refer to the relational concepts, which are acquired from relations between sensible objects. For it is possible to have an a priori representation of time without the deliverance of the sensible content.[60]

[60] This claim rests on Kant's assumption that time must be a homogenous manifold that is not affected by the object's position in time or its duration since time is not affected by the presence of objects in it. It points out

Given that the pure representation of time cannot be acquired experientially, it also cannot be dependent on the content of other relational concepts that are open to conceptual revision or change. But this is not sufficient to confirm the a priori status of pure time, which requires additional argument to confer the apriority of pure time. It is true that pure time does not depend on the availability of other relational concepts. This may appear to threaten the a priori status of time in the sense that Kant intended, but the a priori status of the manifold of time also provides constraints on the empirical representations of time.[61] Thus, Kant's apriority argument for pure time also considers the manner in which pure time can be exhibited or experienced in the empirical cognition of objects, despite the fact that it is "priori" to them. This allows pure time to be open for recomposition and synthesis through laws or rules provided by the spontaneous actions of the understanding. In the Aesthetic, Kant does not clearly speak of the role of the understanding in shaping and informing sensible content, but at this stage, he wants to isolate the role of the understanding, as opposed to sensibility, in the analysis of experience. The conclusion which can be drawn from Kant's Metaphysical Exposition of Time is that the pure manifold of time is given a priori, and that the a priori form of time is to be understood only as originally given through pure intuition, where the empirical representations of time are constrained by the a

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something Newton had also claimed in the Scholium, where he writes: "Just as the order of the parts of time is unchangeable, so, too, is the order of the parts of space. Let the parts of space move from their places, and they will move (so to speak) from themselves. For times and spaces are, as it were, the places of themselves and of all things. All things are placed in time with reference to order of succession and in space with reference to order of position." (*Principia*, 410). The idea is that the order of time is not affected by the events that occupy it, for such order is a priori and unchangeable, but Kant does not endorse Newton's conception of absolute position; rather his claim is restricted to the distinction of form and content in appearance, and that the pure form of time cannot be dependent on the content received, and it must be prior to it. Thus, it is an a priori representation.

[61] Warren (1998, 201-206) examines this aspect of the relational concepts and how this part of Kant's Metaphysical Exposition can be construed as targeting Leibniz's relationalism. Wojtowicz (1997, 79) also makes a similar claim that Kant is targeting Leibniz's relationalism on space-time.

priori content of pure intuition. This will bring us to the next parts of the Metaphysical Exposition of Time.

Since the a priori content of the concept of time is to be viewed in relation to the analytic approach Kant pursues in the Metaphysical Exposition, by outlining the content that belongs to the concept of time a priori, Kant treats the pure manifold of time as an object of conceptual analysis. He directs this analysis towards something that is given as a manifold. It was argued above that this analysis demands that the content of the concept of time must be determined in order to be given as such. Thus, after establishing that the concept of time cannot be empirical or relational, and that it is possible to isolate it from the matter of appearance because time is a uniform structure, which is the *form* of appearance, Kant goes on to consider the a priori necessity of pure time, and whether the content of pure time can be grounded in an empirical basis. This is clearly rejected by Kant, who denies that the axioms of time can be based on relational concepts that are attained from experience. For him, pure time is the basis for the apodictic necessity of these axioms of time. In the third Metaphysical Exposition, Kant writes:

> This *a priori* necessity also grounds the possibility of apodictic principles of the relations of time, or axioms of time in general. It has only one dimension: different times are not simultaneous, but successive…These principles could not be drawn from experience, for this would yield neither strict universality nor apodictic certainty. (A31/B47).

Kant defines the epistemic role of pure time in grounding these axioms of time, which cannot be produced by experience. It is significant to trace the a priori necessity of pure time to pure intuition, and this is where Kant later brings up the object that satisfies the necessary and a priori content of the concept of time. It is the origin to which these properties of the representation of pure time can be traced.

In the fourth Exposition, Kant indicates that the proper object of these necessary features must belong to a determinate object. Since these characterizations belong to the primary structure of pure time, Kant must find a proper reference for this content and takes the pure intuition of time to be that object. This is clear in the fourth part of Metaphysical Exposition:

> Time is no discursive or, as one calls it, general concept, but a pure form of sensible intuition. Different times are only part of one and the same time. That representation, however, *which can only be given through a single object, is an intuition.* Further, the proposition that different times cannot be simultaneous cannot be derived from a general concept. The proposition is synthetic, and cannot arise from concepts alone. It is therefore immediately contained in the intuition and representation of time. (A32/B47). [Emphasis added]

The proper object of these properties of pure time cannot be empirical, nor can it be a general and discursive concept. The object is a pure intuition of time, or the "formal intuition" of time. This primary form is the origin of the a priori content of pure time, and it is primary in the sense that every particular representation of time must be dependent on it, as is also clearly indicated in Kant's fifth Metaphysical Exposition of time. Here, Kant indicates that the magnitude of pure time is determined through the limitation of an infinite given temporal magnitude provided only through the pure intuition of time (B48). Thus, the pure intuition of time contains the primary presentation of pure time, but it is presented in a way that makes it a *determinable* manifold. Consequently, it must be considered as a determinable content of sensibility.

After it was argued that pure time cannot be an empirical concept, nor can it be derived from a relational determination of conceptual content, Kant had to trace the source of the perceptual recognition of temporal relations to an alternative source, and that can only be given through a pure intuition of time. But this claim leaves something unexplained: How can such a determinacy of the pure intuition of time arise? Kant evidently has assumed that there is an object of intuition that corresponds to this analysis of the concept of pure time. The answer is given in the fourth and fifth parts of

the Metaphysical Exposition of time, where pure intuition of time is described as the primary presentation of intuition, which contains the ground for further determinations which cognize and unify the temporal manifold.

In order for such determination to occur, the pure manifold of time must be open to receive it, which is not assured if the manifold of time is taken to be a conceptual form or a material sequence provided by experience. Since the idea of treating pure time as an empirical concept has been ruled out by the previous Metaphysical Expositions, Kant, in the fourth and fifth Expositions, is mainly concerned with distinguishing the pure intuition of time from conceptual and discursive concepts. For this reason, the concept of time corresponds to a singular a priori intuition, which is not represented a particular falling under a general and conceptual representation. The reason behind this essential distinction is to trace the determinacy of pure time to this a priori intuition through which the intuition of time is not to be viewed as involving a relation of a particular as falling under a general concept, but rather a relation of limitation within one whole time. Consequently, in order to attain determinacy of pure time, time is to be taken as a homogenous manifold of intuition. The homogeneity of pure time contains the ground for the a priori nature of the time representation, in that it can be uniformly represented without undermining its unity.

The task of the Metaphysical Expositions of Time (and Space) is to articulate the a priori content of these mathematical concepts. For the purpose of such an analysis of the given content of the concepts of space and time, Kant presupposes the unity of the manifold of the analysed concepts. In order to ascribe quantifiable content to space and time, their manifold must be structured in some way or united. The purpose of outlining the content of time is to explicate its mathematical structure in a way that is *abstracted* from the action of the understanding. Yet, the

object of this Exposition or analysis must be the intuitional manifold, the pure formal intuition of time. While Kant believes that this content of the intuitional manifold must be structured and given as an object, he does not thereby reject the idea that such a structure is open to a higher form of determination, exercised spontaneously by the understanding. But it is still an open question why such an intuitional manifold requires the act of the understanding to be determined in accordance with the rules or the categories of thought.

The intuitive origin of the time-representation contains the ground for the synthetic nature of laws or axioms of time. Their synthetic nature cannot be explained conceptually. For instance, the non-simultaneous nature of successive moments cannot be derived from the analysis of the concept of succession itself, but it requires an a priori intuition of time to articulate the content of this proposition: "…the proposition that different times cannot be simultaneous cannot be derived from a general concept. The proposition is synthetic, and cannot arise from concepts alone." (A32/B47). The idea here is that the synthetic content of the temporal manifold must be guided by the form of pure intuition, and such content is not to be reduced to the logical or analytic content of concepts. The non-simultaneity of successive moments in one time-line is not available conceptually; rather, the ground for asserting this proposition is to be found in the pure intuition of time. This indicates that the negation or affirmation of simultaneity can also only be grounded in the pure intuition of time. This essentially captures the relational aspect of the time determination in the pure manifold of intuition, which will be elaborated later in the role of the understanding of determining the time manifold.

To illustrate the latter point, we must refer to Kant's similar pronouncements in his 1770 *Dissertation* regarding the synthetic nature of our time-representation. In this footnote, Kant asserts that the negation of succession is not identical to the affirmation of simultaneity but that

another positive ground must be added in order to assert the simultaneity of different time-lines:

> Simultaneous things are not simultaneous because they do not succeed one another. For if succession is removed, then some conjunction, which existed in virtue of the series of time, is indeed abolished; but another true relationship, such as the conjunctions of all things, does instantly spring into existence as a result.' (2:401)

Even in the case of a single time-line, whose successive moments cannot be identical, Kant argues that the simultaneity of these non-successive moments does not follow from the concept of *non-successive*, but can be grounded ultimately only through the pure intuition of time.

As mentioned above, in the fourth Metaphysical Exposition of time, Kant argues that pure intuition (or formal intuition) is the object of this determinate manifold whose structure and properties are examined and analysed. Here Kant indicates that this determinate manifold of pure time must be *singular*. This intuitive nature of the manifold of time demonstrates the need for the appearances to be structured or given in the successive order of time, and that order of time is not located within the logical content of concepts which articulate its content through the logical rules of identity and contradiction, but such intuitive content of time is anchored in the a priori forms of sensibility. Therefore, the temporal relations of successiveness and simultaneity are to be experienced through the a priori structure of sensible intuition. Such temporal relations are not brought about through the logical relations of contradiction or identity; they are construed by the synthetic nature of presentation of time, which provides a priori intuitive constraints for representing these temporal relations in experience.

It follows from Kant's argument that the simultaneity relation must be intrinsic to the sensory manifold of time, since it cannot be derived logically from the negation of successivity. Because the temporal relation of simultaneity is part of the synthetic content of axioms of time, and since this synthetic content is only given through the form of a priori sensible intuition and not through

the logical analysis of concepts, the pure intuition of time becomes the ground of the rules for representing material temporal relations. Kant's argument proceeds by elevating the structure of pure time to be a synthesizable and intuitional manifold that is determinable by a priori rules and that relational determination of this manifold of intuition is a necessary ingredient in the empirical representation of time.

Kant emphasizes the significance of the simultaneity relation (or the representation of coexistence) for the empirical determinacy of a pure manifold of time by arguing that the pure structure of mathematical time is linked to the determinable content of the intuitive form. For Kant, absolute Newtonian time lacks causal content in which the empirical realization of the pure relations of time requires the implementation of a relational force as a causal connection. In this sense, Newtonian time is posited as an independent substance that lacks an essential relation to experience.[62] Now, the simultaneity-relation fixes the manner in which time must be injected into space. It is a precondition for the determinacy of these mathematical structures, according to Kant, that they be presented as experienceable and determinable manifolds.[63] Therefore, absolute simultaneity is, from Kant's point of view, implicit in the structure of the Newtonian space-time, and it must be a possible object of experience.[64] It implicitly involves a relational determination of time through positive grounds since simultaneous coexistence contains a reciprocal determination between objects that

[62] It must be emphasized here that for Newton, the First Law of motion is supposed to be a correlate to the absolute time, and the First Law can be considered as containing a causal content which includes the causal or explanatory basis of uniform motion, namely, the force of inertia, and it explains both the resistance and the motion of body.
[63] The synthetic nature of time representation indicates that time needs to be a priori constructed. Kant here abstracts from the pure time the causal content, which will be made explicit in the Analogies through the relational determination of time. For example, the causal content of Newtonian time, such as the universal connective law of gravity, and the relational force behind these connective physical laws are not considered, but the purpose is to present pure time as a determinable manifold, a manifold that contains these formal properties of time which must be reproduced in experience in order to be empirically determinate through the categories.
[64] Brown (2005, 19-22) argues that Newtonian simultaneity is a consequence of introducing forces into the theory, not from postulating a rest frame relative to the Newtonian absolute space.

are spatially separated in the Newtonian space and time. This idea is cashed out in the Transcendental Aesthetic through the exposition of time as a pure and synthetic manifold of intuition that needs to be relationally determined.

The requirement that the pure intuition of time must be synthesized in order to be experienced through the relational determination of its pure manifold elevates the intuition of time into a determinable manifold of experience, whose determination is to be "legislated." Kant ascribes to pure time a structure that needs to be recomposed and reproduced in experience. But in the Aesthetic, Kant does not speak of the relational determination or empirical realization of pure time, deferring this part of the transcendental investigation of experience to later stages of the *Critique*, namely, the Principles of Pure Understanding and their Analogies of Experience. Here, Kant will contend that mathematical time is only determinately experienceable on the condition of a relational determination of pure intuition of time through the categorical synthesis of the understanding.

Thus, in a sense, the intuition of time invites determination by the rules of sensible representation. These rules in the *Dissertation* were provided by the coordinating laws of the intuitive form, coordinating laws that are specific to the form of the sensible world. However, in the Aesthetic, Kant needs to show only that the sensible form of intuition provides the necessary and a priori structure for representing the sensible manifold, without giving much significance to its determining function. Instead, the sensible manifold is presented as determinable content open for conceptual determination. This brings us back to the a priori necessity of time, which Kant has attributed to the pure intuition of time. In the first section of the Transcendental Aesthetic, Kant emphasized the apriority of time in representing the temporal relations of simultaneity and succession. Now, after illustrating the intuitive nature of time, Kant is able to provide more

support for his earlier claim of apriority. The empirical representations of time must be constrained by an a priori form of intuition, and such an empirical representation, on Kant's arguments, must presuppose the givenness of the such manifold of time in order to be determined.

For this reason, any awareness of time is connected with the perception of objects standing in a temporal relation of simultaneity or succession. The argument Kant presents at the beginning of Metaphysical Expositions of Time is that the *existence* of relations of simultaneity and succession between objects of perception depends on their underlying source in the intuitive form of time. But for these objects of *perception* to exhibit an order of time, matter and experience must be involved. Thus, the a priori link of pure time to objects of experience becomes apparent in this respect: any relational determination of pure intuition of time must involve a determination of the objects of experience as well. This further vindicates the relation that Kant has conceived between the synthesizable nature of time representation and the possibility of reproducing pure time in experience by subjecting it to a priori rules of determination. It also confirms the anti-Leibnizian thread of Kant's argument in the Metaphysical Exposition of time. For it demonstrates that the a priori manifold of time cannot be dependent on conceptual representation within monads, namely, being reduced into a conceptual representation that produces temporal relations as a result. Kant finds this Leibnizian picture of time to be problematic because it denies the possibility of presenting time as a determinable manifold of sense, an a priori manifold that can be experienced in accordance with rules.

3.1.3 Conclusion

The preceding analysis of the Transcendental Aesthetic prepared the transition from the Transcendental Aesthetic to the Transcendental Analytic and the Principles of Pure

Understanding. I have indicated that these cohere more tightly within Kant's overall objective of offering an analysis of experience than might be expected. The Aesthetic presents pure time as a synthetically determinable manifold, which, however, remains dissociated until determined by the understanding. Sensibility lacks the power to determine itself, requiring a higher and spontaneous cognitive power to bring unity into its sensible manifold. Yet, such categorical determination of the understanding is constrained in the a priori ways the manifold of pure intuition of time can be combined. Although a pure intuition of time only presents a manifold with no synthetical unity, it still constrains the categorical synthesis. For this reason, Kant argues later in the *Critique* that for each temporal relation, there corresponds a category or a concept of the understanding, particularly in the relational categories of substance, causation, and community where each refers to a specific temporal relation between appearances.

3.2 The Transcendental Deduction

In the Transcendental Aesthetic, Kant examined the a priori forms of sensibility, arguing that such forms are not discursive or conceptual. They are given as a pure manifold of sense, the pure and mathematical forms of space and time. But these intuitional manifolds are forms of passive receptivity and not of the active function of the understanding. In the Transcendental Deduction, Kant examines the activity of the understanding in relation to the intuitional manifold of sensibility. In the 1770 *Dissertation*, these metaphysical and intellectual concepts were not employed to unify or determine sensible appearances since Kant thought such intellectual concepts are limited in their real use to the intelligible world. It was his discovery of the possibility of using these pure concepts of the understanding in determining the manifold of experience that initiated his critical thought after the *Dissertation*. These concepts are the source of the active determination of the manifold provided by sensibility. For this reason, Kant

construes the purpose of the Transcendental Deduction as uncovering the a priori relation of these concepts to the manifold of intuition.

3.2.1 The Manifold of the Pure Intuition of Time in the Transcendental Deduction

The pure manifold of time is articulated in the Metaphysical Exposition of the Aesthetic as an infinite magnitude that requires determination through limitation and that cannot be determined other than the way it is presented as an a priori pure manifold. This a priori form of pure time constrains the ways such active determination of its manifold is to be pursued. This is a significant presupposition in the Transcendental Deduction of the Categories, where Kant intends to further elaborate on the determination of the manifold of time through the spontaneous activity of the understanding. It was argued before that the manifold of pure time is presented as a manifold that needs to be determined through the conceptual activity of the understanding. It is in this sense that Kant argues in the Transcendental Aesthetic that space and time contain a manifold of pure a priori intuition, and that this content is given before the examination of the role of the understanding in determining this a priori manifold. This is reflected in Kant's distinction between *formal* and *transcendental* logic, according to which transcendental logic extends formal concepts into the manifold of intuition:

> Transcendental logic, on the contrary, has a manifold of sensibility that lies before it *a priori*, which the transcendental aesthetic has offered to it, in order to provide the pure concepts of the understanding with a matter, without which they would be without any content, thus completely empty. Now space and time contain a manifold of pure *a priori* intuition, but belong nevertheless among the conditions of the receptivity of our mind, under which alone it can receive representations of objects, and thus they must always also affect the concept of these objects. (A77/B102).

In this regard, Kant maintains that the understanding is responsible for the reconstruction and determination of the manifold of space and time. The pure concepts of the understanding are

rules of synthesis that are applied to the manifold of experience, which is taken as the matter on which the understanding operates:

> The same function that gives unity to the different representations in a judgment also gives unity to the mere synthesis of different representations in an intuition, which, expressed generally, is called the pure concept of the understanding. The same understanding, therefore, and indeed by means of the very same actions through which it brings the logical form of a judgment into concepts by means of the analytical unity, also brings a transcendental content into its representations by means of the synthetic unity of the manifold in intuition in general, on account of which they are called pure concepts of the understanding that pertains to objects *a priori*; this can never be accomplished by general logic. (A79/B105).

The details of how the understanding achieves this synthetical unity through its operation on the manifold of intuition are further elaborated in the Transcendental Deduction. It shows that the understanding must bring unity into the manifold of intuition through the rules of synthesis, which determine the manifold of pure space and time. Kant links the content of the pure concepts of understanding to the manifold of intuition by showing that such a manifold is necessarily subject to the action of the understanding.

The fact that the pure intuition of time contains a manifold that needs to be unified or determined, indicates that the intuitive nature of time makes it susceptible to determination. As a passive faculty of receptivity, it is unable to bring its manifold into a determinate unity without the action of the pure understanding. It also implies that the content of pure time must be *reproduced* in experience for synthetical unity to be achieved. The a priori necessity of time in the Aesthetic is shown to be significant in so far as the structure of the pure intuition of time grounds the apriority of the axioms that involve reference to time. Thus, the representation of time in experience is constrained by specific laws that cannot be violated in the reproduction of time in experience. It is in this sense that the pure intuition of time is to be conceptually determined by examining the a priori relation of concepts of the understanding to the manifold of

pure time. For Kant, it is through the formation and determination of the manifold of pure time that the understanding can reach the objects of experience and, thus, establish the a priori applicability of the pure concepts of the understanding to the objects of experience. This role of the understanding in the synthesis of time is explicated in the second part of the B section of the Transcendental Deduction.

Kant describes the task of the Transcendental Deduction as an "unavoidable necessity." He points out that, although it has been established that the givenness of objects must conform to the a priori forms of sensibility, it is a different task to show how the pure concepts of the understanding can apply to the manifold of intuition. He argues that with "little effort" (A89), it was proven that all sensible appearances are to be given within the formal structure of sensibility, namely, the pure manifolds of space and time, and that "…the synthesis in them has objective validity" (A89/B122). But pure concepts of the understanding cannot be assumed to apply immediately to objects of experience. Kant explains the nature of this difficulty as follows:

> The categories of the understanding, on the contrary, do not represent to us the conditions under which the objects are given to us in intuition at all, hence objects can indeed appear to us without necessarily having to be related to the functions of the understanding, and therefore without the understanding containing their *a priori* conditions. (A89/B122)

The difficulty here, as Kant envisages it, involves the ability of the a priori forms sensibility to play its role of being the sensible conditions for the givenness of sensible objects without the intervention of the determinative role of the categories of the understanding. Kant believes that it is possible for there to be empty intellectual concepts, which do not apply to the objects or the manifold of experience. This constitutes a threat to the objective validity of any pure concepts, namely, the possibility of having concepts without content. Kant rejects the approach of some philosophers who have pursued an empirical deduction of the concepts of the understanding,

such as Locke, arguing that this empirical investigation is in many respects futile (A86/B119). Such concepts are necessary, and it is impossible to cognize such necessity through an empirical regularity that lacks the a priori necessity. Therefore, the task Kant assigns to a transcendental deduction cannot be carried out empirically; rather, a proper pursuit must be sought through the a priori relation of the categories to the possibility of experience.

The consequence of the Aesthetic is that the manifold of pure time is to be represented as an a priori manifold with determinable content—a manifold that involves a synthesis. In the Transcendental Deduction, this conclusion is exploited to further examine the manifold of pure time with respect to its active determination. Here, Kant brings into focus the role of pure synthesis in the determination of the manifold of intuition. This part of the Transcendental Deduction contains many details of the role of pure synthesis in relation to the manifold of intuition. Kant defines synthesis as "…the action of putting different representations together with each other and comprehending their manifoldness in one cognition." (A77/B103). This synthesis can occur at the level of concepts and is thus also a general condition of conceptual analysis. In the Deduction, the focus is on the synthetic unity of the manifold of intuition, and Kant contends that the synthetic unity of the manifold depends on an act of synthesis (A118) involving an active faculty of cognition rather than the passive and receptive component. The presupposition that the manifold of pure time is open for determination through an act of synthesis will play a significant role in Kant's argument to demonstrate the determination of objects of experience by the categories. The pure time contains an a priori manifold with a prospective synthetical unity.

In the Metaphysical Exposition of Time, Kant had maintained that the manifold of pure time is intuitional and that it is prior to all discursive concepts. This shows that the axioms of time

must be synthetic and that their content is inextricably connected to the form of inner sense. Simultaneity is part of this content of pure time, and it is significant with respect to the inability to represent the coordination of different time-lines without the synthetical unity of pure time. Even though space, as the form of outer sense, provides the proper content for the mind, the simultaneous presence of different time-lines must be grounded in the pure intuition of time:

> It is not merely that the representations of outer sense make up the proper material with which we occupy our mind, but also the time in which we place these representations, which itself precedes the consciousness of them in experience and grounds the way in which we place them in mind as a formal condition, already contains relations of succession, of simultaneity, and of that which is simultaneous with succession (of that which persists). (A49/B67).

Simultaneity connects to space in so far as space is a manifold whose parts are simultaneous and not successive, just as time is one whose parts are successive and simultaneous. Because the coordinative relation between two simultaneous events in time is either directly observable or includes the notion of a spatial separation between them, the identity of a temporal moment, in this sense, is projected across two spatially separated points.

By asserting that simultaneity is only possible within the pure intuition of time, Kant is ascribing intrinsic and objective simultaneity to pure time. The pure manifold of time therefore grounds a sensible synthesis of space in time as well. It is through the synthetic unity of the manifold of pure time that the presence of different temporal predicates in the pure intuition of time is possible. For without the synthetic manifold of pure intuition, the content of these temporal relations of succession, simultaneity, and persistence could not be grasped through the subordination or hierarchical model of conceptual definition. Rather, each relation is to be co-present with other temporal predicates, e.g., simultaneity, successiveness, and perdurance. Now, Kant finds this feature of the synthetic manifold of pure time—as it is viewed in relation to the active determination of the intuitional manifold or in relation to the conceptualization of the

relations of time in accordance with the categories of the understanding—provides the possibility of the relational determination of pure time.[65]

In the Transcendental Deduction of the categories of the understanding, Kant argues that the logical structure of judgment is to be analysed with respect to its transcendental application, namely, the functions of judgment with respect to the content of intuition or the concepts of object in general. The relation of the logical form of judgment to the manifold of intuition becomes relevant as it displays the logical form of experience. For, this logical form of judgment and its logical functions are the source of the categories in relation to the determination of the manifold of intuition. These categories are pure concepts that guide the synthesis of representation.

To explain this further, Kant takes the synthetical unity of the manifold of intuition to be determined by a priori rules, and the pure concepts of the understanding are these categorical rules, which the categorical synthesis follows with necessity. It is neither an arbitrary nor accidental unification of the manifold but a normatively constrained activity of a conceptual determination by the understanding.

In order for this synthetical unity of the manifold of intuition to come about, the unity must be produced by the spontaneous activity of the understanding. However, Kant argues that such unity of synthesis is preceded by a transcendental ground, which is the unity of apperception. This is the unity of consciousness in relation to the conceptual activity of determining the manifold of intuition. The transcendental unity of apperception is a precondition not only to the action of synthesis as it relates to the manifold of intuition, but also to the act of judging in its logical use.

[65] This feature of the time presentation is the ground for the relational determination of the temporal manifold. Kant's objective is to present this manifold as an experienceable manifold.

It is a unity that is recognized in the synthetical act of determining the manifold. Kant contends that the unity of cognition is not possible without apperceptive unity:

> Now no cognitions can occur in us, no connection and unity among them, without that unity of consciousness that precedes all data of the intuitions, and in relation to which all representations of objects is alone possible. (A107).

The identity of the subject in the act of unifying the manifold brings into light the idea that the empirical content of the manifold cannot be the ground of such an identity since this content is dispersed and unruly in its order, and it cannot provide the basis for self-ascription. Thus, this identity connects the spontaneous actions that synthesize the content presented to the subject through affection and passive receptivity and grounds the unity of perceptions. Since it depends on the numerical identity of the subject, the unity of apperception underlies the unity of the manifold by subjecting it to the a priori rules.

The ability to connect the manifold in accordance with the a priori rules and reproduce its content is an expression of the subject's synthetical action, which implies the unity of consciousness in the following sense. Kant believes that the relation between the exercise of conceptual determination and spontaneous self-activity is manifested in the projected unity of the manifold of intuition. This unity must be produced rather than passively received from without, and it must be articulated in accordance with the a priori rules that can guide the synthesis and reconstruction of the manifold. The determinacy of the manifold as such is brought about by conceptually determining its manifold through the production of the synthetical unity. It becomes a necessary and determinate relation to an object if such synthesis is elevated to involve a rule which eliminates the arbitrary and empirical model of associating the manifold.

For this reason, Kant presumes in the A-Deduction that there is an "affinity" (A122) among appearances that makes its reproduction and connection possible in accordance with a priori rules

and concepts. This idea confirms that while Kant construes this relation of affinity to be in appearances, he ascribes it to every potential experiential content in order to be taken into a synthetical process. But this affinity is only possible because of the spatial and temporal structure of the manifold of intuition, which admits content only in conformity with the pure forms of space and time. This potentiality for the connection of its manifolds is referred to as the *affinity* of appearances.

However, Kant considers such affinity to be a consequence of the thoroughgoing affinity that is given through self-consciousness: every content that is potentially articulated as entering into a relation with consciousness must be open for connection and reproduction in accordance with laws. The lawfulness which is found within the appearances involves the possibility of recombining and connecting the manifold (A113). But transcendental affinity in this respect is provided by the internal relations of time and space: these pure manifolds have internal structure due to their homogeneity, and this makes it possible for appearances to be ordered into a system of appearances, which are subject to laws resting on these relations, but which are brought into unity only by the exercise of the subject's spontaneous action of determination.

Kant further explores the possible relation between the forms of intuition and the unity of consciousness (§17-§20). As argued above, the unity of consciousness is reciprocally produced through the act of conceptually determining the manifold, and the conceptual unity is a unity of the rule being applied to the manifold. However, the details of this process require more elucidation, for the synthetical action of the understanding cannot be reduced to the forms of sensibility, while the sensible conditions of the givenness of objects cannot be equated with the intellectual conditions deriving from judgment and understanding. For there is an obvious heterogeneity between the sensible forms of intuition and the pure concepts of the understanding.

Thus, a principal goal of the Transcendental Deduction must consist in resolving this heterogeneity between the forms of intuition and the forms of thought by reconceiving the role of these forms of intuition in the Transcendental Deduction.[66] This does not involve the production of these a priori forms of intuition themselves, rather Kant exploits the content of Transcendental Aesthetic in pursuing the idea of *determining* the manifold of intuition. The reconstruction of the forms of intuition means showing that the pure forms of space and time are reproduced in experience by the action of an a priori synthesis. Such an a priori synthesis, Kant claims, must be guided by rules that are supplied by the understanding.

3.2.2 The Threefold Synthesis

Kant describes the pure synthesis of time in the A-Deduction, where it appears as the "threefold synthesis," as well as in the B-Deduction in its second stage, that is to say, in the discussion of the "figurative synthesis of imagination". The idea of a priori synthesis entails that the manifold of intuition be brought into a determinate structure. In the A-Deduction, where Kant also explores the role of the synthesis of imagination, this process of synthesizing the manifold of intuition is first presented along with its role in the production of the synthetical unity of the manifold. This process involves reference to the synthetic content of the manifold of pure time, which is constructed as an image reproduced in experience.[67] Kant calls it a "threefold synthesis"

[66] Longuenesse (1998, 214-235) articulates a position that the Transcendental Deduction requires what she refers to as "rereading" the Transcendental Aesthetic, where the forms of intuition essentially are products of the synthetic action of the understanding on sensibility. But this action by the understanding is not conceptual, for it only involves the first action of the understanding in its reflective function. In this way, Longuenesse believes it is possible to avoid ascribing to Kant the position that the forms of intuition are only a product of the conceptual action of the understanding. This interpretation seeks to extend reflection to the role of sensible intuition in coordinating the sensible content of empirical intuition, but this obviously violates the sheer distinction between sensibility and understanding.

[67] This relates to Kant's emphasis on the role of imagination in the synthesis of apprehension. He makes this clear in this important paragraph in the A-Deduction:
"But since every appearance contains a manifold, thus different perceptions by themselves are encountered dispersed and separate in the mind, a combination of them, which they cannot have in sense itself, is therefore necessary. There is thus an active faculty of the synthesis of this manifold in us, which we call imagination, and whose action

involving the following three steps: the synthesis of apprehension, the reproductive synthesis, and the synthesis of recognition in concept. He argues that, in order for this process of synthesis to be carried out, the combination must reach the content of sensibility. Through the combination, the content of sensible intuition can be presented as a content unified under specific rules, which derive from the categories. Kant has indicated before, in the Aesthetic, that the a priori forms of intuition must contain a manifold and that these forms of intuition present the sensible content in temporal and spatial order. Here, in the Transcendental Deduction, this synthesizable and intuitional content is now to be determinate through conceptual synthesis, specifically, by demonstrating the condition on reproducing the pure manifold of time in experience.

The synthesis of apprehension in the intuition is the first stage, whereby the manifold is taken and synthesized. This synthesis is not only empirical, as it is also exercised a priori with respect to the pure manifolds of space and time. Since every appearance must be subject to the formal structure of inner sense, namely, time, and since the manifold of pure time has intrinsic linear order, all presentations occur in conformity with this order. But the receptivity of sense impressions is not sufficient to apprehend the manifold into these temporal relations, and an a priori action must be exercised on the manifold of sense impressions in order for the apprehension of a unified manifold to succeed. Therefore, Kant argues, the manifold of pure time must be brought into a unity, and this unity is only produced by an activity of synthesis and is not to be reduced to the individual sense impressions.

exercised immediately upon perceptions I call apprehension. For the imagination is to bring the manifold of intuition into image; it must therefore antecedently take up the impressions into its activity, i.e., apprehend them." (A120/121)

Since temporal relations are, according to the Aesthetic, the ways in which both inner and outer content is first received, it is these same relations that must then be apprehended. Therefore, such a unity of the manifold only arises by running through it and synthesizing it, as Kant explains in a famous passage from the A-Deduction:

> Every intuition contains a manifold in itself, which however would not be represented as such if the mind did not distinguish the time in the succession of impressions on one another; for *as contained in one moment* no representation can ever be anything other than absolute unity. Now in order for *unity* of intuition to come from this manifold (as, say, in the representation of space), it is necessary first to run through and then to take together this manifoldness, which I call the *synthesis of apprehension*. (A99).

This synthesis of apprehension accompanies the passive receptivity, making a note of the temporal order that distinguishes the successive array of sense impressions; Kant argues that without this a priori synthesis of apprehension, "we could have a priori neither the representations of space nor of time, since these can be generated only through the synthesis of the manifold that sensibility in its original receptivity provides" (A100). In other words, Kant does not deny that the manifold of sensibility is passive—on the contrary, it is this passivity which requires the active faculty of apprehension. True, the pure intuition of time involves a determinate order, reflected in concepts such as *succession*, *simultaneity,* and *perdurance*; however, without the synthetic action of the imagination, the mind would "not distinguish the time in the succession of impressions." (A99)

The second stage of the threefold synthesis is the synthesis of reproduction in the imagination. This synthesis produces empirical images by retaining and combining the manifold. It is tasked with reproducing the manifold in experience in accordance with rules, since the production of a temporal sequence of successive moments conforms to some pattern. The synthesis of

apprehension, Kant claims, could not operate if the pure manifold of time were not reproduced by being exhibited in this temporal sequence of empirical content.

Kant emphasizes the empirical nature of this reproductive synthesis of imagination, as his point is that the empirical image in the perception of events involves a reproduction of pure time in experience. Kant argues that without the reproductive synthesis, it would be impossible to grasp the successive nature of experience, and thus to retain the identity of the object perceived. This entails that the object of perception unfolds in time and that the sequence of sense impressions belonging to this same object, despite the shifting and changes of perception, forms a unity. Thus, the a priori basis for such an empirical synthesis lies in an a priori synthesis of imagination, which is responsible for the a priori production of images. It establishes a relation between the form of intuition and the rules of time-determination by producing the synthetical unity of the manifold. Kant argues that this reproductive synthesis of the imagination is grounded on an a priori synthesis (of imagination) since even the purest intuition of time and space depends upon the reproduction of images:

> Now it is obvious that if I draw a line in thought, or think of the time from one noon to the next, or even want to represent a certain number to myself, I must necessarily first grasp one of these manifold representations after another in my thoughts. But if I were always to lose the preceding representations (the first parts of the line, the preceding parts of time, or the successively represented units) from my thoughts and not reproduce them when I proceed to the following ones, then no whole representation and none of the previously mentioned thoughts, not even the purest and most fundamental representations of space and time, could ever arise. (A102)

Kant contends in this passage that the temporal connection between successive moments is the ground of the pure representations of space and time. Therefore, the possibility of reproducing the pure manifold of time in experience is not entirely distinct from the pure synthesis of

apprehension in its a priori exercise, since the production of the synthetical unity of the pure manifold of time is also construed as a pure production of the image of succession.

Thus, Kant concludes this discussion of the reproductive synthesis by claiming that the synthesis of apprehension is "inseparably combined with the synthesis of reproduction." (A102). The two syntheses must be so related because the reproductive synthesis retains the previous one and juxtaposes it to the next one, namely the present, enabling the bundling done by apprehension. This resulting ordered sequence exhibits the structure of the manifold of time in empirical synthesis by connecting the succession of sense impressions.

The last of the three syntheses is the synthesis of recognition in a concept, which brings the threefold synthesis to its conclusion, namely, the conceptual determination of the manifold of pure time. It concerns the unity of the synthesis in so far as the reproductive imagination is brought under a rule. In the reproductive synthesis of imagination, the retention of images ensures that the content that is being preserved in successive moments of synthesis refers to one object (A103). In this sense, it calls for a unity of the rule in the successive synthesis. A concept, according to Kant, can be regarded as the recognition of the synthetic unity of the manifold (A103). The reproduction of images in the empirical synthesis of imagination must be carried out for there to be an awareness of the identity of the collection of sense impressions. Thus, it is also required for these to be represented as belonging to one object, that is to say, to constitute a whole, thereby concluding the unification of the manifold of sense impressions into one (A104-105).

The point of this successive synthesis is to demonstrate that the pure intuition of time is open for determination, that it is possible to conceptualize the content of time with the categorical synthesis of the understanding, and that time is presented in relation to the possibility of

categorical synthesis of perceptual content. For Kant, these two syntheses, the pure manifold of time and empirical objects, are not separate. This is explained by Kant through the synthetical content of pure time and pure space as intuitional manifold:

> The synthesis of spaces and times, as essential form of all intuition, is that which at the same time makes possible the apprehension of the appearance, thus every outer experience, consequently also all cognition of its objects, and what mathematics in its pure use proves about the former is also necessarily valid for the latter. (A166/B206).

In other words, Kant appeals to the forms of intuition to establish that such intuitional forms can be reproduced by a sensible and mathematical synthesis, which is required for them to be recomposed in unity. The role of pure time in this relation is significant, as it is through the action of the pure understanding on the pure manifold of time that the perceptual recognition of empirical objects becomes possible. This action of the understanding is a spontaneous exercise of conceptual determination, and it is pursued under the guise of the productive synthesis of imagination as it synthesizes the content of pure sensibility.

3.2.3 The Figurative Synthesis of the B-Deduction

The second part of the B-Deduction explicates the role of the productive imagination, or the "figurative synthesis," in synthesizing the pure content of sensibility and, thus, the empirical content provided by sensibility. As in the A-Deduction's treatment of the threefold synthesis, here, in the B-Deduction, Kant also appeals to time-determination by the understanding as the medium linking the pure concepts of the understanding to the manifold of intuition, thus relating the categories to the empirical content of perception. The operative assumption in this part of the Transcendental Deduction is that all sensible particulars or objects are presented under the formal conditions of the manifolds of pure time and pure space. Every intuition must contain a manifold, and the manifold is to be determined by a rule. For example, the intuition of pure time is to be

determined in relation to the empirical content presented in successive moments. The argument given in this stage assumes that the content of the intuitional manifold includes not only the pure content of the manifold but also the presence of outer objects, as immediately presented to the subject through perceptual experience.

To determine the manifold of the pure intuition of time is to determine it relationally. This refers to the synthesizable and determinable content of the intuition of time, in which objects of experience are determined as they are presented in the manifold of the pure intuition of time. Although the manifold of intuition is inseparable from the determination of objects of experience, the a priori nature of pure time constrains the ways in which the understanding can determine empirical content. Kant explains the nature of this spontaneous action of the understanding in the following terms:

> …inner sense, on the contrary, contains the mere *form* of intuition, but without combination of the manifold in it, and thus it does not yet contain any *determinate* intuition at all, which is possible only through the consciousness of the determination of the manifold through the transcendental action of the imagination (synthetic influence of the understanding on inner sense), which I have named the figurative synthesis. (B154).

The form of intuition only provides the mere form, while the act of combination is accomplished by figurative synthesis. However, the mere form of intuition still constrains the action of the understanding and how this action can be performed. It involves a temporal "sketching," that is to say, a determination that is a priori constrained by the form of intuition.

The relational determination of pure time in the second part of the B-Deduction emphasizes that this spontaneous activity by the subject brings the manifold into a determinate and unified content. It does not, however, involve the spontaneous production of the intuitional form itself, which would render time conceptual against the explicit prohibition of the Aesthetic. Rather, the form of intuition constrains the performance of the understanding in relation to the empirical

content of perception. This only requires the reproduction of pure time in the experience of outer objects, on which pure time can be exhibited in the successive order of experience. It presents the manifold of pure time as an experienceable manifold. In this sense, categorical synthesis transforms pure time from a passive form of intuition into a conceptually determined manifold.

The role of the figurative synthesis in the B-Deduction is explicitly discussed in §24, which concerns the imagination's role in determining the manifold of intuition, as far as it reaches this manifold. The imagination represents the synthetic action of the understanding on the forms of sensibility, particularly on the manifold of inner sense. As explicated in the Transcendental Aesthetic, time is the form of the inner sense, and the proper content of inner sense is provided by outer sense, whose form is space. Kant invokes this symmetry between time and space as the forms of inner and outer sense in the B-Deduction to demonstrate that inner sense cannot, by its mere form alone, determine itself. It is merely a passive capacity, which requires active synthesis, accomplished by the understanding through figurative synthesis. Equally important, the spontaneity of the imagination in affecting inner sense expresses the spontaneity of the understanding, acting under the guise of imagination, to produce a unity of the manifold of intuition. Kant refers to this process as "self-affection" (B156), which invests in the notion of the successive synthesis of the manifold, and is exemplified for Kant by the construction of pure manifolds of time and space:

> We cannot think of a line without *drawing* it in thought, we cannot think of a circle without *describing* it, we cannot represent the three dimensions of space at all without *placing* three lines perpendicular to each other at the same point, and we cannot even represent time without, in *drawing* a straight line (which is to be the external figurative representation of time), attending merely to the action of the synthesis of the manifold through which we successively determine inner sense, and thereby attending to the succession of this determination in inner sense. (B154-5)

This successive synthesis of the space and time manifolds reproduces pure time and space in experience, thereby grounding the formation of particular empirical images within time and space.[68] Kant makes this clear in his claim that time cannot be an object of outer sense, and it is representable only under the image of a line, namely, an outer and spatial representation (B156). In this way, Kant wants to emphasize the possibility of unifying a manifold of both inner and outer content by means of the synthetic determination of the understanding, meaning that a unification of pure time is inseparably connected with a unification of the spatial manifold. This reinforces the notion that a relational determination of the manifolds of space and time is an integral component in the empirical determinacy of pure time.

The final stage of the B-Deduction brings the categorical synthesis of the understanding to the empirical content provided by the synthesis of apprehension and reproduction. In §26, Kant announces that by analysing the conditions under which a categorical synthesis can reach the content of empirical intuition, he will achieve the objective of the Transcendental Deduction. To show that categories necessarily apply to experience, Kant argues that the synthesis of apprehension, as the synthesis presupposed by all giving of sensible content, must conform to the forms of intuition. Furthermore, Kant argues that these forms of intuition are not *mere* forms, but

[68] Laywine (2020, 242) argues that the production of images of space and time is essential to the production of a sensible world, and that perception: it "is a self-active attempt to construe the manifold given to us in our intuitions: it is image production, not image reception. As such, it essentially involves situating the elements of an empirical manifold relative to one another in space and time. But it cannot carry out this activity unless resources are available to us for orienting our imagination in space and time. It seems reasonable to suppose that these resources just consist in a capacity to situate parts of space relative to one another and parts of time relative to one another" (Laywine, 2020, 242).
Laywine is correct to point out the relation between the production of images of space-time and the relational determination of the sensible world as such. But this suggestion does not make it clear as to how the production of images relates to the forms of intuition themselves, and whether this reduces the forms into mere products of a priori synthesis of imagination.

forms that contain a manifold requiring synthesis (B160), explaining this in detail in a well-known footnote to this section:

> Space, represented as *object* (as is really required in geometry), contains more than the form of intuition, namely the *comprehension* of the manifold given in accordance with the form of sensibility in an *intuitive* representation, so that the *form of intuition* merely gives the manifold, but the *formal intuition* gives unity of the representation. In the Aesthetic I ascribed this unity merely to sensibility, only in order to note that it precedes all concepts, though to be sure it presupposes a synthesis, which does not belong to the senses but through which all concepts of space and time first become possible. For since through it (as the understanding determines the sensibility) space or time are first *given* as intuitions, the unity of this *a priori* intuition belongs to space and time, and not to the concept of the understanding. (B160).

This note invites different interpretations, and some have suggested that it can be dismissed as a confusion that should not be taken seriously.[69] The note presumably presents a further explication of Kant's claim that the forms of intuition must be taken to contain a manifold, and since it is a manifold, it must be synthesized.[70] On the other hand, in this note, Kant appeals to the Expositions of the Transcendental Aesthetic to demonstrate that the manifolds of space and time involve a synthesis that precedes all concepts of the understanding, and such a pre-conceptual synthesis within sensibility brings unity to its content, namely, the sensible intuition of space and time. At the same time, Kant makes it clear that the unity of synthesis belongs neither to the understanding nor the senses, but to space and time.

In order to resolve this contradiction, one should recall Kant's earlier assertion that the forms of intuition "contain a manifold" as a guide to make sense of this note. That is to say, space and

[69] Falkenstein (1995, 90-91) makes the suggestion in effect to drop any attempt to make sense of this note, for it contains a contradiction.

[70] Allison (2015, 387) suggests that the difference between the manifold of time in A-Deduction and B-Deduction, as it relates to the manifold of pure intuition of time, is that the synthesis of time in A-Deduction is concerned with the successive nature of time as modification of inner sense which focuses on the empirical successive data, and how it entails a corresponding a priori synthesis of time. However, on the figurative synthesis of B-Deduction, Kant focuses from the beginning on the a priori synthesis and its unity as such, which requires viewing time not merely through its empirical and given successive nature but also on its 'singleness' and unity.

time are, in some sense, unities that contain parts, even if only implicitly. In this sense, the synthetic content of the manifold of intuition offers a "determinable manifold". The understanding, in its determinative function, does not produce these multiplicities themselves, but binds together the content of the manifold of intuition that is "given". This gives a way to reinterpret this note as being about the conversion of the form of intuition into a manifold, where the presented manifold must be determinable. For the understanding does not synthesize or produce the forms of intuition themselves but only performs a synthesis on the determinable manifold as exhibited within the a priori conditions of space and time.

For this reason, Kant refers to the unity of the forms of intuition as being independent of the operations of the understanding, however, the forms of intuition are only the a priori conditions for the giving of sensible content, which in turn provides the understanding with the proper material for unification. It is by virtue of such a priori forms of intuition that the understanding can determine the empirical content of the synthesis of apprehension through the recognition of the a priori forms of temporal and spatial relations exhibited by the manifold of sensible content. Therefore, the understanding, by synthetically unifying the manifold, can also determine the *empirical* content of the intuitional manifold, and consequently, the categories provide the synthetical unity of the synthesis of apprehension (B161).[71]

[71] In his "Two Kinds of Unity in the *Critique of Pure Reason*", McLear (2015, 99-105) argues that there are two kinds of unity which Kant has developed to account for cognition. One type is an *aesthetic* unity, and it is provided by the structure of intuition, while a *discursive* unity is given through the conceptual combination of the manifold. The difference lies, according to McLear, in the aesthetic unity, in the fact that there is an episodic consciousness which does not involve a combination, but it yet is sensory taking of an object without ascribing to it qualities. This is contrasted with a discursive unity, in which the recognition of these qualities as belonging to an object is necessary. The problem with this interpretation is that it does not take into consideration Kant's insistence on the a priori synthesis as accompanying every empirical synthesis or perception. Kant's argument for the necessity of an a priori synthesis in relation to perceptual experience indicates that as long as a spatio-temporal manifold underlies perceptual experience, it must be open for synthetic determination.

3.2.4 Conclusion

As we have seen, in the Transcendental Deduction, Kant pursues the relational determination of the pure manifold of time and space. In doing so, he revisits his claim that the *a priori* nature of time and space as forms of intuition that await the action of the understanding to be unified and structured. The objective is, therefore, to demonstrate the applicability of the categories considering their role in synthetically and relationally determining the manifold of space and time, and in this, determining time. The Transcendental Deduction thereby grounds the lawful determination of time,[72] and prepares for the next stage of Kant's idea of the empirical determinacy of time. This next stage is the Analogies of Experience, where Kant aims to show how the relations or "modes" of time (B227), such as persistence, succession, and simultaneity, are reproduced in experience through the relational and dynamical categories.

[72] Stan (2019, 434) argues that the durative or the necessary structure of pure time cannot be grounded through the categorical and transcendental synthesis of the Transcendental Deduction, but requires a metaphysical grounding through the nature of matter. As has been demonstrated so far, the a priori and categorical synthesis of the understanding is essential in so far as it entails that the time-manifold must be synthesized, and that this synthesis is an a priori condition on the empirical determinacy of time, and of the possibility of reproducing temporal relations in experience. For Kant, the empirical realization of the structure of time demands that such a priori structure of time be presented in the sensible manifold of time and be synthesized in accordance with the relational categories of the understanding.

4. Kant on Causal Interaction

In the Principles of Pure Understanding of the *Critique,* Kant derives the results of his arguments concerning the empirical determination of time, the most important of which are the Principles of the Analogies of Experience. In the Transcendental Deduction, pure time was determined by the action of the understanding through the synthesis of the imagination, which brings the manifold of inner sense into a determinate manifold. In the Analogies, this synthetical action of the understanding is shown by the empirical determination of time, thereby conceptually realizing the relations of pure time such as duration, succession, and simultaneity in experience. This is made possible through the principle of the Analogies, which posits that experience is possible only through the representation of a necessary connection (A176/B218). Perception involves the synthetic unity of experience, requiring a determinate relation to the object of perception. Kant contrasts it with the occurrence of mere *sensations,* which lacks this determinate relation to objects of perception. So, in order for this relation to objects to obtain, the empirical determination of pure time must find the necessary rules to connect the perception of objects. For example, the relations between objects of perception must exhibit temporal relations, and the unification of this manifold is achieved through the relational determination of experience. Kant argues that the connection of appearances follows the procedures of relational determination, which includes the deployment of the relational categories such as substance, causation, and community.

Each of the relational categories contains a temporal relation applicable to temporal experience. The relational determination of the pure manifold of time posits that pure or absolute time cannot be perceived. This premise is involved in the development of Kant's arguments in each section of the Analogies of Experience. The determination of the manifold is pursued by

examining the relations between appearances and how the connection among these appearances gives rise to necessary rules. Kant's strategy is to explicate the temporal relations within the structure of perception that corresponds to the connected and sequential occurrence of appearances. Thus, the synthesis is about the existence of objects in the manifolds of space and time rather than the mathematical synthesis of the form of time and space as such.

Kant argues that, through the application of these relational categories, the existence and position of appearance in the manifold of space and time "can be determined in respect of the unity of all time" (B219). Thus, the spatio-temporal location of material appearances can only be determined by their relations with each other, and the mode of explanation of this relational content of experience is *dynamical* rather *mathematical*, since the latter is concerned with the quantification of the pure manifold of space and time, as opposed to the order-relations of material appearances within it.

4.1 The Second Analogy

In the Second Analogy, Kant analyzes the successive order of appearances. The significance of this Analogy is that it pertains to the most important feature of time, namely the successive order of its contents. The principle of the Second Analogy is expressed differently in the A edition and B edition. In the A edition, it is stated as follows:

> Everything that happens, that is, begins to be, presupposes something which it follows in accordance with a rule. (A189)

But in the B edition, Kant states it differently:

> All alterations occur in accordance with the law of the connection of cause and effect. (B232)

The emphasis in both formulations is on the concept of alteration (*Veränderung*) or "everything that happens", which must involve a succession of opposite moments. The idea of alteration or

change needs to be subsumed under a causal rule in order to be objectively determined. Kant presents different formulations of the proof of the principle of causality;[73] and I will take the position that there is only one proof to be found in these different formulations that Kant puts forward. I argue that, for Kant, the concept of causation is necessary for the empirical determinability of time in experience. The empirical determinability of time requires that the perception of an event includes a recognition of the necessary succession of its parts, which requires positing a cause as the condition for this necessary and objective succession within the temporal content of the event. Thus, by exhibiting this temporal succession of an event as indicating a necessary succession, the pure succession of time becomes empirically determinate.

The concept of empirical determinability of time is evident from Kant's arguments in the Second and the Third Analogies. In the Second Analogy, which is concerned with the successiveness of time, the empirical determinability of temporal succession must be accounted for by the concept of causal determination. The consideration of the idea of the empirical determinability of time in the Second Analogy connects the Second Analogy with the Third Analogy. The latter Analogy, as will be demonstrated, is concerned with the empirical determinability of time as well, and intends to explain the causal basis for the temporal relation of simultaneous coexistence through mutual interaction.

Both Analogies are significant in so far as the empirical determinacy of pure time is concerned, as each one of them is about the possibility of empirically exhibiting a temporal relation, either succession in the Second Analogy or simultaneity in the Third Analogy. For this reason, these two Analogies must not be treated in isolation if the objective is to determine the

[73] Paton (1951, V.2, 224-225) presented six proofs of this principle in the Second Analogy. He does not take these proofs as different versions of the same proof.

relations of time empirically. Kant seeks a causal explanation for these temporal relations, and he will link the two Analogies by demonstrating that the principle of necessary connection in perception requires successive causality and reciprocal determination. For this reason, it is important to examine Kant's proof of successive causality as it pertains to the ordering of time as a successive order.

The Second Analogy contains several formulations of proof, which is intended to establish that causal determination brings determinate order into the subjective succession of appearances. The first formulation of Kant's "proof" proceeds as follows:

> 1) "I perceive that appearances succeed one another, i.e., that a state of things exists at one time the opposite of which existed in the previous state."
>
> 2) "Thus I really connect two perceptions in time."
>
> 3) "Now connection is not the work of mere sense and intuition, but it is here rather the product of a synthetic faculty of imagination, which determines inner sense with regard to temporal relations."
>
> 4) "This, however, can combine the two states in question in two different ways, so that either one or the other precedes in time."
>
> 5) These two states cannot be connected by taking them in relation to absolute time itself, since time itself is not perceived.
>
> 6) "the objective relation of appearances that follow upon one another is not to be determined through mere perception."
>
> 7) "Now in order for this relation be cognized as determined, the relation between the two states must be so thought in such a way that it is thereby determined as necessary which of them must placed before, and which after rather than vice versa."
>
> 8) "The concept, however, that carries a necessity of synthetic unity with it can only be a pure concept of understanding, which does not lie in the perception; and that it is here the concept of the relation of cause and effect." (B233/B234)

In this proof, Kant considers the idea of temporal succession through the perception of successive states that can be ordered in different ways. This means determining the successive manifold in

accordance with a necessary rule, which then turns the subjective succession as presented in the inner sense into an objective succession. This proof is reformulated in various ways throughout the Second Analogy, and in each formulation, Kant emphasizes the idea of perceiving a subjective succession that needs to be objectively ordered. The point of this emphasis on the concept of a successive manifold for Kant is to indicate that perception involves a uniting of two or more temporal moments and that perceptual experience contains this process of uniting different and incompatible moments of time.

According to Kant, this synthesis of time is effected by the imagination in its empirical function, specifically, the reproductive synthesis of imagination, which is not constrained in its use and is free to place discrete events in any order. Kant then rules out two possible ways of making this indeterminate synthesis of time a necessary one (B233-234). First, one might relate every appearance to an absolute time, with its intrinsic order, that is, without reference to its relational position with other appearances. However, since it is impossible to perceive absolute time, this option is ruled out. Second, the appearances themselves might somehow determine their relative temporal positions. But, the mere perception of the temporal order, as presented subjectively, is not sufficient to determine the temporal position of appearances relative to other appearances. This is because perception, guided by the empirical function of the reproductive imagination, cannot alone account for the necessary order of the successive manifold. The successive synthesis of the temporal manifold means that the manifold of succession is linearly ordered, and this order must be necessary and irreversible. In order for the irreversibility of the successive appearances to be objective, it must be determined not through my subjective receptivity, but through a relation conceived as governing the appearances independently of me. This rule must determine the synthetic unity of objective perception, and this determination

entails that the states be represented in only one successive order. This relation between these successive states is taken by Kant to be the relation of cause-effect. This claim is articulated by Kant as the conclusion of his argument demonstrating the necessity of employing the concept of causality to determine the successive manifold of perception.

In the subsequent parts of Kant's discussion of causality in the Second Analogy, he presents different versions of this proof. For instance, in his initial claim, where he asserts the temporality and successiveness of perceptual awareness, he also maintains that there is diversity within this perceptual awareness, and the subject recognizes *differences* within each perceptual content. Kant argues that such difference must be temporal, involving two states, each of which is considered to occupy two successive temporal positions.

This claim about the temporal location of each appearance in the successive manifold makes it clear that the subjective temporal order of sensory experience is possible without the application of causal concepts, and the subject is aware of this temporal difference within the content of sensation. This awareness reflects the dependency between the present and the preceding moment. However, this dependency calls for further determination, but at this stage, the subject finds it necessary to ascertain the type of dependency that must exist between different moments. In characterizing the temporal content of perception and how the successive manifold is temporally arrayed, Kant refers to appearances succeeding one another, stating that "a state of things exists at one time the opposite of which existed in the previous state" (B233). He characterizes this temporal difference and separation between states of things as manifesting opposite states, showing that the state being apprehended is incompatible with the preceding one. In sensory perception, the incompatibility between states refers in part to the mere temporal separation between them. However, the temporal order of this content is presented in inner sense,

with no determinate relation to an object. Kant characterizes this temporal separation between the prior state and the present as follows:

> That something happens, i.e., that something, or a state comes to be that previously was not, cannot be empirically perceived except where an appearance precedes that does not contain this state itself. (A191/B237).

This characterization of incompatibility between the different states is presented in a temporal structure, which includes the idea that the current state contains in its content the idea of being preceded by a state that excludes it from happening. According to Kant, this perception makes it part of the content of the successive manifold that a present state is incompatible with the prior state. This is also reinforced later by Kant's description of the temporal position of appearances:

> …I represent something as an occurrence, or as something that happens, i.e., I cognize an object that I must place in time in a determinate position, which, after the preceding state, cannot be otherwise assigned to it. Thus if I perceive that something happens, then the first thing contained in this representation is that something precedes, for it is just in relation to this that the appearance acquires its temporal relation, that, namely, of existing after a preceding time in which it did not. (A198/B243).

Kant's question regards the temporal position of appearances and what makes them acquire their determinate temporal position. The temporal position of appearances can only be determined relative to a preceding state, which is possible only if I recognize the current state as being precluded from taking place in the preceding position in time. This recognition indicates that both states are incompatible in some way or another. This result follows from the mere recognition of the temporal unfolding of a given event (*Begebenheit*), where the temporal parts of an event cannot coexist simultaneously, but rather have a successive order of unfolding.

However, Kant finds it necessary to distinguish between objective succession and subjective succession because mere apprehension is only ever subjectively successive. Thus, in order to rule out the mere subjective succession, it is required that the temporal unfolding of an event be

objectively determined. For this reason, Kant contrasts the perception of an event, such as the perception of a ship moving down stream where it is not possible to reverse the order of its temporal parts, with the perception of a house. In the case of the house, the successive manifold of perception does not demand a specific order, as its parts coexist, and it is possible to reverse the order of the successive manifold without affecting the way the object of perception is determined. Thus, in the perception of a house, "there was therefore no determinate order that made it necessary when I had to begin in the apprehension in order to combine the manifold empirically." (A193/B238). However, in the case of an event, specifying the order of apprehension is required. (A193/B238). In a successive event, the order of presentation cannot be reversed, as this would undermine the objective succession ascribed to the objective determination of the event. Since the imagination is always free to place appearances in any order, only an objective order would rule one possibility out. The missing element is, therefore, whatever rules out one possibility in favour of the other.

In the following section, different interpretations of the proof of the Second Analogy are presented. The purpose is to demonstrate the limits of these interpretations with respect to Kant's objective in the Second Analogy, which is to provide empirical determinacy of time through the concept of causality.

4.1.1 Interpretations of the Second Analogy:

i. Peter Strawson

The concept of irreversibility in Kant's argument requires further elucidation. He attaches this concept to the objective determination of the successive manifold, implying that the way an event is presented, its temporal parts cannot be reversed. For example, a perception of an event consists of successive temporal parts A-then-B., and in this case, A cannot be posterior to B, nor

can B precede A. Thus, by excluding these possible temporal arrangements of the temporal parts of an event, A-then-B, irreversibility is included in recognition of this temporal unfolding of perception as representing an objective event.

One possible objection to this line of reasoning is advanced by Peter Strawson.[74] Strawson aims to demonstrate that Kant equivocates between two forms of necessity in his argument for successive causality. Kant, according to Strawson, seems to argue that if irreversible and necessary order is indicated by the perception of a sequence of A and B, this order also indicates a necessary order between A and B as objectively occurring. However, the problem with this proof is that it presupposes that my perceptions of either A or B must be caused by A and B in order to make this judgment. However, this inference from the necessary order of perception to an objective event requires independent causal dependencies between the perception and the objects.[75] Strawson refers to this conflation of necessity in Kant's argument in the following passage:

> Suppose the objective succession in question consists in the succession of state of affairs B upon state of affairs A, in the change, that is to say, from A to B. It is admitted, in the sense and with the qualifications mentioned, as necessary that the perception of the second state (B) follows and does not precede the perception of the first state (A). To conceive the sequence of perceptions as perception of an objective change is implicitly to conceive the order of perceptions as, in this sense, necessary. But—and here comes the step—to conceive this order of perception as necessary is equivalent to conceiving the transition or change from A to B as itself necessary, as falling, that is to say, under a rule or law of causal determination.[76]

This reading of Kant's argument in the Second Analogy assumes that he has conflated two forms of necessity in his proof of causality. The argument assumes that the necessity of perceptual irreversibility is equivalent to the necessary order of an objective event.

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[74] Strawson characterizes it as "*non-sequitur of* numbing grossness" (1966, 136)
[75] (Strawson, 1966, 136)
[76] (Strawson, 1966, 137-38)

The problem with Strawson's interpretation is that Kant does not infer the necessary order of an objective event from the order of perception. As argued earlier, subjective succession cannot independently provide the necessary and irreversible order of an event. The subjective succession, as the temporal content of inner sense, only offers a manifold that needs to be structured. Thus, Kant contends that the objective unfolding of an event cannot be extracted from the sensory apprehension of it. Perception must be brought under a rule to attain this determinate irreversibility of perception, which involves the conceptual determination of the synthetic unity of perception, thereby recognizing the successiveness and irreversibility of the content of perception as objective.

ii. Lewis White Beck

To address the worry about invoking the concept of irreversibility, Lewis White Beck develops an interpretation in which the concept of irreversibility plays a prominent role. Beck argues that Kant's proof should be presented as follows:

> 1- That the state A in the object precedes the state B in the object, symbolized as (AB), is a sufficient condition, given perceptual isomorphism, for the irreversibility of the sequence of the perceptual representations of the states A and B (symbolized as (A_rB_r)).
>
> 2- But our knowledge of (A_rB_r) irreversibly is not a sufficient condition for knowledge that (AB) occurs, and a fortiori not a sufficient condition for knowledge that (AB) irreversibly occurs. For:
>
> (i) It could be the case that A and B are coexistent but such as to be always perceived in the order (A_rB_r), which is interpreted as (A_rB_r)- irreversibly; or
> (ii) It could be the case that B precedes A, if perceptual isomorphism fails.
>
> 3- In order to know, or to have good reason to believe, that (AB) occurs, given knowledge of (A_rB_r)- irreversibly, I must know or have good reason to believe both that:
>
> (i) A and B are opposites states of a substance, in order to rule out 2 (i); and
> (ii) (AB)- irreversibly, in order to rule out 2(ii).

> 4- Knowledge of, or a sufficient reason to believe, 3 (i) is sufficient reason to know or justifiably believe there is an event (a change of states of an object) but not sufficient reason to know or believe that the event is (AB) and not (BA).
>
> 5- But I know, or have sufficient reason to believe, that (AB) occurs.
>
> 6- Therefore I know, or have sufficient reason to believe, that (AB)- irreversibly occurs. (3, [ii]).
>
> 7. (AB)-irreversibly is the schema of causation.
>
> 8- Therefore to know, or to have sufficient reason to believe, that (AB) occurs, I must know, or have sufficient reason to believe, that, A is, or contains, a causal condition of B.[77]

In this reconstruction of Kant's proof, Beck considers premise 7 as the mediating term connecting (AB) irreversibility with causation. Irreversibility is the schema of causation, where a cause cannot precede its effect. This schema is interpreted to entail that the objective ground for this irreversibility lies in A being the causal condition for B. Hence, Kant does not accept the idea of deriving (AB) irreversibility from the mere recognition of (A_rB_r) irreversibility—the sequence of perception does not sufficiently demonstrate that an objective irreversibility occurs in (AB). Instead, Kant argues that for (AB) irreversibility to obtain, it must be based on an objective determination, i.e., A determines B. Therefore, it is incorrect to ascribe to Kant the non sequitur that Strawson finds in Kant's proof. According to Beck, irreversibility (A_rB_r) alone cannot justify the inference from this representation to the objective succession, and thus undermines the attempt to conflate perceptual awareness of necessity with objective and conceptual necessity.

Beck's reconstruction of Kant's proof assigns a role to the perception of successive manifold and argues that perceptual irreversibility must somehow be interpreted as indicating an event. In

[77] (Beck, 1978,148-149)

premise 3 of Beck's reconstruction, it stated that knowledge of (A_rB_r) irreversibility provides good reason to believe (AB) irreversibility, provided that conditions (3 [i]) and (3 [ii]) are satisfied. These conditions require that A and B be opposite states of a substance, and that (AB) irreversibility holds. This (AB) irreversibility is the schema of causation, which justifies the inference that A contains the causal condition for B. However, the problem with this justification is that it calls for a stronger sense of irreversibility in (AB) to justify this inference. In this stronger sense of irreversibility, it cannot be inferred from the fact that a sequence of A and B is caused by another sequence, where A is not the cause of this irreversible sequence, and a separate cause C is posited to explain the sequence of A and B.

This strong sense of irreversibility is discussed by Van Cleve, and it refers to the possibility of A as caused to precede B, resulting in a caused sequence rather than a causal sequence that exhibits a causal determination between its components. This sense of irreversibility implies that a separate cause (or an independent sequence) must be posited as the cause for the succession of A and B, which cannot be included in the succession itself, as it is only posited. Van Cleve also develops another sense of irreversibility, where the sequence must occur in the same order, so that the first is followed by the second whenever the first occurs. Van Cleve argues that Beck's reconstruction of Kant's proof suffers from inconsistency as it employs different senses of irreversibility in different premises. For instance, the first sense of irreversibility is used in premise 3 (ii), while premise 7 calls for much stronger sense of irreversibility. He suggests that premise 3 must be reconstructed to include a stronger sense of irreversibility, which makes it possible to avoid this inconsistency in Beck's version of Kant's proof.[1]

Van Cleve is correct to point out that premise 7 of Beck's reconstruction calls for stronger sense of the irreversibility, and the corrective that is suggested by Van Cleve is that the caused

[1] (Van Cleve, 1984 49-50)

sequence of (A-B) must include a reference to its cause; a cause C which produces the sequence of A and B. In other words, the sequence (A-B) must be construed as referring to C in the causal relation.

The purpose is to rule out the scenario of B-A, so that a sequence of A-B can be inferred, and the cause C can be included to ensure that A cannot be preceded by B. This is in line with Kant's concern in this proof of causality, which aims to establish a causal determination between the cause C and the caused sequence of A-B. However, this only offers an analysis of the effect itself (the caused sequence of A-B) in terms of its temporal connection, and does not specify the temporal position of C relative to this effect. To specify the temporal position of the cause C, a dynamical relation between C and A-B is required, in which C might be simultaneous with the temporal duration of the effect A-B. But, according to Kant, this dynamical relation can still distinguish between the causality of the cause and the effect. This aspect of Kant's conception of causality is significant for explicating the temporal and spatial separation between the parts involved in causal relation.

iii. D.P. Dryer

There are other interpretations of Kant's proof in the Second Analogy that do not focus on the concept of irreversibility in the argument. One such interpretation is offered by D.P. Dryer in his *Kant's Solution for Verification in Metaphysics*. For Dryer, in the Second Analogy, Kant argues for the conditions that enable us to observe an event, stating that an event is part of a temporal sequence that is caused by a preceding state. Dryer gives a summary of his interpretation of how Kant's proof ought to be interpreted when he considers the idea of perception of (an event) A by a subject:

> It does not enable him to know that A exists after a state in which A did not exist…Even though someone is conscious of observing A after some state in which it did not present itself, this would not enable him to know of the occurrence of A. For it would still be possible for him to regard A as having already existed when the previous observation was made. A previous observation of a state in which A did not present itself would not enable him to know of the occurrence of A, unless it would be correct for him to think that this possibility is ruled out. *This possibility would not be ruled out unless it would not be possible for the state in which A did not present itself to exist without A existing after it*. Hence a previous observation of a state in which A did not present itself would not enable him to know of the occurrence of A, unless he would be correct in thinking that it could not exist without A existing after it. But it would be not impossible for a state in which A did not present itself to exist without A existing after it, unless A is caused by something existing in the previous state.[79]

Dryer's approach is distinctive in that it does not rely on the absence of the concept of irreversibility in its reconstruction. According to Dryer, for an event to be observed, there must be an incompatibility between the states of the event, which implies the absence of A before it presents itself as occurring. To ensure this, it must be precluded from happening in the previous state, namely, there must be a way to exclude it from taking place in the previous state. Dryer suggests that a stronger condition is needed in this respect, and he presents it as observing the occurrence of A to be preceded by a state where it necessarily presents itself as existing only on the condition by being followed by A in sequence. This ultimately ensures that the occurrence of A is preceded by its non-existence, and that its existence is preceded by a causal condition for it to take place.

Van Cleve argues that the stronger condition posited by Dryer is not required in the argument of the Second Analogy. For it is sufficient to know that the states of A and the prior state are opposite. For this reason, Kant does not need to invoke a stronger condition for succession, as Dryer believes, that is to say, the "kind" of effect which is necessitated to follow after its

[79] (Dryer, 1966, 420-421)

absence.[80] To preclude this effect from happening in the previous state, knowing that these two states are opposite is therefore sufficient. However, Van Cleve's objection to Dryer fails because Dryer is concerned with locating the determinate order of the causal sequence. The idea of opposite states does not seem to be sufficient for Dryer to grant the observation of A as being preceded by its absence.

However, Dryer's reconstruction relies on the assumption of the incompatibility of different successive states, which generates the determinate order that Kant takes to be associated with a causal relation. The occurrence of A must be recognized as being preceded by its non-existence, but this condition can be reinterpreted as only requiring the temporal parts of an event to be positioned relative to each other. Kant begins the Second Analogy with the assumption that the manifold of pure time must be filled with content such that the temporal parts of events require relational determination. This assumption is also operative in the development of other Analogies. Therefore, the idea of being preceded by something that necessarily excludes the occurrence of the specious present from happening does contain an assertion of incompatibility between these two states. Thus, this assertion is equivalent to the claim made by Kant when he maintains that an event cannot be preceded by an empty time (A192/B237). Both assertions are equal in this respect because being preceded by an empty time allows the determination of appearances without the recourse to other appearances' positions relative to each other. This does not produce a judgment regarding the temporal position of the appearances.

Also, Dryer's reconstruction of Kant's argument does not sufficiently explain the causal content of the idea of obtaining an event on the condition that it is being observed unless it is

[80] (Van Cleve, 1973, 84-87)

being preceded by an incompatible state where it is a condition to be followed by A. This suggestion invokes the successive nature of events, but it also assumes that an observed succession must indicate an objective causal relation. It does not explicate how this sequence of events should be viewed as exhibiting a causal determination between its temporal parts or that the causality of the cause is exhibited in the temporal sequence of the event.

iv. Arthur Melnick

Arthur Melnick also interprets the argument of the Second Analogy without the irreversibility criterion in determining the causal connection between the objects of appearances. In his reconstruction of the Second Analogy, Melnick argues that the Second Analogy is about the complete determinability of time relations between events. Such determinability, according to Melnick, requires successive stages of determination between events. For example, in deciding that A precedes B, locating the temporal position of A as prior to B involves not only these two causal relata, but also the determination of these events relative to other events. According to Melnick, it is a "thoroughgoing temporal determination". He argues:

> To determine when the succession A-B occurred is to determine the position of this succession in relation to still other events C1…Cn in time. Suppose that this has been determined to be in the following order C1-C2…CN---A-B. Again, the question *arises* when this series of events as whole (and in this order) took place, and again the answer can only be in terms of the relation of this series of events to still other events. Ultimately, the relative position of all events or states of affairs to all other events or states must be determinable.[81]

This determinability of the relative time order between events is to involve a recognition of certain features of the appearances that allows for ordering them temporally. Thus, the way to proceed in determining the order of appearance is not determined by relating them to an absolute time, nor by relying on the order of perception, but is grounded in features of the appearances.

[83] (Melnick, 1973, 88)

For Melnick, these features of appearance are connected in a definite temporal order, and recognizing this order involves deploying a causal law. Thus, Melnick reconstructs Kant's argument in the Second Analogy in the following way:

> 1) The determinability of the order of events as non-coexistent must be grounded on features of appearances.
> 2) The determinability of the order of events requires that we be able to infer from features of appearances the relative order of the events.
> 3) Thus, we must have rules that enable us to conclude, on the basis of features of appearances, that events are ordered in a certain way (rules that enable us to make the transition from real features of appearances to temporal order).
> 4) But a rule that enables us to conclude that events are ordered in a certain way asymmetrically (as non-coexistent) on the basis of features of appearances (features of the events and of the surrounding circumstances) is…causal law.
> 5) Therefore, causal laws are required for the determinability of the order of appearances as successive.[82]

For Melnick, such inference from the features of appearances to their temporal order defines a causal law, which enables the transition from these features to their order. For this reason, causal law is posited as providing a regulative guide to the complete determinability of events. The continuous determination of the time order of events relative to other events can proceed by positioning the time order of local successive events in a larger context, and so on. Complete determinability is not an empirical determination of time order, but empirical determinability takes complete determinability as a background.[83]

Melnick argues that the ultimate objective of a causal law, posited to indicate an objective succession of appearances, is to rule out successive states being coexistent. According to Melnick, in order to attain this result, objective succession must be referred to a rule that shows that the successive states are based on features of events. But Kant states in the Second Analogy that an effect can be simultaneous with the causality of its cause. This claim is made to

[82] (Melnick, 1973, 90)
[83] (Melnick, 1973, 88)

address the possibility of having an effect that is simultaneous with the causal activity of its cause. In this scenario, Kant argues that such simultaneity of the cause and the effect should not be taken at face value since, in the moment or instant of the causal connection between the cause and the effect, there is still a vanishing time that indicates a time order of succession between the cause and the effect:

> But in the instant in which the effect first arises, it is always simultaneous with the causality of its cause, since if the cause had ceased to be an instant before then the effect would never have arisen. Here one must note that it is the order of time and not its lapse that is taken account of; the relation remains even if no time has elapsed. The time between the causality of the cause and its immediate effect can be vanishing (they can therefore be simultaneous, but the temporal relation of the one to the other still remains determinable.) (A203/B248).

Kant provides an example of a ball leaving a dent on a stuffed cushion. The ball, as a cause, is simultaneous with the effect, namely the dent on the stuffed cushion, which was previously in a flat smooth shape. However, Kant argues that it is possible to distinguish the two by "means of the temporal relation of the dynamical connection" (A203/B248).

In his analysis of Kant's idea of the simultaneous occurrence of the cause with its effect, Melnick distinguishes between the causal law and the condition of applying it. This distinction allows for ascribing the successive states that the effect goes through rather than to the succession of the cause and the effect, which are taken to be simultaneous in this scenario. A causal law describes the successive states that an effect might have as a result of a causal activity, but the act of pointing out the "condition" that initiates the successive states of the effect does not take into account the temporal position of this condition or whether it might be simultaneous with the effect or precede it. The causal law describes only the successive states within the effect (for example, the states of the cushion from being smooth to having a dent). Melnick further elaborates on this idea:

> That this condition is simultaneous with the change of state of the cushion…does not detract from the fact that the *rule* applied on the basis of this condition asserts a *succession* of states in the cushion. *In other words, a causal rule may assert a succession of states whether or not the condition of applying the rule singled out as the cause of the succession precedes it or is simultaneous with the effect (the effect being a succession of states.*[84] (Emphasis is in the original)

In this sense, for Melnick to avoid the problem of having a cause that is simultaneous with its effect, the causal relation between the two must not be articulated through temporal relation. Instead, the causal law aims to describe the effect in its successive states.[85]The temporal position of the cause relative to the successive states of the effect becomes irrelevant as it is only the condition of applying the causal law, irrespective of whether it is simultaneous with the effect or it precedes it.

In this analysis of Kant's Second Analogy, Melnick agrees with the idea that successive causality is to be reinterpreted as containing a caused rather than a causal sequence. A causal sequence is where the temporal position of the cause is included in describing successive causality. This distinction is important with respect to demonstrating the empirical determinacy of time. For Melnick (and others, including Van Cleve), the causal relation does not require specifying the temporal position of the causality of the cause as long as the effect exhibits temporal differentiation of before-after in its parts. However, despite the attractiveness of this interpretation, Kant seems to be insistent on identifying the temporal position of the cause as

[84] (Melnick,1973, 100)

[85] Paul Guyer expresses the same view in his discussion of simultaneous causation. He claims in regard to Kant's assertion that there is a vanishing time between the cause and the effect, Guyer finds this 'expedient' to be unnecessary. He writes:
"…Kant's basic principle does *not* require that an event—or alteration—can be determined to occur only if the first stage of the event is itself the cause of the second stage which succeeds it as its effect. All that is required is that the second stage be determined by its cause only to succeed the first stage, whether that cause is itself is identical to the first state or is instead some third state of affairs. Thus, an event can also be determined to occur, or one state to precede another, if the cause of the succeeding state is simultaneous with *it*, but succeeds the earlier state of affairs which constitutes the initial state of the event—though again, of course, it will be a separate time-determination that the cause does succeed the first stages of the event at issue." (Guyer, 1987, 261-262)

necessarily preceding its effect. Whether the cause is a continuous cause in the sense of sustaining the effect or is a momentary action that prompts the causal sequence, the temporal position of the cause must be included in the description of the causal relation.

The preceding interpretations of the Second Analogy overlook the important role of the empirical determinacy of time in Kant's argument for the principle of causality. In this Analogy, the argument proceeds to demonstrate that in order to interpret a sequence of succeeding perceptions as indicating an objective event, the content of perception, which is presented in the manifold of inner sense, must be ordered. For in the recognition of the successiveness of the event as necessary through causal determination implies that the pure manifold of time in the inner sense becomes empirically determined. In other words, the pure successiveness of the manifold of time is "converted" into dynamical relations between the content of the objective succession of events.[86] In this sense, the "dynamical content" of an objective event must provide the empirical correlate to the pure succession of time by recognizing the successiveness of the event itself as causally determined. However, to present an event as objectively determined, it must be preceded by a cause.

In this sense, an event is treated as an effect of a prior cause, and forms a caused sequence.[87] It is a caused sequence by virtue of differentiating its temporal parts to be exhibiting the causality

[86] In §26 of B-Deduction, Kant speaks of "abstracting" from the form of inner sense:
"But now this synthetic unity, as the a priori condition under which I combine the manifold of intuition in general, if I abstract (*abstrahiere*) from the constant form of my inner intuition, time, is the category of cause. Through which, if I apply in to my sensibility, I determine everything that happens in time in general as far as its relation is concerned." (B163)

[87] Kant refers to the occurrence as being "conditioned" by something that precedes it in time: "If one were to suppose that nothing preceded an occurrence that is must follow in accordance with a rule, then all sequence of perception would be determined solely in apprehension, i.e., merely subjectively." (A194-B239)

or the activity of the cause. Kant refers to the temporal boundaries (*Grenzen der Zeit*) of an alteration when discussing the causality of the cause:

> Thus every transition from one state (*Zustande*) into another happens in a time that is contained between two instants, of which the former determines the state from which the thing proceeds and the second the state at which it arrives. Both are therefore *boundaries of the time* of an alteration, consequently of the intermediate state between two states, and as such they belong to the whole alteration. Now every alteration has a cause, which manifests its causality in the entire time during which the alteration proceeds. (A208/B253)

The temporal boundaries of an alteration allow for showing the causality of the cause in the entire transition from the initial state to the final state. This is because a cause cannot produce its effect suddenly (B253). This process involves a progression in time, which is a necessary law of sensibility, whereby the content of perception must involve passing through the continuous moments of time, and the preceding time determines the following one (A199/B244). The causality of the cause is, therefore, exhibited in the entire progression of time, in the caused sequence. However, it is presupposed that this causality of the cause is dynamically prior to the occurrence and the generation of a caused sequence.[88] The recognition of this condition as being prior to the occurrence is an ingredient in the perceptual experience of an objective event.

The notion of the causality of the cause pertains to the activity of substances in relation to other substances. Kant argues that causal action is the empirical criterion of substances as the "ground" of these actions. In this regard, the inference to the persistence of substance requires the mediation of concepts of force and action, which are exhibited in the progression of time as a determinately caused sequence. For this reason, the principle of causality makes it possible to refer to the concept of substance as an appearance. Since Kant posits the law of causality as

[88] "The temporal sequence is accordingly the only empirical criterion of the effect in relation to the causality of the cause that precedes it." (A203/B249)

necessitating the sequence of appearances, this law-involving relation within experience can be used to infer the persistence of substance. At this point, Kant states that the inference to the substance must be meditated by its causal action:

> This causality leads to the conception of action, this to the concept of force, and thereby to the concept of substance. (A204/B249

Later Kant elaborates more on this inference from action to substance as the seat of all actions:

> Action already signifies the relation of the subject of causality to the effect. Now since all effects consist in that which happens, consequently in the changeable, which indicates succession in time, the ultimate subject of the changeable is therefore *that which persists*, as the substratum of everything that changes, i.e., the substance. (A205/B250)

Kant's inference to the persistence of substance does not follow the analytic connection between actions and substance, but it refers to the synthetic import of time as indicating the sequence of effects of these causal actions.[89] The link between the cause and its effects is only empirical, exhibited in experience. Consequently, while the effects are spread out in time, they must be referred back to the instantaneous configuration of the substance as the "ground" of these actions. The empirical synthesis of time, according to Kant, undermines the notion of empty space, or disruption between the successive moments of the empirical synthesis. This concept of connecting the empirical synthesis of time with space appears in the Third Analogy, where Kant describes the connection as follows:

> Without community every perception (of appearance in space) is broken off from the others, and the chain of empirical representations, i.e., experience, would have to start entirely over with every new object without the previous one being in the least connected or being able to stand in a temporal relation with it.[90] (A214/B261)

[89] On this point, it important to recall Kant's rejection of reducing the substance's causal powers to one active force, and this is in agreement with his earlier philosophy, where he criticized this reduction of forces. For more on this aspect of Kant's theory of causal powers, Dyck (2008) explores further Kant's position on this conception of powers.
[90] *"...ohne daß die vorige damit im geringsten zusammenhänge, oder im Zeitverhaltnisse stehen konnte*."

It demonstrates that an empirical synthesis of time *occurs* in space as well, in which the concept of standing in a temporal relation cannot be maintained without the presupposition of a spatial connection. In this way, the parts of the causal relation are not only temporally separated, but also spatially separated, and connected through causal determinations between its relata. This calls for a stronger sense of a dynamical relation between the parts of the causal relation, namely, that the causal action of the cause must emanate from a substance that is also progressing in time.

This feature of causal action points toward a form of causal interaction where the parts of the causal relation are in time. This brings us to the Third Analogy, where the mutual and causal relation between different parts of the causal relations is explored.

4.2 The Third Analogy

In the Third Analogy of Experience, Kant turns to the conditions under which the simultaneous coexistence of substances can be experienced. Continuing from the preceding Analogies of Experience—the First and the Second—Kant aims to provide a procedure through which the determination of time is possible. Therefore, similar to the Second Analogy, time is determined through the deployment of a relational category. In the Third Analogy, the category of community (*Gemeinschaft*) enables the cognition of the simultaneous coexistence of substances in space. Kant states the principle of the Third Analogy in the following way in the first edition:

> All substances, insofar as they are simultaneous, stand in thoroughgoing community (i.e., interaction with one another). (A211)

But in the second edition, it is stated in this way:

> All substances, insofar as they can be perceived in space as simultaneous, are in thoroughgoing interaction. (B256)

The two formulations are distinct with regard to the addition of space in the second edition's formulation of the principle. In the second formulation, Kant includes space in the principle of simultaneity, demonstrating how the structure of space relates to the content of the principle of simultaneity. But as will become clear, Kant also employs the structure of time to illustrate the simultaneity-relation, which involves a causal determination in the form of interactive causality or thoroughgoing interaction (*durchgängige Wechselwirkung*). Thus, this Analogy invokes not only the structure of space, but also temporal content that is being determined alongside it. For this reason, the inclusion of space in the second edition neither alters nor adds to the principle of simultaneous coexistence as formulated in the first edition.

In the proof of the Principle of the Third Analogy, Kant begins similarly to the Second Analogy by directing the reader to the perception of objects that are considered successive or simultaneous. In the case of simultaneous coexistence, the perception of one object can reciprocally follow the perception of another object, and it is possible to direct one's perception from one object A to another B, or conversely, from B to A:

> I can direct my perception first to the moon and subsequently to the earth, or, conversely, first to the earth and then subsequently to the moon.' (B257)

In this case, both objects, as given in the temporal content of perception, are considered simultaneous. In a similar fashion to the Second Analogy, where the successiveness of perception is immediately given, Kant argues that such perceptual successiveness does not provide the justification for inferring objective succession; rather, a category of causality must be employed in order to justify the objective temporal succession of objects. In the case of simultaneous coexistence, the possibility to direct one's perception from one object to another implies that perceptual experience can provide awareness of the simultaneous coexistence of objects in space through the reciprocity included in the perceptual experience. But this awareness does not justify

objective simultaneity or provide a necessary connection within experience of the objective simultaneous presence of objects. Empirical imagination in perception cannot provide sufficient ground to establish the coexistence of the objects of perception. Therefore, a conceptual rule is needed to make the necessary connections or establish the mode of a temporal connection within experience objectively. It must objectively reproduce this temporal relation in experience. A categorical synthesis of understanding does provide the justification needed to infer the objective simultaneity between objects. Since it is impossible to perceive absolute time and know the temporal position of each object in time except through their relational determination, then a relational category serves as the objective ground for attaining simultaneity:

> Consequently, a concept of the understanding of the reciprocal sequence of the determinations of these things simultaneously existing externally to each other is required in order to say that the reciprocal sequence of perceptions is grounded in the object, and thereby to represent the simultaneity as objective. (B257)

But the content of this concept of the understanding needs further explication, and it is about the community of substances (*Gemeinschaft*), in which it involves a reciprocal determination or mutual interaction:

> …the relation of substances in which the one contains determinations the ground of which is contained in the other is the relation of influence, and, if the latter reciprocally contains the ground of the determination of the former, it is the relation of community or interactions. (B258)

The content of this relational category is about the mutual and reciprocal determination between substances, where one substance causally influences another substance, and the second substance also causally influences the first substance. This causal tie goes in both ways, so that each substance is cause and effect in relation to the other. Kant argues that the concept of

simultaneous coexistence generally expresses the condition that the perception of simultaneous presupposes the category of mutual interaction to ground the temporal relations objectively.

The other formulations of the proof of the Third Analogy follow a similar pattern but with more emphasis on the temporal aspect of the argument. In the following paragraphs, Kant argues that perceptual experience contains an indifferent order in the case of perceiving the simultaneous presence of objects in space. However, such indifference is not enough to establish objective simultaneity. He includes the successive order to demonstrate that a reversal of other order of perception necessarily implies that earlier objects of perception must belong to a past time, because it is impossible to connect these two moments of perceptual experience except as following each other successively (A211). In this scenario, it becomes impossible to recognize the simultaneity of these objects, demonstrating once again the insufficiency of the immediate order of perceptual experience to ground these temporal relations. The supposed indifference in the order of perception is intended to indicate that such perceptual order is associated with the category of reciprocal determination or mutual interaction. Although indifference is much more like the case of irreversibility in the Second Analogy, it follows necessarily from the application of this relational category to experience rather than being taken by itself as an objective ground for the simultaneous coexistence of objects.

In the following parts of the Third Analogy, Kant expands on his proof of objective simultaneity. He argues in more detail that the concept of coexistence requires the assumption of a causal connection between substances in space, and that the idea of a dynamical space, a non-empty space, implies the denial of isolated substances in space. Kant's critique of the causal isolation of substances in his early period resurfaces here with respect to the concept of coexistence. This critique was directed at the Leibnizian position of causal isolation of

substances, but here it becomes more connected to Kant's mature conception of causation. The idea is that coexistence necessarily entails a rejection of the causal isolation of substances, and the reason is that it becomes impossible or indeterminate whether such substances follow each other or are simultaneous. The assumption of reciprocal determination or mutual influence involves a causal openness that allows for the objective perception of whether these states of substances are successive or simultaneous. In this part of his argument, Kant also emphasizes the role of empirical synthesis in relation to denying the causal isolation of substances (B259). The temporal aspect of an empirical synthesis or perception for Kant is brought to illustrate that the succeeding moments of perceptual synthesis ought to be objectively ordered, and the ground for this perceptual order presupposes the interactive causal activity between substances in space.

Kant brings the temporal aspect of simultaneity-relation more clearly when he argues that the temporal position of a substance must be inferred via interactive causality rather than being posited by the substance's mere existence. This is also an argument that Kant had used in his early works, where he argued that mere existence, which contains the substance's inner ground of existence, cannot alone determine the substance's temporal position without being in an interactive and causal relation with the other substances in space. He states this position in the Third Analogy in the following way:

> In addition to the mere existence there must therefore be something through which A determines the position of B in time, and conversely also something by which B does the same for A, since only under this condition can those substances be *empirically* represented as existing simultaneously. Now only that determines the position of another in time which is the cause of it or its determinations. Thus each substance (since it can be a consequence only with regard to its determinations) must simultaneously contain the causality of certain determinations in the other and the effects of the causality of the other, i.e., they must stand in dynamical community (immediately or mediately) if their simultaneity is to be cognized in any possible experience. (A212-13/B259)

The bidirectional link of the causal relation between the two substances determines their positions in time. In the Second Analogy, the successive and asymmetric line of causality is treated as what determines the successive order of time, or it is the categorical or conceptual synthesis that makes empirical determinacy of time possible. However, in the Third Analogy, and especially in the previous passage, Kant argues that the concept of mutual interaction necessarily implies the empirical determinacy of the substance's position in time. In this sense, Kant is making the distinction of mutual interaction and successive causality explicit. He clearly intends to establish the necessity of mutual interaction as the ground for the cognition of the simultaneous coexistence of substances. The implication here is that the category of mutual interaction or reciprocal influence reproduces a necessary and significant structure of pure time, namely, the simultaneous coexistence of different objects in time, and such a feature of pure (or mathematical) time requires a category different from the category of successive causality to be empirically realized. This poses the interpretative question of whether Kant is successful in making the transition from successive causality to mutual interaction and whether simultaneity relation does need such interactive causality to be cognized. The import of Kant's claim regarding the necessity of employing mutual interaction is to demonstrate that pure time is not yet empirically determined without the category of mutual interaction.

In the first edition formulation of the proof, Kant proceeds by stipulating that the experience of empirical synthesis of the temporal positions of substances must be determinate. He argues that mere perception cannot establish such determinacy because the reversible order of perception associated with simultaneous coexistence contains a temporal delay that does not guarantee the simultaneous coexistence of the perceived objects (A211/A212). Therefore, to obtain this determinacy of time, there must be a different ground for the determinate order of

time other than perception. There, Kant argues whether such determinacy is achievable through the mere existence of substances and the causal isolation of each substance. He contends that such causal isolation is insufficient to bring out the temporal determinacy of substances (A212/B259). There must be something else besides their existence to make the empirical synthesis of time a determinate synthesis. This is possible through the interactive causality between substances, which includes the idea of reciprocal determinations. In the first edition's proof, Kant intends to include the position of those who want to establish the simultaneity of substances without interactive causality, showing the insufficiency of this position regarding the determinacy of the empirical cognition of simultaneity. But in the second edition, Kant's proof does not invoke the idea of isolated substances; instead, he follows the same structure of argument in the Second Analogy, which invokes the impossibility of perceiving the absolute positions of things and the insufficiency of perception as an objective ground of simultaneity (B257/B258).

4.2 Interpretations of the Third Analogy

i. A.C. Ewing

In *Kant's Treatment of Causality*, A.C. Ewing presents objections to Kant's proof of mutual interaction as that which underlies the concept of coexistence. He argues that the concept of coexistence as such does not require causal dependence or interaction between substances, as it is possible for things to coexist without a causal interaction. According to Ewing, Kant is not clear on the sense of reciprocity that is entailed by the argument of the Third Analogy, for it is conceivable that we can have coexistent states of different substances without entailing this coexistence is grounded in concept of reciprocal determination. Ewing makes the following observation:

> But two events might coexist necessarily and yet have no causal, or determining, connection with each other, but might be severally capable of full causal explanation without introducing the other. Similarly two perceived events in different substances might be necessarily connected in the sense that the perception of the one followed by certain movements in space would necessarily be succeeded by the perception of the other, and yet either might, as in the former instance, be capable of full causal explanation without introducing the other. The fact that A and B necessarily coexist is quite compatible with the present state of A being deducible according to causal laws from a set of events not including the state of B coexisting with the state of A, nor any other state of B either.[91]

In other words, Ewing contends that a causal explanation for successive states of substance need not involve a reference to the other coexistent substance, and Kant, for this reason, equivocates between different senses of reciprocity. The strong sense of reciprocity as mutual causal determination is not necessary for the other sense of reciprocity, which simply involves coexistence of different substances in space. However, the problem with Ewing's objection is that the mere correlation of clocks with events presupposes the causal conditions of the Second and Third Analogies, in which the temporal duration of an event involves causal concepts and, therefore an objective judgment of time depends on successive causality and mutual interaction.[92] Kant argues for external influence between substances in space, and such external determination produces simultaneous coexistence among substances.

The argument presented by Kant in the Third Analogy is intended to demonstrate that a causal link must be bidirectional, limiting the causal activity of a substance by another causal activity of a different substance.[93] In light of this, successive causality cannot alone explain this sort of dynamical relation between coexistent substances in space, because it only explains one direction of the causal link between substances. Thus, it needs a causal connection that makes the temporal

[91] (Ewing 1969, 116-117)
[92] In other words, the judgment of simultaneity depends on coordinating clocks, but the clocks need to satisfy the causal conditions of the Analogies.
[93] Moggach (2000) explains the nature of mutual interaction as involving mutual limitation in space with respect to the practical implication of this principle in Kant's conception of juridical space.

relation of successiveness and simultaneity determinate.[94] Furthermore, the synthetic unity of time-relations, according to Kant's transcendental account of experience, does not restrict the temporal relations of an object to one determinate relation of successiveness. There is no contradiction in the idea of a synthetic determination of time-relations that an object can stand in two temporal relations of successiveness and simultaneous coexistence. An object can have different dynamical relations.

Ewing also targets Kant's reference to the unity of empirical synthesis as evidence of the coexistence of substances. He argues that Kant's reliance on the spatial aspect of the empirical synthesis does not necessarily support the conclusion that it involves a reciprocal interaction. According to Ewing, explaining the unity of physical phenomenon, if it is intended to be an object of experience, requires "(1) a causal continuity between the earlier and later stages of the world-process such that every stage is necessarily connected with the precedent part of the process, (2) a connection between coexistent states either as attributes of the same substance or as standing in some spatial relation to each other."[95] On the latter point regarding the spatial relation between coexistent substances, Ewing argues that spatial determinations between substances do not necessitate causal relations between them, as is the case with temporal relations between substances. He elaborates on this point:

> That spatial relation in itself implies a reciprocal interaction I can see no means of proving…The different parts of space, taken in the abstract, as of time, determine each other, not doubt; they do so in the sense that by exclusion they fix the limits of each other. But this kind of determination is quite different from causal interaction of phenomena, or from any determination, whether causal or logical, of their content by each other.[96]

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[95] (Ewing, 1969, 116-117)
[96] (Ewing, 1969, 116-117)

This objection by Ewing also suggests that Kant confuses two forms of determination. The relational structure of space or time does not in itself involve *causal* determinations, while Kant does not offer an argument for relating positional determination (between the parts of space and time) to causal determination.

However, Kant is not confusing the two forms of determination but rather demonstrating the causal content in the space-time structure by utilizing the relational categories of substance, causality, and mutual interaction. He is not arguing that the mere relational structure of space-time contains these causal relations. Rather, since these a priori forms of intuition are forms of appearances, the content is presented in the form of inner and outer sense as a determinable content. Therefore, this content of appearance must be determined in accordance with relational rules that are supplied by the understanding. In the Analogies of Experience, the relational forms reproduce these determinate orders of time, permanence, succession, and simultaneity by subjection the heterogenous content of appearances to rules of determination. In this respect, Kant does not argue that the mathematical forms of intuition are sufficient for making the relations of time or space in experience determinate, but they must be subjected to conceptual rules in order to attain the dynamical content of the manifold of intuition. For this reason, Ewing's objection is not only directed against the Analogies of Experience but also against the results of the Transcendental Deduction.

ii Margaret Morrison

The role of space in Kant's argument in the Third Analogy is given a prominent role in Margaret Morrison's analysis. In her (1995) and (1998) papers, she argues that the unification of a spatial manifold is what Kant intended his argument in the Third Analogy to be about. Morrison relies on Kant's argument in the first edition, where he reconceives the principle of

coexistence as excluding the idea of separate and causally isolated substances. As illustrated before, in this part of the Analogy, Kant provides a critique of causal isolation. He argues that since empty space cannot be a possible object of experience, while mutual interaction adds to space as a mere form of intuition, dynamical connections between coexisting substances, there must be dynamical connections between coexisting substances. Morrison invests in this part of Kant's argument to interpret the Third Analogy as being about the possibility of having a unified spatial framework that determines the spatial position of each coexistent substance. It is about locating the interacting substances in one single space. She argues:

> In the third analogy Kant establishes the temporal relation of coexistence, but in order for this relation to event to be possible, it requires the additional condition of spatial coordination. That is, two events or substances cannot occur or exist at the same time without being in different places; and in order for us to judge that these different places are part of the same temporal moment, we need some guarantee that each substance belongs to larger unified spatial and temporal framework; structures that are necessary for a unified experience. In that sense the third analogy brings together space and time in a way that the previous two (First and Second analogies) do not.[97]

Morrison is correct in pointing out the role of space in this way, and a unified spatial manifold or a single space indeed involves the reciprocal determination of substances, according to Kant's argument in the Third Analogy.[98] Therefore, the role of space in the argument cannot be ignored. However, Morrison considers the idea of reciprocity or coexistence as necessarily referring to the spatial coordination between events or substances. But the argument presented in the Third Analogy exceeds the interpretation offered by Morrison in this respect. It refers to the dynamical

[97] (Morrison, 1998, 266)

[98] In a different essay, Morrison explains this unification of spatial framework: "whereby A determines for B and B determines for A its position in time. Moreover, only that which is the cause of something else or of its determinations can function in this respect. And, if mutual causation grounds this relation, then simultaneity follows straightforwardly. To see this, we need only consider the following case: if A causes B then B must be later than A and if B also causes A then A must be later than B. It is impossible for A to be both later and earlier than B, therefore they must be simultaneous. In order to determine the position of two or more coexisting objects in time, it is necessary that such objects exist in different parts of space." (Morrison, 1995, 190)

and causal activity of substances, whereby the instantaneous configuration of the substance or the dynamical system becomes part of the temporal progression of this system. In this sense, the argument of the Third Analogy is not only about belonging to one single and unified spatial framework but also about the components of this framework, namely the dynamical system, being extended in time.

iii. Arthur Melnick

Arthur Melnick develops a more elaborate interpretation of the argument in the Third Analogy. Melnick's analysis of the Second Analogy was discussed on its own before, but he draws a strong connection between the two Analogies. He argues that Kant cannot correlate mutual interaction with simultaneous coexistence, nor can mutual interaction be solely responsible for establishing this temporal relation, for this could equally well be achieved by means of successive causality, according to Melnick. It is also the case with successive causality, which is capable of producing a simultaneity relation. Thus, for Melnick, Kant does not succeed in correlating these temporal relations with either successive causality or mutual interaction.

For this purpose, Melnick presents certain scenarios to demonstrate this conclusion. But before presenting these scenarios, Melnick, as discussed before, distinguishes between the causal rule and the condition of applying it. The purpose of this distinction is to point out that the condition of applying the rule initiates the causal process, or it is the condition we tend to refer to as the cause. He presents the following case: We have two billiard balls, *b,* and *c,* which were at rest and are now caused to move by a billiard ball, *a*. This causal interaction between *a*, *b,* and *c,* respectively, produces successive states in *b* and *c*. Thus, there are two lines of succession, *b,* and *c,* which can be interpreted as either *interacting* with *a* or

caused by it. This characterization, according to Melnick, depends on how we relate the motion of *b* and *c* to the motion of *a* after the collision of *a* with *b* and *c*. He argues that it is not possible to single out either successive causality or mutual interaction as the appropriate characterization that uniquely fits this scenario. For, he argues, suppose that we are interested in determining *b*'s position with respect to *c*, but not with respect to *a*'s position. If we assume a certain L_1 as a rule for determining the simultaneity and the succession of the states of *b* and *c*, then in this scenario, Melnick argues:

> On the basis of L_1, and the various factors that enable us to calculate in accordance with L_1, we can determine that *c* must be at PI′ when *b* is at PI; i.e., that the two states, "*b* at PI," and "*c* at PI′," are simultaneous. Now the position of *b* at any time is not directly a function of *c* or vice versa; i.e., *b* and *c* are not in any important sense in mutual interaction.[99]

Melnick's point is that the simultaneity of *b* and *c* can be uniquely determined without mutual interaction. The initiating condition or the cause of this simultaneity is the successive causality of *b* with respect to *a*, and *c* also with respect to *a*. Here, Melnick purports to show that such simultaneity does not involve an interaction between a pair of successive lines of *b* and *c*. Therefore, Kant fails to correlate simultaneous coexistence with mutual interaction as its causal ground. However, this analysis by Melnick suffers from certain problems regarding the simultaneity that he assumes to be between *b* and *c*. For it is possible that *b* and *c* are simultaneous, but this assumption must refer to the state of *a* after interaction with either *b* or *c* in order to be ascertained. The necessary part of Kant's argument in the Third Analogy is the idea of including a pair of objects in describing the dynamical relation between coexistent objects. This necessarily refers back to the states of the cause after the interaction, which is taken to be instantaneously connected with the effect. Therefore, the successive states of *b* and *c* are to

[99] (Melnick, 1973,104)

be simultaneous when both refer back to the instantaneous configuration of *a* as it progresses in time. This condition only allows for the characterization of their states as being simultaneous. For Kant, Melnick is not justified in assuming such simultaneity between *b* and *c*, since it is required that the state of *a* before and after collision be considered along with the state of either *b* or *c*.

Melnick also extends this case to include the successive states of *b* and *c*, and the application of L_1 can serve to determine both simultaneous and successive states of *b* and *c*. The initiating condition in this case after it was specified is not essentially indicating a case of successive causality or mutual interaction, according to Melnick, and this is sufficient to demonstrate that there is no unique correlation between mutual interaction with simultaneous coexistence. The second case in Melnick's discussion considers the state of *a* after interaction with *b* and *c*, and he also contends that by considering the states of *a* after the collision, the successive states of *a* and *b* are a result of this mutual interaction between *a* and *b*. The point here is that *a* being at one moment before *b* being at the successive moment is a consequence of this interaction, and for Melnick, it is then a result of mutual interaction rather than successive causality. The conclusion that Melnick wants to draw is the following:

> In both cases, the same condition is picked out as the initiating condition, but in Case 1 it is described as the action of one thing upon another, whereas in Case 2 it described as the interaction of two things. The way we describe the initiating condition is completely indifferent of whether, in accordance with the law, we are determining succession or coexistence of states.[100]

In case 2, it is true that a mutual interaction can produce successive states in the effect, however, mutual interaction is never taken to be independent of successive causality, because it already contains two worldlines (or objects) in time where both are manifesting successive states in

[100] (Melnick, 1973, 107)

their temporal progression. But Kant argues that successive causality with one direction cannot determine simultaneous coexistence alone; it requires the pair of objects to be in an interactive causality to produce a simultaneity relation. Melnick's account fails to consider the constraints that Kant had placed to determine the simultaneous coexistence of objects in space, namely, that both objects must be represented as containing the determinations of the other object and, consequently, such dynamical relations cannot be viewed only on one side of the causal interaction, either the cause or the effect; instead, the causal line connecting both objects is to be bidirectional in order to establish reciprocity. The act of picking an initiating condition, or the cause, in Kant's analysis of causality, must consider this cause as being active before and after the causal context in which it is being considered as the initiating condition for the effects that follow it. In other words, the reference back to the cause in the Third Analogy, or the inclusion of the cause in the causal relation, is intended to demonstrate this fact about causation, namely that both cause and effect are active in relation to each other and that causation is reciprocal.

iv. Paul Guyer

In *Kant and the Claims of Knowledge,* Paul Guyer reconstructs Kant's argument in the Third Analogy as expressing the following claim: the order of successive representations includes another reversible order of representations, and since this reversibility is not experienced in one successive line of representations, it must be assumed to be possible. The reversibility is conditioned on the object of the successive representations determining the other object's position in time. In this case, it is justified to believe that the experience of successive representations could have been reversed without denying the temporal position of each part of the successive representations. For Guyer, this reversibility of the successive content of

representations is justified only through a relationship between the objects of representation. Thus, he summarizes Kant's position in the following terms:

> …only a relationship between A and B such that the state of A at t_1 is necessarily connected with the state of B at t_1 will provide me with the evidence necessary to judge that, although it was A that I was perceiving at t_1, B also existed at t_1, and *a fortiori* could have been perceived by me then. That is, although I am having A_r (a representation of A) at t_1 because I am perceiving A then, the existence and the state of A at that time must also imply the simultaneous coexistence of B.[101]

The dependency involved here is that the state of A at that time is causally produced by the continued or simultaneous existence of B. But Guyer finds this transition from unidirectional causation to mutual interaction unwarranted since the most that can be inferred is simply that the state of one object "at one moment necessitates the existence of another object in another state at the same moment."[102] Guyer further argues:

> But this logical relation of necessitation will be satisfied if one object *either* depends upon *or* produces the state of the other at that moment; it is therefore not obvious that each state must be *both* cause and effect of the other.[103]

Guyer argues that Kant is going beyond what he has proven by positing that substances must be active with respect to each other. Such a requirement is not justified if the desire is only to establish a causal connection that warrants the simultaneous coexistence of the two objects. This conclusion can be drawn by relying on a causal relation whereby an object in its successive states is causally connected with another. So, according to Guyer, Kant is not justified in making this transition from causality to mutual interaction. In other words, following Melnick's

[101] (Guyer, 1987, 272)
[102] (Guyer, 1987, 272)
[103] (Guyer, 1987, 272)

interpretation, simultaneous coexistence does not require mutual interaction since it can be ascertained by means of a unidirectional causal connection.[104]

Guyer's account is similar to Melnick's, in which unidirectional causality is considered sufficient to establish simultaneity.[105] However, an important aspect of Kant's argument in the Third Analogy is that the causal action is to be relativized to a pair of objects acting on each other, which must be explained. This demand of reciprocity is crucial for the following reason: it allows us to refer to the instantaneous configuration of a substance (or a dynamical system) in its spatial position. An interactive form of causality between two spatially separated systems can make it possible to refer to such an instantaneous state of a system that is extended in space, but a successive form of causality does not serve this purpose, according to Kant. A mutual interaction between substances contains a successive causality, but it supplements the conservation of the substance's state over time by referring to its instantaneous configuration in its spatial position. A conservation of the system's state over time allows for the possibility of connecting different temporal lines and the synchronization of clocks. It this sense, a causal connection between a pair of objects demonstrates the need for mutual interaction to produce the relation of simultaneity.

v. Eric Watkins

Eric Watkins develops a more elaborate reconstruction of Kant's argument in the Third Analogy. Watkins seeks to avoid some of the problems associated with Melnick's and Guyer's

[104] Guyer also argues that Kant is operating under a "premodern thinking" about natural laws that assumes that there is a sort of "inflow" from one substance to another, which involves a notion of agency that is being ascribed to substances. (Guyer, 1987, 272)

[105] It is also the case that both accounts have assumed absolute time in their discussion the Third Analogy, which Kant would reject. In Guyer's formulation, it is possible to perceive the temporal position of A or its existence at "the same time as," which implies relating the temporal position of A to an absolute time.

interpretations of mutual interaction. But as will be argued later, Watkins's reconstruction is not truly distinct from either Melnick's or Guyer's account. Watkins does propose a more detailed interpretation of Kant's theory of causality, one that takes particular account of Kant's argument in the Third Analogy. In his first presentation of Kant's argument of mutual interaction, Watkins proposes an alternative way to understand the "model" of causal interaction that Kant advances. Before presenting Watkins' suggested model of mutual interaction in Kant, it is important to consider the model with which Watkins intends to contrast with his interpretation of the concept of mutual interaction.

In "Kant's Third Analogy of Experience," he takes this model to consist of the following: A substance S at t_1 causes the state of another substance S′ at t_2, and S′ in t_1 in turn causes S to be in a state at t_2. This simple model of mutual interaction, according to Watkins, seems at first sight to be sufficient to establish the simultaneity of both substances at each successive t_1 and t_2 respectively. But he argues that there is a "fatal difficulty" with this model, which is that by employing the time intervals between t_1 and t_2, it "smuggles in coexistence illegitimately."[106] This represents a defect in this model of mutual interaction, and it also generates difficulty if we replace t_1 and t_2 with "before" and "after". In this scenario, the first causal tie that connects S with S′ occurs *before* the state of S′ in t_2, and S′ causing S to be t_2 is also before the later state of S. He concludes that this model of mutual interaction does not guarantee the simultaneous coexistence of the two substances in t_1 and t_2, making the following objections:

> 1. It has not been shown that the later state of substance S′ determined by the first causal tie is simultaneous with the later state of substance S determined by the second causal tie, but rather only that each one occurs after the other's initial state.
> 2. It has not been shown that the later states occur an equal temporal distance after the initial states. It is entirely possible on this model that the one later state occurs

[106] (Watkins, 1997, 435)

> just a split second after its causally related initial state so one cannot infer the simultaneity of the later states from their occurring at an equal temporal distance after the initial states. 3. But even if one could determine equal temporal distances between both sets of initial and later states, one could not infer the simultaneity of the later states from this fact, since this inference requires the simultaneity of the initial states, which has also not been shown. Therefore, the initial states of substance S′, which is determined to be prior to the later state of substance S by the second causal tie, is not necessarily simultaneous with the initial state of substance S determined to be prior to the state of substance S′ by the first causal tie. This is because both states are determined as occurring only at some indeterminate time prior to the later states of substance S and substance S′.[107]

For Watkins, this model of mutual interaction is defective because it assumes the specification of the temporal position of the initial states of interaction between the pair of substances and thus cannot necessarily ensure the simultaneity of the later states in each substance. Equally important, the temporal distance between the initial states and the later states is not specified, since it is possible to have mutual interaction, yet the time-difference between the causal tie is not equal. This produces an unequal temporal delay between the initial and later states. Hence, Watkins argues that an alternative model must be proposed that avoids the pitfalls of this model of mutual interaction.

Watkins suggests an alternative model that contains a two-way causal relationship between the two substances instead of having two independent causal ties. This works to avoid certain problems associated with the previous model since it indicates the causal activity of both substances and thereby determines each other's position in time. Watkins argues that such a model does not presuppose simultaneity; for this purpose, he appeals to Kant's account of the communication of motion in *Metaphysical Foundations of Natural Science*. He argues that simultaneity is not assumed in this communication of motion and that the inference to coexistence is warranted accordingly. The other essential component of this proposed model is

[109] (Watkins,1997, 435-438)

that the causal connections are not to be construed as a relation between two determinate events, that is, as a determinate event causing another event to occur. Watkins contends that through this model of mutual interaction, Kant is remedying a common misconception about the nature of causation. This conception of causation is articulated by David Hume, who assumes that causation is a relation between events. Rather, the model of causation that Kant wants to argue for is about the exercise of causal activity by a substance on another substance, and this relation comprises "…one of the causal ties that make up mutual interaction establishes only that substance S changes the state of substance S′ from *c* to *d*, not that any state of substance S is thereby changed in a determinate way."[108] The implication of this model according to Watkins is that:

> …the activity of causing (the exercise of the force) of the 'cause' substance is not itself a determinate event.[109]

The consequence of Watkins' model is that the cause's temporal position is indeterminate, which resolves the problem of it being both prior to and after the occurrence, leading to a contradiction. In Watkins' reconstruction, this model does not fall into this problem because it construes the cause as indeterminate and therefore does not need to specify its temporal position to account for the coexistence of substances. It is possible, therefore, that the cause does not precede its effect.

Watkins' account successfully points out certain elements in Kant's Third Analogy that must be taken into consideration. But the model he suggests for mutual interaction is not sufficient with respect to the objective Kant sought to achieve in the argument of the Third Analogy. Let us set aside the debate over whether the causal connection should be between events or

[108] (Watkins,1997, 435-438)

[109] (Watkins,1997, 435-438)

substances and focus on the idea of having a cause that is indeterminate with respect to its temporal position. The Third Analogy makes clear reference to the temporal position of both the cause and effect, indicating that a cause must be in a determinate temporal relation with respect to the effect. Replacing the time intervals of t_1 and t_2 with the temporal order of "before" and "after" does not resolve the problem. What is needed is an account that explains the causal connection between two substances that are both instantaneously connected in time with no temporal delay. This allows for inferring the time of one momentary state of a substance from another momentary state of a different substance. Watkins's account is not different from Melnick's with respect to the specification of the temporal position of the cause. As stated earlier, Melnick suggests that the temporal position of the cause does not matter as long as the effect exhibits the successive relation between its parts.

5. An Alternative Interpretation of Mutual Interaction

The argument of the Third Analogy presented in the first edition emphasizes that the causal isolation of substances does not provide determinate temporal positions of substances. The causal connection between substances, on the other hand, may provide such determinacy of time for the relations of successivity and simultaneity. Kant emphasizes the role of causal connections in producing simultaneous coexistence between substances, and such coexistence involves filling space with matter. By filling space with content, the empirical synthesis is not disrupted by temporal gap between its contents. In other words, the empirical synthesis of time becomes dependent on the causal and reciprocal determination between substances in space.

In the Third Analogy, Kant argues that the mere existence of a substance[110] cannot determine its temporal position. It needs to be involved in a causal interaction with other substances in order for its temporal position to be determinable. This thesis of reciprocal interaction between substances gives empirical content to time-assignments because it postulates real physical interaction. As a consequence, no causally isolated system can be assigned a temporal position relative to other systems. Thus, a line of causal relata connecting two systems or more is necessary to realize and exhibit the temporal unfolding of each system empirically. The time of one system can accordingly be normed with respect to other systems with which it is causally connected. An interaction, in this sense, must involve an exchange of a physical quantity (e.g., energy) to be empirically realizable. For this condition to be fulfilled in both directions, Kant envisages a situation where both substances act on each other in a spatial perspective within which both substances are considered active and where both objects are simultaneous. This

[110] Or a physical system

spatial perspective indicates the relative temporal position of each system with respect to the other system but unified under one single time-coordinate.

In the First Analogy, Kant had discussed the idea of persistence with respect to the application of the relational categories to the time-manifold. The relevance of this Analogy here is that time relations presuppose a substratum through which the concept of persistence is ensured, and through which it is possible to ascribe simultaneity or successiveness to the manifold of appearances (A182/B226).[111] This Analogy, therefore, expresses the idea of the conservation of *something* over time, for instance, energy or mass, and that quantitative notion of substance grounds the duration of temporal series in terms of persistence. Kant provided two formulations of this principle in the First Analogy, the first of which emphasizes the notion of a persistent object in appearances and that its changes are mere determinations. But in the second formulation, Kant requires that the persistence of a substance be exhibited as a persistent *quantum* of substance, in which quantum can, therefore, neither increase nor diminish. It is only on the condition of the conservation of the quantum of substance that it is possible to ascribe temporal duration to it.

In space, the conservation of constant energy allows for the compensation of energy loss elsewhere, and such compensation assumes that a dynamical system is both spatially and temporally extended.[112] Concerning simultaneous temporal series, the conservation of energy is distributed across space, holding the parts of a dynamical system in one space, and mutual

[111] The point of such claim is to establish that the temporal relations of succession and simultaneity are grounded on something which persists. For example, a temporal interval between two instants can be taken as indicating a change only on the presupposition of a unified temporal framework.

[112] The spatial aspect of the First Analogy is pointed out by Melnick (1973,72-77) in his discussion of qualitative similarity as it can possibly be replaced by law-governed spatial connections between different states.

interaction preserves the same energy for the whole system over time. In other words, a single time-coordinate can be extended across space through mutual interaction as long as the parts of the system in mutual interaction are instantaneously connected. The relation of the First Analogy to the Third Analogy is demonstrated through the idea that the conservation of a quantum of substance is also assumed in the mutual interaction between two substances in space and that each substance involved in this reciprocal interaction is presupposed to preserve its temporal unity (or its magnitude) before and after the moment of instantaneous causal connection.[113]

Returning to Kant's critique of causal isolation in the Third Analogy, we may recall that Kant draws our attention to the difficulty characterizing an isolated body's natural and unperturbed behaviour.[114] Such a behaviour of a dynamical system can be negatively characterized in terms of isolation from outer interventions or external influences (whatever the amount of this influence is thought to be). But a closed system is an ideal construction. To set out the normal condition of an isolated and closed system, we need to posit certain laws whereby we assume that behaviour exhibited for this duration of time expresses the default condition or configuration of the system. Sometimes, this idea of isolation plays a regulative role in scientific theory, as it

[113] Melnick (1989, 49) suggests that in what he refers to as "temporizing procedure", a representation of here-now, or a spatial-temporal instant, includes a "crossings" between the histories (or the time-lines) of different substances, which assumes the "pasts" to be connected. He takes this points to the "crux" of Kant's argument for interaction.
[114] In the Third Analogy, on the critique of causal isolation, he states, "Now if you assume that in a manifold of substances as appearances each them would be completely isolated, i.e., none would affect any other nor receive a reciprocal influence from it, then I say that their simultaneity would not be the object of possible perception, and that the existence of one could not lead to the existence of the other by any path of empirical synthesis. For if you thought that were separated by a completely empty space, then the perception that proceeds from one to the other in time would certainly determine of the latter by means of a succeeding perception, but would not be able to distinguish whether that appearance objectively follows the former or is rather simultaneous with it." (A212) This impossibility of ascribing determinate temporal relations to an isolated substance can be applied to the state of this system, whether it is in a "natural" state or "accelerated".

minimizes the causal interventions of other factors and allows for a causal description of a local system.[115]

Kant, however, finds the idea of ascribing determinate temporal relations to a causally isolated system incoherent. The alternative is to posit lawlike connections between different systems to produce background conditions that provide us with invariant conditions through the stability and balance of forces. For Kant, such a lawlike connection must be relational and not intrinsic to a single system—it necessarily involves a causal connection with other dynamical systems; in other words, it contains the spatial-temporal coordination of the system.[116] The objective is not to deny that there is a default or normal behaviour, but rather to assert that such a default configuration of the system is connected causally with other dynamical systems in space and time.[117] This characterization provides a constraint as to which physical processes can be described as causal processes. Kant might not be clearly concerned with the latter point, but the Third Analogy is intended to provide a characterization of the conditions under which a physical system can be described as involving a causal process, and this is possible through being causally connected with other systems.[118] In this respect, the default configuration of the system is also a causal process since such configuration is about the stable conditions under which a system is moving inertially in space. In this case, construing the default configuration of the system does not require a causal isolation. Instead, the stability of forces can play this function by creating conditions under which any perturbation can produce instantaneous effects on the

[115] On the nature of default behaviour and its relation with causal explanation, Maudlin (2004) explores this relation.
[116] Here Kant expresses an idea which was also articulated in Section §26 in B edition of the Transcendental Deduction (B162/163). The examples of freezing water and the perception of a house both include the claim that the structure of space and time in the sensible manifold imposes a structure on the matter of perception such that this matter of intuition is being elevated to be determinable by concepts of the understanding, and it is cognizable as being related in space and time through causal relations.
[117] The concept of a closed system is also discussed by Brittan (1984) in relation to Kant's theory of causation.
[118] This is in line with Kant's rejection of internal and absolute force.

other side. A reciprocal and mutual interaction is the causal relation that is needed for such stability and balance of forces between different dynamical systems that are moving over time.[119]

In this respect, to think of a reciprocal interaction is to think of two spatially connected systems. They are connected with a line of causality. A privileged spatial perspective is where these two systems can be represented as active in relation to each other at the same time. Kant in the *Metaphysical Foundations of Natural Sciences* (thereafter *MFNS*), provided a concrete form of local motion in which the idea of reciprocal interaction is invoked, in which he added a differentia to the concept of matter as being movable *in space*. With this differentia, it is possible to concretely represent the concept of mutual interaction through the communication of motion between moving bodies. In the Fourth Proposition of the Mechanics chapters of the *MFNS*, Kant seeks to prove the law of equality of action and reaction, and in this section, he argues that such a law is a particular instantiation of the "metaphysical law of community" (*MFNS*, 545). The proof proceeds to establish that the equality of action-reaction must be guided by an equilibrium rule, which divides one motion between the two interacting bodies. This equilibrium is reproduced in absolute space, where the center of mass represents the two moving bodies as equally active to each other.

In his proof in the *MFNS*, Kant deploys the Relativity Principle on at least two separate occasions, which we will discuss in reverse order, beginning with our present topic, dynamic interaction, and turning to the "Phoronomy" immediately afterwards. According to Kant, connecting two bodies is impossible when one is considered to be at absolute rest. To provide a precise characterization of local interaction, it must be reconstrued as involving a

[119] In other words, such assumption can be thought of as the fragmentation or the pulling-apart of one system in different spatial coordinates. Thus, any instantaneous change in one part of the system affects the other parts, and instantaneous configuration of the system over space-time requires that its constant energy is preserved.

reciprocal and mutual interaction in which the line of causality is relativized between the two empirical points. Motion can be divided between the two bodies in an arbitrary number of ways, but the equilibrium principle can single out a unique one in which the motions are considered equal and opposite. Therefore, the communication of motion is construed as reciprocal, allowing for the conservation of physical quantity in this exchange.[120]

The concept of reciprocal interaction can be viewed as an extension of the concept of collision, which corresponds to two trajectories, thus two time-lines (or "world-lines") that intersect at one point—simultaneity here is the geometrical identity of the intersection point of the two lines. Furthermore, associated with this intersection is a conservative exchange of "quantity of motion". Physical collision is the dynamic correlate to this intersection, where each world-line is associated with a causal process or chain.[121] The argument of the Third Analogy imposes that the motions of systems must be positioned relative to one single time-coordinate, in which each dynamical system, along with its time-line, must be represented as moving before and after the intersection, and it produces a symmetrical coordination of time. For this reason, the temporal equality of both systems is inferred by being connected with the other system, which is moving toward it, and in this case, both systems are positioned relative to each other.

[120] Kant provides more details to this concept of interaction in the communication of motion: "All *active* relations of matters *in space*, and all changes of these relations, insofar as they may be *causes* of certain actions or effects, must always be represented as mutual; that is, because all changes of matter is motion, we cannot think any motion of a body in relation to another *absolutely at rest* that is thereby also to be set in motion. Rather, the latter must be represented as only *relatively at rest* with respect to the space that we relate it to, but as moved, together with space, in the opposite direction, with precisely the same quantity of motion in absolute space as the moved body there has towards it. For the change of relations (and thus the motion) between the two is completely mutual; as much as the one body approaches every part of the other, by so much does the other approach every part of the first." (*MFNS*, 545)

[121] Dowe (2000, 90) endorses the theory of conserved quantity of causation, and in his account, a causal interaction is an intersection of worldlines (which expresses a causal process with uniform and conserved quantity) that involves an exchange of a conserved quantity. In this intersection, Kant also endorse the idea of mutual change of relations between two pairs of worldlines, but he relies on relativizing the causal line connecting the two empirical points.

As Kant argues repeatedly, isolated systems cannot be synchronized. However, a coordination of states between the two systems makes it is possible to infer the time of whatever is connected with either system, since their frame is uniquely determined by the equilibrium principle. Therefore, if we take each body to represent a uniform process, each body in its motion goes through equal intervals of time in equal intervals of space before and after the impact, which connects these two world-lines.[122] But the coordination of the two moving bodies before and after the impact cannot be checked unless the causal connection is reciprocal, which means that the causal activity exerted by the cause is equal to the opposite causal activity produced by the effect on the cause. The two dynamical systems can then be considered in a relative spatial position to each other, and to apply the relativity principle in this way is to invest in the physical content of the relativity rule to produce a spatial perspective that subsumes another spatial point under it. In this sense, it is possible to "double" the relative space in two directions,[123] where the two bodies involved in the interaction are regarded as the endpoints and the boundaries of the interaction.[124]

However, in order to refer to the instantaneous configuration of the system as it is moving uniformly in space, it requires that such a causal process be determinable by the relative spatial positions of different systems connected with it, and that the concept of doubling relative space

[122] This realizes what can be referred to as the 'linearity condition' which states that any motion which is taken as uniform motion in one inertial frame and that it represents a uniform straight line, it then must be viewed as such in any other inertial frame. This linearity condition is discussed with relation simultaneity in Ellis and Bowman (1967,123).

[123] Vuillemin (1955, 60-69) provides an elaboration on the role of "doubling" space in Kant's parallelogram law for the composition of forces.

[124] On this supposition, uniform and stable systems are to be taken as directed toward spatially located points in order to ensure temporal equality before and after the collision. Hyder (2009, 60.61) provides more elaboration on the idea of forces as spatially directed towards empirical points.

into two directions, implicit in the rule of the composition of motions in Phoronomy, provides us with the idea of a self-intersecting line in every inertial motion.[125] The idea of a self-intersecting line indicates that the time of sending and returning of a message through a causal process is identical in every inertial frame. Thus, it is possible to make the following claim: The elapsed time of the causal process is equal to the elapsed time of the moving body in its inertial frame, and since the time interval between before and after the sending of the message in a self-intersecting causal process is identical, then the instantaneous configuration and state of the body in its causal connection with other bodies is included in the causal relations. For it becomes possible to link the instantaneous configuration of one system with another and, therefore, any perturbation or wiggling of one side of the causal relation will immediately produce instantaneous effects on the other members of this causal community. Thus, coordination of time relies on this idea of a self-intersecting causal line in every frame, which makes it possible to include the instantaneous configuration of the system over time.[126]

As mentioned above, Kant first introduces his Principle of Relativity in the Phoronomy of *MFNS*, where he argues that since absolute space is not an object of experience, while sensible or relative space can be experienced, motion is observable only relative to a larger empirical space, or "frame", relative to which motion can be observed (*MFNS*, 488). Kant then uses this principle to derive principles for mathematically composing different motions by means of constructions. Since the Relativity Principle allows Kant to divide any motion and ascribe it either to the frame, or to the body, or to divide it among both within the frame, he concludes that it can be used to

[125] I borrow this term from Adolf Grünbaum (1974, 686-687)

[126] This shows that Watkins' worry with respect to establishing the equality of time-interval between the states of substances is unwarranted since it is demonstrated here that this temporal equality is ensured through the equal dissection or fragmentation of one causal line between two points, and that the mutuality of relation provides a constraint of the doubling of space in two opposing directions allows for inferring the properties of one space to the other, including uniformity and simultaneity, which justifies the idea a causal line as being self- intersecting.

complement the composition. However, as we saw, this method does not involve or require an absolute rest frame, meaning that ambiguity remains that will only be removed in the Mechanics of the *MFNS*. Here, a reciprocal and mutual causal connection empirically realizes the equilibrium condition and leaves only one reference frame as an option.

Thus, as we have seen, the conservation of a physical quantity in a spatially extended system makes it possible to describe the temporal evolution of this system in relation to a single time-coordinate. As was pointed out earlier, unifying time means a single-time coordinate and therefore demands that we can describe the temporal evolution of spatially separated material points with one variable. Thus, it demands a criterion of whether they are "at the same time", and the conservation of energy or momentum of a spatially extended system the whole system can provide it.[127]

In this relation between the instantaneous configuration of a dynamical system and the determination of the time that a causal process can take to carry information between spatially separated points establishes a link between determining distant simultaneity and causal processes, which for Kant, must be actions-at-a-distance. This relation was brought to light more clearly in Einstein's theory of Special Relativity which assumes limits to the speed of light, which in turn sets limits on all causal propagation. Thus, in Special Relativity the

[127] The simultaneity of two states in different spatially separated dynamical systems is established by assuming that each system has conserved its constant energy over time, namely, each system contains equal temporal interval of before-after structure. This interprets the relation of the Third Analogy to the asymmetric-time causality of the Second Analogy. The Third Analogy contains an extension of the asymmetric-time structure of causality to the spatially extended systems (or substances), and it poses a constraint, that the event-causality in the Second Analogy must be referred back to a spatially extended systems, and since the principle of continuity imposes that the effects of a causal activity must be temporally successive, these effects of causal activity are to be understood in the Third Analogy as being relative to space, namely as being extended in space as well. This allows for redescribing the asymmetric causal influence in the Second Analogy as consisting of two spatially material points or (end-points) of the causal relation (following the symmetrical nature of space), and that the spatial separation between the relata of causal relation in the Third Analogy asserts that both systems are temporally extended (containing a before-after temporal extension) through mutual interaction.

synchronization of spatially separated clocks depends on causal signals between clocks that take time.[128] In Newtonian mechanics, by contrast, there is no speed limit to a causal connection, which is why actions-at-distance are allowed. In order to define the concept "at the same time as", Einstein invokes the concept of a light signal that is to be sent from one spatial position to another, and time for this signal to arrive at the other position where it will be reflected back to the first position. For both Kant and Einstein, in other words, synchronization depends on causal connections, realized as an action-reaction relation. Nevertheless, for Einstein, even though signals have to be sent back and forth in a two-way communication but there is a time lag between the "legs" of the interaction. According to some interpretations, the synchronization of different clocks requires that in the communication between the different readings of spatially separated clocks, the speed of the causal process must be known in order to correctly register the "objective time".[129]

In Special Relativity, action-at distance through instantaneous communication is constrained by limiting the speed of causal propagation. But Kant endorses this action-at-distance in his account of the causal activity of the substance, and for him, such a distant action must be taken as involving a reciprocal and mutual interaction in the way it was described above. To examine this further, it is necessary to go back to Newton's account of action-at-distance before elaborating on Kant's account.

[128] Hans Reichenbach (1958, 124-126) argues this synchronization involves causal chain, because it contains the sending of a signal from one distant place to another, and it requires beside the knowledge of the distance, knowing velocity of the signal.

[129] Wesley Salmon (1976, 518-519) argues that in Newtonian mechanics the measurement of one-way speed of light is possible, because in classical mechanics there is no limit to the speed of material particles, and it can accelerate to arbitrarily large velocities. However, considering that Special Relativity takes the speed of light to be a limiting velocity, it becomes impossible to accelerate any speed beyond this limiting velocity.

5.1 Newton on Action-at-a-Distance

Newton's account of causation is not entirely separate from his theory of the universal law of gravitation. In this theory, massive bodies attract each other at a distance, with no intermediary in between. This theory of universal action-at a-distance between interacting bodies prompted many objections from Newton's contemporaries, among them Leibniz, who argued against positing an occult force to account for the mutual interaction. Newton, however, contented that his treatment of forces was merely mathematical and does not concern the physical seat of causation, which is the agent of such causation. It must be presented as a mathematical description of the actions of forces of nature and to provide a coherent interpretation of physical systems.

As discussed before, according to Newton, gravity is a centripetal force that causes the curvilinear motion of satellites around their primary body. As a result, these satellites deviate from inertial motion in a straight line at a uniform velocity, and this perturbation of the inertial motion can be considered the effect of an "impressed force" in Newton's terms. Newton's justification of the universal law of gravitation relies on an inference of the inverse squared distance of the gravitational force from the form of ellipses, particularly the equal area law of Kepler, and applying it to the equation of motion involving a central force. He extends the application of area law to other kinematical frames, where the orbital motion of secondary planets and primary planets is also governed by this law.[130] By generalizing these rules to other

[130] In Book III of *Principia*, and in Propositions 1-3, Newton relates the accelerative motions of satellites relative to the central body (directed towards the center of the primary body), and he provides the mathematical description of this centripetal motion. (*Principia,* 802-3)

frames, Newton believes it is possible to generalize the third law of mutual interaction, which contains the idea that every pair of massive bodies is in an action-reaction relation.[131]

Gravity is a centripetal force that belongs to the category of impressed forces and requires a spatial separation between massive bodies to act. Gravity is proportional to the masses of the bodies involved, and it acts instantaneously on all parts of the body. By describing it as an impressed force, which indicates an action, gravity is not an essential property of matter. Instead, it is an impressed force which includes a spatial separation between the two interacting bodies. This spatial component of the gravitational interaction, along with the proportionality to masses, is an invariant structure in this causal action.

The spatial component of gravitational action demonstrates that gravity is not an accident of one body; instead, it requires the inclusion of two massive bodies and the distribution of one force between them. For Newton, gravitational action, in this sense, is not an inherent property of the body, and this allows him to avoid ascribing active and self-determination to matter as such, as this would violate his philosophical and theological commitment to deny self-motion to matter. To avoid this consequence of giving matter self-activity, Newton refers to the relational nature of impressed force and also to his interpretation of the third law, which shows that an action-reaction consists of one force as being symmetrically divided between both bodies.[132] He describes it as follows:

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[131] This extension occurs in Proposition 4 to Proposition 5 of Book III. In Proposition 4, Newton states that the moon gravitates towards the earth by the force of gravity, (*Principia*, 803) and in Proposition 5, this assertion is repeated with regard to other systems (*Principia*, 805-6)

[132] Newton clearly refers to the third law in his argument for universal law of gravity in Corollary 1 to Proposition 5: "Therefore, there is gravity toward all planets universally. For no one doubts that Venus, Mercury and the rest [of the planets, primary and secondary,] are bodies of the same kind as Jupiter and Saturn. And since, by the third law of motion, every attraction is mutual, Jupiter will gravitate toward all its satellites, Saturn toward its satellites, and the earth will gravitate toward the moon, and the sun toward all the primary planets." (*Principia*, 806)

> It is not one action by which the sun attracts Jupiter, and another by which Jupiter attracts the sun; but it is one action by which the sun and Jupiter mutually endeavor or approach each other. By the action with which the sun attracts Jupiter, Jupiter and the sun endeavor to come nearer together; and by the action which Jupiter attracts the sun, likewise, Jupiter and the sun endeavor to come nearer together. But the sun is not attracted towards Jupiter by a twofold action, nor Jupiter by a twofold action towards the sun; but it is one single intermediate action, by which both approach nearer together.[133]

Newton then applies this universal force to explain different phenomena, including the orbiting of planets and the gravitational pull in earth. The mathematical form of gravitational force that Newton discovered is a physical fact about the nature of gravitational action. Equally important, Newton mathematically articulates the possibility of composing different motions that a single body can have. In this way, the composition of forces, especially that of centripetal accelerations, illustrates that since one body can have multiple motions, it is possible to extend this law of mutual interaction beyond one frame, such as the frame of Jupiter and its satellites, to Jupiter and the sun. This extension is justified by the mathematical composition of centripetal accelerations.[134]

Newton's "immediate action" is instantaneous and can be seen as an empirical correlate of absolute and mathematical simultaneity. However, Newton (similar to Kant) proceeds from local interaction in this empirical realization of the mathematical structure of space and time. By registering the phenomenal laws of Kepler's laws that exhibit empirical regularities regarding the circular motion of planets in their orbits, Newton finds that such 'regularities' contain the form of a law that explains the behaviour of the satellites with respect to the center of the primary planet. This method of extending the laws beyond the local interaction

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[133] (Newton, 1728, 38-39)

[134] This is stated by Newton in Book I, Proposition 3, Theorem 3:
"Every body that, by a radius drawn to the center of a second body moving in any way whatever, describes about that center areas that are proportional to the times, is urged by a force compounded of centripetal force tending to that second body and of whole accelerative force by which that second body is urged." (*Principia*, 448)

helps Newton capture the mathematical content of space and time. Although, on the nature of matter, Newton admits that this action-at-a-distance is not about ascribing to matter active forces that allow it to be self-active, he believes that, despite being passive, matter is a recipient of action in accordance with laws, and this shows that Newton is somehow sympathetic to the top-down concept of the laws of nature, which deprives matter of active principles, and gives God the power to continuously act in the world without secondary causes. However, this does not describe Newton's view of divine causation because he accepts the idea of secondary causes.[135] Newton takes these laws to be constitutive of the nature of causal action as such, and mathematical laws are sufficient to play this role.

5.2 Kant on Action-at-a-Distance

One challenge to Newton's theory of gravitational force concerns the possibility of its action without mediating mechanical actions.[136] This challenge is about the intelligibility of such action. Newton's way to address this challenge is to claim that his treatment of this force is mathematical. Kant, by contrast, accepts the idea of action-at-a-distance; in other words; that matter can act immediately on other matter in empty space. However, unlike Newton, he considers attractive force essential to the dynamic conception of matter, where it is a fundamental force. In this way, he not only allows that action at a distance without an intermediary is possible, but asserts that it is necessary.

[135] Newton rejects the notion of matter as being essentially self-active, and consequently, the idea of attributing gravity to matter in a similar way as extension is thought to be essential to matter. Despite Newton's rejection of ascribing gravity to matter, it does not entail that he rejects action-at-distance, and he contemplates, in his letter to Bentley, the possibility of material or immaterial agent which endows matter with the power of distant action. As a result, it is not possible to describe Newton's position vis-á-vis the causal powers of matter, as occasionalist position, because he accepts that God allows for secondary causes, and in this cause, the power given to matter to act at distance on another matter. For more on this interpretation, Henry (2011,13-19)

[136] The challenge is posed from the mechanical philosophy point of view which asserts that a causal action between a pair of substance must be through contact, and since gravity includes the concept of an action without contact, or action-at-distance, then the "intelligibility" of such action is questioned.

Kant's argument for the possibility of action-at-a-distance is presented in the Dynamics chapter of the *Metaphysical Foundations of Natural Science*. In the Dynamics, Kant presents matter as movable by filling a space by a moving force. According to Kant, this property of filling a space through resistance adds a causal content to matter, and this presupposes the concept of movability, as discussed in Phoronomy, which only treats matter as a mathematical point. Kant's characterization of matter as consisting of moving force includes a reference to the idea of rejecting the mere existence of matter as sufficient for filling space. This recurrent theme in Kant's theory of causation is presented here to account for the active nature of matter, which proceeds to provide a dynamical rather mathematical and mechanical description of matter. This dynamical characterization of matter entails that matter is composed of certain fundamental forces that provide the basis for filling space through resistance.

Matter consists of two fundamental forces, which cause either the approach of other matter to it or a force that causes removing others from it (*MFNS,* 504-511). These two forces are called attractive forces and repulsive forces, respectively. Repulsive force is an expansive force that, through all of its parts, fills space (*MFNS,* 500). It is the ability of matter to repel other matter by being able to resist compression, and since, for Kant, matter cannot be completely penetrated, then the ground for such impenetrability lies in a fundamental force, namely, repulsive force. This leads to Kant's conception of relative impenetrability, contrasted with absolute impenetrability (*MFNS,* 502). Absolute impenetrability assumes that matter is not capable of compression, and therefore it can resist penetration merely by its existence and with "absolute necessity". Kant calls this conception of absolute impenetrability "mathematical impenetrability", because it does not attach to matter an essential moving force. However, Kant considers relative impenetrability, which rests on repulsive force, to be a

consequence of the dynamical conception of matter he advocates. For repulsive force leads to filling space by determinate degree, and therefore it can be "overpowered" by a compressing force (*MFNS,* 502-503). In this respect, the resistance to filling space by repulsive force can be estimated in degrees.

In Proposition 5, Kant introduces attractive force as another central force besides repulsive force. He now argues that both repulsive and attractive forces are jointly considered essential to matter and that neither can be reduced to the other. In fact, each moving force consists in a causal relation of repelling and attracting. To this end, Kant offers an argument demonstrating that attractive force is essential to matter as such, which is labelled as the "balancing argument". This *reductio* suggests that restricting material forces to repulsive ones alone, implies that matter "would disperse itself to infinity, and no specified quantity of matter would be found in any specified space" (*MFNS,* 508). There must be an opposite force to limit repulsive force and for it to be confined, as Kant concludes:

> Hence, there must somewhere be assumed an original force of matter acting in the opposite direction to the repulsive force, and thus to produce approach, that is, an attractive force. Yet since this attractive force belongs to the possibility of a matter as matter in general, and thus precedes all difference of matter, it may not be ascribed merely to a particular species of matter, but must rather be ascribed to all matter or originally and as such. Therefore, an original attraction is attributed to all matter, as a fundamental force belonging to its essence. (*MFNS,* 509)

In a similar fashion, Kant argues that it is not possible for attractive force only to be as fundamental to matter, since repulsive force is needed to counteract attractive force to not diminish the space between matter. Thus, "nothing can hinder the action of a moving force except another moving force opposed to it, and that which opposes attraction is repulsive force" (*MFNS* 511). Thus, in both parts of the "balancing argument", Kant alludes to the dynamical relation of reciprocal determination, making it possible for the mutual interaction between

fundamental forces to reduce the essential properties of matter to two central forces. This proof presupposes the composition of motions, as outlined in Phoronomy, where the symmetry of relative space, including the concept of "doubling" the relative space, appears to allow for the composition of forces.[137]

In this characterization of the essential moving forces of matter, Kant also argues for action-at-a-distance. He contrasts it with contact, which involves an interaction of repulsive forces at a common boundary. Action-at-distance is also about the interaction of matter, action and reaction, but it does not involve a matter between the interacting material point pair; rather, it acts through empty space. So, in Proposition 7, Kant asserts that the "attraction essential to all matter is an immediate action of matter on other matter through empty space" (*MFNS* 512). Building on the previous articulation of matter as essentially consisting of two central forces, Kant argues that since attractive force is essential to matter, it "contains the very ground of the possibility of matter," and thus it contains the very possibility of physical contact as well. This establishes the independence of attractive force and, therefore action-at-distance from the condition of contact. Here Kant draws the following consequence of these claims:

> But the action of a moving force that is independent of all contact is also independent of filling of space between the moving and the moved; that is, it must also take place without the space between the two being filled, and thus as action through empty space. Hence the original attraction essential to all matter is an immediate action of matter on other matter through empty space. (*MFNS*, 512)

In this way, Kant thinks it is possible to prove such distant action *a priori*, without invoking the condition of contact since attractive force is an independent force and plays a different causal role than repulsive force or impenetrability. In line with this thought, Kant contends that the

[137] Friedman also considers the role relativity of motion in Phoronomy in Kant's deduction of these two forces in the Dynamics (2013, 150-152).

intelligibility of this action-at-distance is not threatened by having empty space between the two interactive objects since as was previously indicated, the condition of attractive force as containing action-at-distance is independent of either repulsive force, or the requirement of filling space. Kant accepts that impenetrability or its ground, repulsive force, seems to be more intelligible because it can affect outer sense; however, both forces are to be equally justified because it is not conceivable that one moving force is to be derived from the other, as attractive force is "negative" of impenetrability.

In these arguments concerning action-at-distance, Kant extends the symmetrical nature of local *intersection* to distant simultaneity.[138] For this reason, a local interaction or synchronization is extended into a larger frame.[139] By ascribing essential properties to matter as composed of attractive and repulsive forces, Kant, unlike Newton, articulates the idea of matter as essentially active, which is significant to account for the action between distant objects in space.

This model of mutual interaction enables us to explain the synchronization at different spatial points without temporal delay. The concept of synchronization requires that events at two different places be "connected" which for Kant implies a conservation of energy through the intersection of two time-lines, and this is expressed through the equality of action-reaction. In this way, Kant has envisaged the possibility of realizing the unity of time across space through mutual interaction. For in this case, the causal line connecting two systems ought to be

[138] It is no doubt that for local intersection, repulsive force is involved in the small distance between the matter, but by extending this form of interaction into larger space, it requires a penetrating force which acts on all parts of matter, and attractive force plays this necessary role in considering a causal and mutual interaction between spatially separated points.

[139] By extending it from a local interaction into a larger frame, Kant's theory of mutual causation can account for locality through successive causality, but this successive causality when reconsidered in light of the argument of the Third Analogy becomes relative to spatial frame of two interacting substances, and therefore, the causal interaction becomes reciprocal. Invoking the symmetrical nature of space allows Kant to extend the causal interaction into larger frame. For more on the problem of locality (Elga, 2007) and (Field, 2003).

relativized, and assumed to be directed toward empirical points. In this way, as the one line of causality is relativized, it is also symmetrically divided between two separate points. It would make it possible, therefore, to infer the properties of one space-time into the other, and thus the equality of the time-interval is preserved. The mutuality of relations between the two systems is then reproduced in absolute space, and in this way, it is possible to divide the causal line (connection) between two points symmetrically. This is referred to as the doubling space, which retains the idea of reciprocity and mutuality of action. Also, the composition of motions, where the concept of doubling space involves the connection between two systems, demands that each system be considered relatively moving in relation to each other. The concept of self-intersection allows for introducing action-at-distance since it implies that the time between sending and receiving information is identical in every frame, and since it is the case that a conserved system expresses an inertial and uniform behaviour only through mutual interaction with other systems, it is therefore possible to ascribe an equal time interval to the two systems that are mutually interacting. This is inferred via the property of doubling space in the reproduction of intersection in absolute space.

Conclusion

The motivation and scope of Kant's theory of simultaneity were investigated in this study in connection with Kant's requirement of the empirical determinacy of time. It was argued that Kant's account of simultaneous coexistence is articulated through the relational determination of the manifold of time, and by the introduction of the relational categories of persistence, causation, and mutual interaction, which form conditions on the empirical cognizability of empirical relations within the manifold itself. Mutual interaction between substances realizes absolute simultaneity between the substances, and this category grounds an equilibrium principle governing the forces which is the Third Analogy of Experience itself.

As we saw in Chapter 2, Kant's theory of simultaneous coexistence was first developed in his early philosophical writings on the cosmological unity of the world. It was argued that this topic of the cosmological unity of the world was articulated by Leibniz and others in terms of the causal interaction between the parts of world, and that Kant defended this explanation of cosmological unity, according to which the mere existence of substances does not necessarily entail their community. Instead, community is reconceived as requiring real causal interaction between substances. Spatial and temporal relations were thought to be contingent on these reciprocal and causal relation, that is to say, the temporal and spatial relations depend on the interactions between substances. In this respect, Kant was not deviating from the relational conceptions of time and space. However, Kant would later argue, due to the change of his conception of mathematical cognition, that concepts of space and time belong to sensible and a priori forms of intuition.

Nevertheless, as we saw in our discussion of the empirical determinacy of time in the *Critique* in Chapter 3, Kant maintains that these forms of intuition are given a priori, and that it is

necessary to provide a dynamical correlate to each temporal relation within the manifold of pure time. To this end, he argued in the *Critique of Pure Reason* that the mere non-successive existence of substances does not immediately and necessarily entail their simultaneous coexistence, for the inference is not analytic. Rather, it requires a synthetic addition, in the form of a causal and mutual interaction between them, in order for judgments of simultaneity to count as empirically determined, and in this sense objectively necessitated. A main goal of this thesis was to explicate and analyze the nature of this mutual interaction, and it was argued that mutual interaction must be interpreted to involve the conservation of a quantity of the dynamical system, which is taken to be preserved across space and over time.

The principle is an equilibrium principle, because, according to the First Analogy, a quantity must be conserved over time. And, in order for us to speak of the instantaneous state of a system extended in space, the preserved quantity must be spatially extended. Kant concludes that it must conserve its *energy* over time, and its parts must be connected at any given time in such a way that this quantity is conserved. This gives Kant a way to providing a rational determination of time without appealing to insights into the metaphysical nature of monadic interactions, and without having to posit *specific* empirical laws of motion, which remains the task of the physicist, even after the *Critique* and *Metaphysical Foundations* have explicated their general form.

But, as we saw in Chapters 3 and 4, Kant argues from requirements on the determinate *experience* of temporal relations. Thus, Kant requires that simultaneity be empirically cognizable, and therefore that spatially extended systems be tied together by instantaneous causal interactions. As we have argued in the last chapter of this thesis, this form of interaction is codified as a principle in the *Critique*'s Third Analogy of Experience. It also, and not

coincidentally, sets conditions on the synchronization of spatially separated *clocks*, since it provides a substitute for the geometrical identity of intersecting worldlines. The simultaneity of spatially contiguous events can be directly intuited, as Einstein observed in his (1905), and the problem is to extend that concept to non-contiguous simultaneous events.

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