Immanuel Kant’s Theory of Objects and Its Inherent Link to Natural Science

Abstract: In the theoretical philosophy of Immanuel Kant, the term object has an extensive and far-reaching significance, and it can therefore be understood as a theory of objects. This becomes particularly clear when it is observed that all of his guidelines can be traced to different concepts of objects and their combination. With his concept of the object of experience, he attempts to mediate incompatible aspects in this: in relation to the object of experience, we have apodictic claims but at the same time our knowledge of the object develops and contains the possibility of historical progress. This theory of objects was elaborated by Kant with regard to natural science and the claim of its metaphysical foundation. For this reason, Kant’s concept of object is inherently linked with his concept of science. Astronomy is at the core of his investigation, because it represents a perfect example of a so-called proper and rational natural science.

Keywords: intelligible object, object of thinking, sensible object, appearance, object of experience, rational and proper natural science, focus imaginarius, Critique of Pure Reason, astronomy, metaphysical foundation

1 Introduction

Immanuel Kant’s Critique of Pure Reason¹ has often been understood as a theory of subjectivity or as a starting point for theories of self-consciousness or personality.² This point of view is entirely justified with regard to the concept of the unity of consciousness³ and the synthetic unity of apperception⁴ as the highest point of transcendental philosophy but does not satisfy the intention of Kant’s investigation. All the endeavours in the Critique of Pure Reason are made for a theory of objectivity.⁵ The starting point of Kant’s thinking is thereby the so-called “scandal of philosophy and universal human reason that the existence of things outside us […] should have to be assumed merely on faith and that if it occurs to anyone to doubt it, we should be unable to answer him with a satisfactory proof”⁶. That means, Kant has designated the Critique of Pure Reason as an answer to these sceptical approaches.⁷ To guarantee the existence of objects outside of us and the possibility of their recognisability, Kant does not investigate the thing in itself but

---

¹ The Critique of Pure Reason is quoted according to the edition by Paul Guyer and Allan W. Wood and the usual A/B pagination. The Prolegomena to Any Future Metaphysics is quoted according to the edition by Gary Hatfield and the Metaphysical Foundations of Natural Science is quoted according to the edition by Michael Friedman. Both books as well as other texts of Kant are quoted with the usual pagination of the Akademie-Ausgabe.

² Schulting, Deduction; Schulting, Subjectivism; Rosefeldt, I ch; Mohr, I ch; Ameriks, Theory; Klemme, Philosophie; Kitcher, Psychology; Sturma, Kant.

³ Kant, Critique of Pure Reason, B 137-8; A 112; B 420.

⁴ Ibid., B 131; A 137/B 176.

⁵ Zöller, Gegenstandsbeziehung, 4; Nonen, Objektivität; Collins, Experience; Lechner, “Deduktion”, 56-121; Mohr, Grundlegung; Findlay, Kant; Blackburn, “Truth”, 353-371; Bachmair, Konstitution.

⁶ Kant, Critique of Pure Reason, B XXXIX; B 274-6.

⁷ Forster, Kant, 5; Rescher, Scepticism; Tonelli, “Kant”, 93-123.

*Corresponding author: Rudolf Meer, University of Graz, Austria; E-mail: rudolf.meer@uni-graz.at
restricts the examination to objects of experience. From a systematic point of view, Kant introduces with the object of experience a completely new theory of objects in which the undetermined object of an empirical intuition (appearance) is united by subjective conditions of thinking.

Prima facie, this status of an object seems to be counterintuitive but becomes particularly obvious with regard to Kant’s aim in the Critique of Pure Reason, the Prolegomena as well as in the Metaphysical Foundations of Natural Science, which is to establish a “Metaphysics of Nature”9. For this reason, Kant’s concept of object is inherently linked with his concept of science. Astronomy is at the core of his investigations, because it represents a perfect example of a so-called proper and rational natural science10. To reach this status, the objects of astronomy are determined from two subjective conditions of thinking, the principles of understanding and the principles of reason.

To reconstruct Kant’s theory of objects, and to develop the unique position of this theory across the philosophical traditions, I will argue in two steps:

First, it is necessary to differentiate Kant’s concepts of objects into intelligible object (2.1), sensible object (2.2), and object of experience (2.3). Based on this distinction, it is possible to highlight the specific status of the concept of objects of experience (2.4), in which Kant combines in a specific way the first two classes of objects.

Second, Kant’s theory of objects must be contextualized with his theory of science, in particular with his concept of astronomy. In § 38 of the Prolegomena (3.1) and also in the Appendix of the Transcendental Dialectic in the Critique of Pure Reason (3.2), Kant explains and justifies the principle of understanding and the principle of reason based on one and the same example from astronomy. Both principles are compatible and necessary to fix an object of experience as an object of a proper and rational natural science (3.3).

In this two step-argumentation process, Kant’s theory of objects will be reconstructed based on three theses. All guidelines of Kant’s theoretical philosophy (i.) can be traced to different concepts of objects and their combination. With the object of experience, Kant attempts (ii.) to mediate incompatible aspects: In relation to the object of experience, we have apodictic claims but at the same time our knowledge of the object develops and contains the possibility of historical progress. To establish science as a so-called proper natural science all three sorts of objects are necessary. For this reason (iii.), Kant’s concept of object is inherently linked with his concept of science.

In the course of the following investigation, Kant’s theory is not primarily developed with regard to the problem of the affection through the thing in itself but based on the subjective conditions of thinking which make the undetermined object of an empirical intuition or given manifoldness in time and space to objects of experience. This methodological starting point offers the opportunity to reconstruct Kant’s concept of objects inherently in his own theoretical system and defend it from hasty criticism.

2 The Critique of Pure Reason as a theory of objects

In the Critique of Pure Reason, the term object has an extensive and far-reaching significance. “Now one can, to be sure, call everything, and even every representation, insofar as one is conscious of it, an object”11. Thereby, Kant does not differentiate in a strict sense between object (Germ. Objekt) and thing or entity (Germ. Ding).12 For this reason, it is not clear if the terms are used as equivalents.13 Despite this ambiguity, Kant’s

---

8 Because, if the objects were things in themselves, we would not be able to have any a priori concepts of them. However, if we have to do everywhere only with appearances, it is not only possible but also necessary that certain a priori concepts precede the empirical cognition of objects (Kant, Critique of Pure Reason, A 128-9).

9 Ibid., A XXII; A 845/B 873.

10 Kant, Metaphysical Foundations of Natural Science, AA 04: 468.

11 Kant, Critique of Pure Reason, A 189/B 234.

12 In addition to the terms object and thing, Kant also uses in the Critique of Pure Reason the term Gegenstand as a German translation of the Latin objectum (Heintel/Anzenbacher, “Gegenstand”, 129) but in the translation of the Critique of Pure Reason by Guyer and Wood the German term Gegenstand is always translated as objet. For this reason, the differentiation between the German Objekt and Gegenstand disappears in the English translation.

13 The equation of these terms is denied for example from Caygill, Kant, 304-5.
usage of the term object can be extracted threefold: First, the intelligible object or the object of thinking; second, the undetermined object of an empirical intuition or the appearance; third, the object of experience. An exegetical difficulty of the Kantian theory lies in the fact that these terms are used slightly altered in different contexts of his philosophy. For this reason, it is necessary to develop and detail this division.

2.1 Intelligible object or object of thinking

“[I]ntelligible […] objects” or “intelligibilia” are objects “insofar as they can be represented only through the understanding, and none of our sensory intuitions can refer to them.” That means, intelligible objects are objects which are represented through intellectual concepts. Kant uses this term congruent with the concept of noumenon and differentiates between an improper usage (a) and a permissible use (b) of these intelligible objects.

In the improper usage (a), the noumenon does not have an acceptable positive meaning. In this sense, intelligible objects are object of an intellectual intuition. “If, however, I suppose there to be things that are merely objects of the understanding and that, nevertheless, can be given to an intuition, although not to sensible intuition (as coram intuiti intellectuali), then such things would be called noumena (intelligibilia).” This is an improper usage of the intelligible object because it is used as a thing in itself but human beings merely have sensible and not intelligible intuition. Based on this restriction, it could not be resolved in a theoretical way if such objects are actually given.

In a permissible use (b), the noumenon has merely a negative meaning. In this sense, Kant uses the notion object to designate a thought-entity that is an object which is not given in intuition. This item includes all forms of conscious representations that are all of what is possible to think. “All representations, as representations, have their object, and can themselves be objects of other representations in turn.” In this sense, Kant calls representations as well as objects of representations intelligible objects. These objects are objects of our reference that is something of which we can have thoughts. They have a permissible use although they have a negative meaning because they do not indicate objects in intuition.

The specific function of the intelligible object becomes particularly clear in a Kantian correction of his personal copy of the Critique of Pure Reason. In the first edition of the Critique, Kant writes: “If by merely intelligible objects we understand those things that are thought through pure categories, without any schema of sensibility, then things of this sort are impossible.” In his personal copy, Kant deletes the formulation “are thought” and replaces it with the formulation “are cognized by us.” By means of this correction, Kant affirms that we cannot expand our cognition through intelligible objects but that they have a specific function in the framework of thinking. Apart from the realm of possibility in time and space, there is also a field of the conceivable in which intelligible objects have a permissible function.

14 Kant, Prolegomena to Any Future Metaphysics, AA 04: 316.
15 Kant, Critique of Pure Reason, A 249; A 256/B 312; A 264/B 320.
16 Kant, Prolegomena to Any Future Metaphysics, AA 04:316
17 Kant, Critique of Pure Reason, B 312.
18 Ibid., B 306.
19 Ibid., A 299.
20 Normally, Kant uses for the term things in themselves or thing in itself, which is more common in research, the Latin translation for res per se considerat that is Ding an sich selbst betrachtet.
21 Ibid., A 287/B 343-4.
22 Ibid., B 307.
23 Ibid., A 108.
24 Rosefeldt, Ich, 71.
25 Kant, Critique of Pure Reason, A 286/B 342.
26 Kant, Reflection, AA 23: 49; see also: Kant, Critique of Pure Reason, A 147; 246; 247; 251; 259.
27 In addition to this permissible use in the theoretical philosophy, these intelligible objects have also a practical function. Through their representations, the acting humans are the cause of the reality of an object. “The power of desired is the being’s power to be, through its presentations, [the] cause of the actuality of the objects of these presentations.” (Kant, Critique of
2.2 Undetermined object of an empirical intuition or appearance

In opposition to the *intelligible object*, Kant introduces the “undetermined object of an empirical intuition” or the “appearance”. With this sort of an object, Kant describes a thing of the external world, which can be perceived through the senses. Already in *De Mundi* (1770), Kant has a concept of such an appearance, and terms objects of this kind the *sensible objects*. In a footnote of the *Critique of Pure Reason*, he justifies the selection of this term although he does not use it very often. Beyond these definitions, sensible objects are objects, if they are represented through sensible concepts, meaning in time and space. For this reason, Kant also uses as an opposite to the term noumenon for sensible objects the term phenomenon. The most important characteristic of these objects is that they are given immediately. “Appearances are the only objects that can be given to us immediately, and that in them which is immediately related to the object is called intuition.” That means intuitions are also representations but relate to their object, the thing in itself, without referring to a concept. A sensible object "contains only the way in which we are affected by objects".

For this reason, Kant establishes with the sensible objects in the *Transcendental Aesthetic* a non-conceptual or rather non-recognizable but singular relation to an object. This “given manifoldness" is therefore the product of the affection in the forms of intuition.

It is noteworthy that the undetermined object of an empirical intuition has an outstanding importance in the *Critique of Pure Reason*, because it serves as the benchmark of cognition. “[O]nly what this word ["object"] is to mean in the case of appearances, not sofar as they are (as representations) objects, but rather only insofar as they designate an object requires a deeper investigation.” The given manifoldness is of the utmost importance and needs deeper investigation because it is the *re-identifiable* in the process of cognition, and therefore the condition of all forms of objectivity. Everything that is not in regard to such a given manifoldness is merely subjective. The “object of inner sense (I myself with all my representations)” can never be such a *re-identifiable external object* because the modifications of the inner world, for example feelings, are not available intersubjectively.

---

28 Kant, *Critique of Pure Reason*, A 20/B 34.
29 Ibid., A 20/B 34.
30 Kant, *De Mundi*, AA 02: 392.
31 Kant, *Critique of Pure Reason*, B 312.
33 Ibid., A 51/B 75.
35 Kant, *Critique of Pure Reason*, B 140.
36 The relation between appearance and things in themselves is much debated in the research on Kantian philosophy. Apart from non-integrable theories, two different interpretations can be distinguished: the so-called two-worlds and the two-aspects interpretations. Following the first one of these, things in themselves and appearance are actually two different things (Strawson, *Bounds*, 277; Guyer, *Claim*, Chap. 15; Van Cleve, *Problems*, Chap. 1 and 10; see also the critique from Allais, “World”, 660-665; Ameriks, “Idealism”, 329-342). Following the second one, things in themselves and appearance are two different points of view to one and the same thing (Prauss, *Erscheinung*, 13-15; Walker, *Kant*; Allison, *Idealism*, 35-37; Collins, *Experience*). For an overview to the actual debates see Schulting, “Idealism”, 128.
40 Kant, *Correspondence*, AA 11: 515.
2.3 Object of experience

Kant differentiates from the *intelligible* and the *sensible object* the "object of experience"\(^{41}\). With this specific case of objects, the aim of Kant’s critical investigation is named. The aim of the first *Critique* is, in fact, a transcendental-philosophical foundation for the objects of experience. To this end, his investigation must show how it is possible that objects of experience are autonomously existent (subject-independent) and at the same time not merely subjective and therefore arbitrary. Or in other words, how can the empirical object of the external world “be valid at all times for us and for everyone else”\(^{42}\)? *Valid at all time for us* and *for everyone* means intersubjective, or as Kant describes in one of his letters to Jacob Sigismund Beck, *communicable\(^{43}\).* To solve this problem, Kant develops the first *Critique* as a “transcendental philosophy”\(^{44}\) in which he does not examine objects but rather “our mode of cognition of objects insofar as this is to be possible a priori”\(^{45}\). For this reason, neither objects as *intentio recta* nor objects as *intentio obliqua* are at the focus of his investigation. In point of fact, Kant’s theory of objectivity focuses on the relation\(^{46}\) between concepts and the *undetermined object of an empirical intuition*, and asks the question *how are synthetic judgments a priori possible*\(^{47}\).

The corresponding relationship of a representation (A) and the object (B) is conceivable in a twofold manner: “Either if the object alone makes the representation possible, or if the representation alone makes the object possible.”\(^{48}\) If the object makes the representation possible (B→A), as is the case with sensible objects or rather sensations\(^{49}\), the representation is merely passive and receptive. It arises only through the affection of the senses\(^{50}\), and therefore the representation has merely empirical but never a priori character. But if the representation is the cause of the object (A→B), it precedes any empirical knowledge. In this way, the representation can be a priori determined in respect of the object. The conformity of the object with the representation intended as cause makes it possible, as Kant emphasizes, “to cognize something as an object”\(^{51}\).

With regard to the objects of experience, Kant accepts the traditional determination of truth as an accordance between cognition and objects.\(^{52}\) Thereby, the sensible objects are necessary to install this differentiation to the concepts. The appearance as the result of the affection guarantees the *narrowness* and the *dependence* of the human cognition upon the outside world. But the manifoldness in time and space is merely an object of experience through the constitutive functions of the categories and the regulative classification in the systematic context of our recognition through ideas. In fact, the given manifoldness is not an object of experience, it is merely its condition to *cognize something as an object*\(^{53}\). Kant pointed this out in a very precise and historically far-reaching way, when he writes: “Thoughts without content are empty, intuitions without concepts are blind.”\(^{54}\) Based on the main goal of the *Critique of Pure Reason*, which is as stated to develop the *mode of cognition of objects* insofar as this is possible a priori, Kant formulates the following very famous definition of an object of experience: “An object, however, is that in the concept of which the manifold of a given intuition is

\(^{41}\) Kant, *Critique of Pure Reason*, A 8/B 12; A 141/B 180.

\(^{42}\) Kant, *Prolegomena to Any Future Metaphysics*, AA 04: 298.

\(^{43}\) Kant, *Correspondence*, AA 11: 515.

\(^{44}\) Kant, *Critique of Pure Reason*, B 25.

\(^{45}\) Ibid., B 25; A 11; A 56/B 80-1.

\(^{46}\) Ibid., B IX; A 85/B 117; A 95; B 137.

\(^{47}\) Ibid., B 19.

\(^{48}\) Ibid., A 92/B 124-5; Kant, *Prolegomena to Any Future Metaphysics*, AA 04: 319; Kant, *Correspondence*, AA 10: 130.

\(^{49}\) Kant, *Critique of Pure Reason*, A 92/B 125; B 34/A 19-20.

\(^{50}\) Ibid., A 20/B 34.

\(^{51}\) Ibid., A 92/B 125.

\(^{52}\) Ibid., A 58/B 82.

\(^{53}\) Ibid., A 92/B 125.

\(^{54}\) Ibid., A 51/B 75. For a closer analysis of the structure of this famous sentence see Caimi, “Gedanken”, 135-146, a historical is provided by Rothacker, “Anschauungen”, 161-184.
united.” In this quotation, Kant describes the concept of an object as the manifoldness united by necessary rules. Thereby, his fundamental new concept is that an object is an object of experience in consequence of its lawfulness. An object of experience is an entity, which can be grasped through principles.

2.4 Combination between these concepts of objects

In order to cognize something as an object, the representation has to be the cause of the object. Therefore, Kant’s theory of objects of experience is based on his doctrine of “two stems of human cognition” or “two fundamental sources in the mind.” In the Third Section of the First Book of the Transcendental Dialectic, Kant argues that all the relations of representations are of three sorts.

Now what is universal in every relation that our representations can have is 1) the relation to the subject, 2) the relation to objects, and indeed either as appearances, or as objects of thinking in general. If we combine this subdivision with the above division, then all the relation of representations of which we can make either a concept or an idea are of three sorts: 1) the relation to the subject, 2) to the manifold of the object in appearance, and 3) to all things in general.

This tripartite division can be symbolized as follows:

```
  relation of representations
    to the subject  to objects
       as appearances  as objects of thinking
        the relation to the manifold of the object in appearance
        the relation to all things in general
```

Figure 1. [Michael Wolff]

If we ignore the relation to the subject because it is not relevant in this context, Kant differentiates the relation to the object in this passage twofold, the relation to appearances and the relation to objects of thinking. Moreover, he combines this classification with his theory of judgement and gains the relation to the manifold of the object in appearance, and to all things in general. In the Transcendental Logic, namely the Transcendental Analytic and the Transcendental Dialectic of the Critique of Pure Reason, Kant elaborates two different concepts to analyze these two relations. Based on this critical division and the above-mentioned differentiation between a permissible use and an improper usage, both concepts, the concepts of understanding and the permissible use of the concepts of reason, can be formal conditions through which alone an object of experience can be possible. “Thus all human cognition begins with intuitions, goes from there to concepts, and ends with ideas. Although in regard to all three elements it has sources of cognition a priori.”

55 Kant, Critique of Pure Reason, B 137; A 105.
56 Ibid., A 15/B 29.
58 Kant, Critique of Pure Reason, A 333-4/B 390-1.
60 Kant, Critique of Pure Reason, A 702/B 730.
It is a remarkable aspect that an object of experience requires and combines in this way both other objects, the intelligible and also the sensible one. Thereby, Kant designs an analogous relationship between the concepts of understanding and the concepts of reason.

Thus reason really has as object only the understanding and its purposive application, and just as the understanding unites the manifold into an object through concepts, so reason on its side unites the manifold of concepts through ideas by positing a certain collective unity as the goal of the understanding’s actions, which are otherwise concerned only with distributive unity.\textsuperscript{61}

For Kant’s concept of an object of experience, two different relationships between two different concepts are required. The concepts of understanding relate to the sensible objects in time and space and unite the manifold into an object. “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 understanding.”\textsuperscript{62} Apart from the concepts of understanding, the concepts of reason relate to intelligible objects or thought entities.

Such transcendent ideas have a merely intelligible object, which one is of course allowed to admit as a transcendental object, but about which one knows nothing; but for the assumption of such an object, in thinking it as a thing determinable by its distinguishing and inner predicates, we have on our side neither grounds of its possibility (since it is independent of all concepts of experience) nor the least justification, and so it is a mere thought-entity.\textsuperscript{63}

An object of experience is given, if the manifoldness in time and space is subsumed under the concepts of understanding, but only based on the regulative concepts of reason (ideas), it is classified in the systematic context of cognition. Therefore, it stands under \textit{formal conditions} in the strict sense of the \textit{Critique of Pure Reason}, if it stands under the concepts of understanding and reason.

To explain the inherent link between these two forms of concepts and their relation to objects, it is possible to refer to a Kantian analogy in the \textit{Critique of Pure Reason}. In the \textit{Appendix of the Transcendental Dialectic}, Kant borrows the so-called \textit{looking glass metaphor} from Newton.\textsuperscript{64} With this metaphor, Newton describes a specific constellation of observing an object.

Thereby, an “Object seen by Reflexion or Refraction, appears in that place from whence the Rays after their last Reflexion or Refraction diverge in falling on the Spectator’s Eye”\textsuperscript{65}. Figure 9 of the \textit{Opticks} illustrates what Newton has in mind.

![Figure 2. [Isaac Newton]](image-url)

\textsuperscript{61} Ibid., A 643-4/B 671-2; A 670/B 698; A 664-5/B 692-3.
\textsuperscript{62} Ibid., A 79/B 105; Kant, \textit{Prolegomena to Any Future Metaphysics}, AA 04: 300.
\textsuperscript{64} Ibid., A 644/B 672.
\textsuperscript{65} Newton, \textit{Opticks}, 18.
In this sketch, the object (A) is located in the background of the spectator (E, F, G). He or she sees this object through a reflection (B, C, D) in the looking glass (m, n). Thereby, the object appears not to be in its proper place (A) to the eye of the spectator, but behind the glass at (a). The rays AB, AC, AD, which flow from one and the same point of the object (A), after their reflection made in B, C, D, diverge in going from the glass to E, F, G. These rays create the image in the eyes as if they had come from the object behind the glass (a), meaning without the interposition of the looking glass.66

Kant integrates this analogy in his theory of objects to explain the connection between the sensible and the intelligible objects in an object of experience. He interprets the object (A) as the sensible object. This object is given through affection in the forms of intuition, space and time, and is therefore an object “in the field of possible empirical cognition”67. It is important to notice that the spectator’s eye cannot see these objects directly; it is not given as a thing in itself. In Kant’s interpretation of figure 9 of Newton’s Opticks, the looking glass symbolizes this mediated relationship between the concepts of understanding and the appearances. In addition to this mediated constitution, Kant interprets the object (a) as merely a thought-entity, that is as “an object lying outside the field of possible empirical cognition”68. Thereby, it is a transcendental illusion, if the spectator believes that the “lines of direction were shot out”69 from the object behind the mirror. It is transcendental because it “is a natural and unavoidable illusion”70 and has therefore in the system of reason an immanent function as a focus imaginarius.71 The specific function of the focus imaginarius is to order the cognition according to a principle. That means in the words of the metaphor, the object behind the mirror is an illusion but an illusion through which alone the spectator can create a systematic unity of the manifoldness of empirical cognition. The Critique of Pure Reason has the task of showing that this object is pure semblance but simultaneously also to install it as a regulative principle supplementary to the constitutive one.72

In summary, two different objects are presupposed for gaining an object of experience, the sensible and the intelligible object. As the concepts of understanding relate to the undetermined object of an empirical intuition or appearance, the concepts of reason relate to the intelligible objects or thought entities. The combination between these principles in these different objects creates the possibility of an object of experience.

3 Objects of experience as objects of a proper and natural science

Prima facie, Kant’s concept of an object of experience seems to be counterintuitive. It is a mismatch with common sense, because an object is not a simple given entity but an empirical intuition determined through principles. Furthermore, Kant differentiates between two different principles which create two different forms of lawfulness. Only if Kant’s theory of objects of experience is localized in the context of natural science in the 17th and 18th centuries and only if his theory of objects of experience is localized in the framework of his attempt to provide a metaphysical foundation of natural science, can its specific function be detected.

66 Newton, Opticks, 18.
67 Kant, Critique of Pure Reason, A 644/B 672.
68 Ibid., A 644/B 672.
69 Ibid., A 644/B 672.
70 Ibid., A 298/B 354; A 669/B 697; A 743/B 771.
71 “Everything grounded in the nature of our powers must be purposive and consistent with their correct use, if only we can guard against a certain misunderstanding and find out their proper direction.” (Ibid., A 642/B 670) For a detailed analysis of the function and the genesis of the focus imaginarius in Kant’s thinking, see Meer, “Vorstellungen”, 87-99; Grier, Doctrine, 37-8; Büchel, Geometrie, 107-9.
72 Despite the fundamental differentiation in the status of the concepts of understanding and concepts of reason, Kant applies in both the same methodological tools. In the Transcendental Analytic as well as in the Transcendental Dialectic, he develops a derivation (Kant, Critique of Pure Reason, A 77-83/B 102-10; A 321-2/B 377-8), a transcendental justification (ibid., A 84-130/B 116-66; A 669-70/B 697-8) and a schematism of the concepts (ibid., A 137-47/B 176-87; A 664-5/B 692-3). For more details see Caimi, “Deduktion”, 308-320; Zocher, “Deduktion”, 43-58; Karásek, “Selbstbezugs”, 59-74.
Already in the Critique of Pure Reason, the transcendental investigation of an object of experience starts in respect to the theoretical sciences of reason, that is, mathematics73 and natural science (physics)74. In the Prolegomena and the so-called regressive-analytic method75, Kant explicitly develops the possibility of synthetic judgments a priori based on the validity of these disciplines. Furthermore, in the Metaphysical Foundations of Natural Science, he tries to mediate his transcendental concept of an object of experience with the objects of physics. In his book of 1786, Kant analyses the empirical given concept of matter based on the table of categories.76

Resting upon this connection between metaphysics and natural science in critical philosophy, Kant’s most important examples to explain his specific concept of objects of experience are taken from astronomy.77 This is a fact which links Kant’s theory with other philosophical theories of the Early Modern Era78 but its specific elaboration makes his theory unique.

In accordance with Kant, the celestial bodies and stars in space are the objects of astronomy. Astronomy examines the orbits of the planets around the sun and their specific properties. Thus astronomy is in company with mechanics, dioptrics, hydrostatics, hydraulics, catoptrics, etc. a part of applied mathematics or rather physics. In this sense, astronomy is an “empirical science”79, because it includes a systematic framework of a priori concepts and principles and also an empirical research object. The groundwork for describing the planetary motion is thus the “law of reciprocal attraction”80. At the same time, astronomy includes an empirical part, and based on this premise Kant ascertains that astronomy depends on technical progress, for example in the further development of the telescope.81

This twofold characterization is the basis which makes astronomy a rational and so-called proper science as can be demonstrated with Kant’s classification in the Metaphysical Foundations of Natural Science. In this work, Kant argues that science is “a whole of cognition ordered according to principles”82. If these principles are structured through tenets of an empirical connection, then they produce a “historical doctrine of nature”83. This doctrine includes natural description as well as natural history. Both contain nothing but “systematically ordered facts about natural things”84. However, if the principles are structured through tenets of rational connection, as it is the case in astronomy, then they produce a “rational natural science”85. This rational science can be divided into “a properly or improperly so-called natural science”86. A properly designated natural science, as is again the case in astronomy, includes in addition to the applied cognition of reason also a “pure part, on which the apodictic certainty”87 is based. This denotes a doctrine in which the research object can be examined “wholly according to a priori principles”88. Whereas
in an improperly designated natural science, for example in chemistry, the research object is examined “according to laws of experience”\(^{89}\). For this reason, the cognition has “mere empirical certainty”\(^{90}\) and “is only knowledge improperly so-called”\(^{91}\). This twofold division can be illustrated as follows:

![Diagram of Kant's classification of the doctrine of nature]

Consequently, astronomy satisfies the highest standards of Kant’s classification of the doctrine of nature. The concepts of understanding make the objects of astronomy a proper natural science and the concepts of reason make it a rational natural science.

It is remarkable, however, that Kant develops both integrated concepts in the framework of astronomy based on one single example. He refers to astronomy in § 38 of the Prolegomena and explains the constitutive principles of understanding. Thus, he answers the question: How is natural science possible? This means Kant explores his concept of transcendental idealism and empirical realism; in accordance with this doctrine, the understanding does not draw its (a priori) laws from nature, but prescribes them to it.\(^{92}\) Only on this basis, is apodictic certainty, which is proper science, possible. However, Kant also refers to astronomy in the Appendix of the Transcendental Dialectic to explain the role of the focus imaginarius as a regulative principle of reason. In this passage, Kant develops the reciprocal relationship between several particular cases and their universal rule. Based on this, a whole of cognition ordered according to regulative principles\(^{93}\) is possible. In both examples from astronomy, the conic section is the binding link in exploring these different laws to create an object of experience.

### 3.1 Object in a proper natural science

In § 38 of the Prolegomena, Kant exhibits the “pure part”\(^{94}\) of astronomy. This pure part establishes astronomy as a proper natural science and distinguishes it from improperly natural sciences. Kant shows the connection between the construction of a circle, an ellipse, a parabola, a hyperbola and physical astronomy. The circle, the ellipse, the parabola, as well as the hyperbola are created from different conic sections. This can be illustrated with the following sketch:

---

89 Ibid., AA 04: 468.
90 Ibid., AA 04: 468.
92 Kant, Prolegomena to Any Future Metaphysics, AA 04: 320.
93 Kant, Metaphysical Foundations of Natural Science, AA 04: 467.
94 Ibid., AA 04: 469.
If the cone is sliced parallel to the base area, you gain a circle (a). If the angle of incidence is changed, this leads to an ellipse (b), to a parabola (c) and to a hyperbola (d). In order that, all four curves are in a continuous relationship to each other. Through a continuous deformation, all these different figures can be gained, as you can see in the following sketch.

On this basis, Kant discovers that “two lines that intersect each other and also the circle”\textsuperscript{95} are in a regular manner “such that the rectangle from the parts of one line is equal to that from the other”\textsuperscript{96}. It should be mentioned in this context that a rectangle is a geometric figure which builds a specific case of a parallelogram. In this figure the opposite chords [Germ. Sehnen] are parallel to each other.

Thereby, the regularity in the chords of the rectangle rests only on “the condition on which the understanding based the construction of this figure”\textsuperscript{97}. This means the reason lies in the “equality of the radii [Germ. Halbmesser]”\textsuperscript{98} in the construction of the circle. Thus, the rectangle has parallel chords merely because of the same radii (r) as the constructive conditions of the circle and depends therefore on the understanding as the reason of this law.\textsuperscript{99}

\textsuperscript{95} Kant, Prolegomena to Any Future Metaphysics, AA 04: 320.
\textsuperscript{96} Ibid., AA 04: 320. With this example, Kant refers to Proposition 35 of Book III of Euclid.
\textsuperscript{97} Kant, Prolegomena to Any Future Metaphysics, AA 04: 321.
\textsuperscript{98} Ibid., AA 04: 321.
\textsuperscript{99} See also Kant, Critique of Pure Reason, B XI-XII. Pollok, Anfangsgründe, 51; Koriako, Philosophie, 289. For further details to
Even if the circle (a) as a conic section is deformed to an ellipse (b), to a parabola (c) or to a hyperbola (d), it can be shown “that the rectangles from their parts are not indeed equal, but always stand to one another in equal proportions”\textsuperscript{100}. Even though these conic sections do not have identic radii, they have equal radii at the outermost points.\textsuperscript{101}

And even if “we go still further, namely to the fundamental doctrines of physical astronomy, there appears a physical law of reciprocal attraction, extending to all material nature”\textsuperscript{102}. This reciprocal attraction follows the rule “that these attractions decrease inversely with the square of the distance from each point of attraction, exactly as the spherical surfaces into which this force spreads itself increase”\textsuperscript{103}. For this reason, this “seems to reside as necessary in the nature of the things themselves and which therefore is customarily presented as cognizable \textit{apriori}\textsuperscript{104}. Thus, Kant reformulates\textsuperscript{105} Newton’s principle of gravitation from the \textit{Principia Mathematica} (1687). In this book, Newton presents the relationship between the relation (r) of two masses (m\textsubscript{1} and m\textsubscript{2}) as follows:

\[ G = \frac{m_1 \times m_2}{r^2} \]

The law of attraction is merely based “on the relation of spherical surfaces with different radii”\textsuperscript{106}. For this reason, not only all possible orbits of the celestial bodies can be presented as conic sections, but their mutual relations can also be shown only through the “law of attraction save that of the inverse square of the distances”\textsuperscript{107}.

With this example, Kant exhibits an intersection between the construction of a circle, an ellipse, a parabola and a hyperbola as different conic sections, and physical astronomy. Through this he leads the origin of all order in nature in the framework of astronomy back to geometry and in doing so back to understanding, insofar as it contains the basis for the unity of the construction of these figures. Consequently, Kant shows that Newton’s law of attraction, which is extended to all material nature, can be

\textsuperscript{100} Kant, \textit{Prolegomena to Any Future Metaphysics}, AA 04: 321.
\textsuperscript{101} With this example, Kant refers to Proposition 35-36 of Book III of Euclid.
\textsuperscript{102} Ibid., AA 04: 321.
\textsuperscript{103} Ibid., AA 04: 321.
\textsuperscript{104} Ibid., AA 04: 321.
\textsuperscript{105} Kant, \textit{Kant}, 193; Brittan, \textit{Kant}, 140-2.
\textsuperscript{106} Ibid., AA 04: 321.
\textsuperscript{107} Ibid., AA 04: 321.
explained and a priori cognized on the basis of the acts of construction.\textsuperscript{108} By this means Kant justifies the concepts of understanding as an a priori condition.

To sum up, astronomy has a pure part, which includes the principle of all other explanations of nature. This pure part establishes objects of astronomy as objects of a proper natural science in the strict sense of the \textit{Metaphysical Foundations of Natural Science}.\textsuperscript{109}

3.2 Object of a rational natural science

In the \textit{Appendix of the Transcendental Dialectic} of the \textit{Critique of Pure Reason}, Kant introduces the same example from astronomy, however, in a completely new context. His aim here is not to indicate the pure part of proper science, but to explain “the systematic in cognition, i.e., its interconnection based on one principle”\textsuperscript{110} or rather “a whole of cognition ordered according to principles”\textsuperscript{111}. In this sense, he writes in the \textit{Transcendental Doctrine of Method}: “I understand by a system, however, the unity of the manifold cognitions under one idea.”\textsuperscript{112} Based on this unity of the manifold cognitions, the astronomy can be a “rational natural science”\textsuperscript{113} and is differentiated from a “historical doctrine of nature”\textsuperscript{114}. As already mentioned, a rational natural science not only subordinates the proper but also improper sciences.

In the first part of the Appendix, the unity of the manifold cognitions under an idea (focus imaginarius) is developed by the means of the “hypothetical use of reason”\textsuperscript{115}, that is the principle of homogeneity (unity), specification (manifoldness) and continuity (affinity).\textsuperscript{116} It is important to note that the systematic in cognition gained through these principles is not an \textit{Archimedean point} but is governed by a historical change and development. Kant illustrates this with regard to astronomy, when he writes:

Hence if, e.g., the course of the planets is given to us as circular through a (still not fully corrected) experience, and we find variations, then we suppose these variations to consist in an orbit that can deviate from the circle through each of an infinity of intermediate degrees according to constant laws; i.e., we suppose that the movements of the planets that are not a circle will more or less approximate to its properties, and then we come upon the ellipse. The comets show an even greater variety in their paths, since (as far as observation reaches) they do not ever return in a circle; yet we guess at a parabolic course for them, since it is still akin to the ellipse and, if the major axis of the latter is very long, it cannot be distinguished from it in all our observations.\textsuperscript{117}

In these theories of the movements of the celestial bodies, namely the circle (a), the ellipse (b), the parabola (c), the cone is again the binding geometric link. As with conic sections, the different theories of the movement of the planets are in a continuous relationship (see figure 2 and 3). In turn, this continuity is the condition for a theory of a continuous process in the history of astronomy, as Kant explains:

\textsuperscript{108} The analysis of § 38 of the \textit{Prolegomena} can be seen as a proof for the necessity of the categories in natural science (physics) and is therefore an example based proof of the lawfulness of the categories (Friedman, \textit{Kant}, 165). In the \textit{Transcendental Analytic} of the \textit{Critique of Pure Reason} this proof is called \textit{transcendental deduction of the pure concepts of understanding} (Kant, \textit{Critique of Pure Reason}, A XVI; B 129).

\textsuperscript{109} Kant, \textit{Metaphysical Foundations of Natural Science}, AA 04: 470.

\textsuperscript{110} Kant, \textit{Critique of Pure Reason}, A 645/B 673.

\textsuperscript{111} Kant, \textit{Metaphysical Foundations of Natural Science}, AA 04: 467.

\textsuperscript{112} Kant, \textit{Critique of Pure Reason}, A 832/B 860.

\textsuperscript{113} Kant, \textit{Metaphysical Foundations of Natural Science}, AA 04: 468.

\textsuperscript{114} Ibid., AA 04: 468.

\textsuperscript{115} Kant, \textit{Critique of Pure Reason}, A 647/B 675.

\textsuperscript{116} In the \textit{Appendix of the Transcendental Dialectic}, Kant develops the regulative use of reason in two different ways, in the first part of the passage based on the principle homogeneity, specification and continuity, and in the second part based on the ideas God, world and soul. In addition, Kant reformulates the first explanation in the \textit{Critique of the Power of Judgment} but in a completely new framework. To the relation between the first and the second part of the \textit{Appendix} see Zocher, “Deduktion”, 43-58; Caimi, “Deduzione”, 308-320; Blackburn, “Truth”, 353-371. To the relation between the first part of the \textit{Appendix} and the \textit{Critique of the Power of Judgment} see Ginsborg, \textit{Role}, 174-192; La Rocca, “Funktionen”, 13-31; Düsing, \textit{Teleologie}, 24-51.

\textsuperscript{117} Kant, \textit{Critique of Pure Reason}, A 6623/B 690-1.
A naive, incomplete and “still not fully corrected” experience teaches that all celestial bodies have a circular movement. Beginning with the school of Pythagoras to Ptolemais and Copernicus this was the position taken on interpreting the movement of planets and this opinion even survived the change from the geocentric to the heliocentric model.

If there are variations or inconsistencies in our observations of the circular movement, then we suppose, based on the law of continuity, that the movement of the celestial bodies is not circular but elliptical. The properties of an ellipse are “more or less approximate to” those of a circle. For this reason, it is possible to transform a circle in an ellipse through “infinity of intermediate degrees”, that is, a continuous transformation. This is Kepler’s point of view; he argues that the celestial bodies move through elliptical orbits around the sun, as the first law of Kepler determines.

Compared with the planets, the movement of the comets shows an even greater variety of paths. As far as observation reaches, it is shown that they “do not ever return in a circle”. For this reason and based on the affinity between ellipse and parabola, it is necessary to transform the theory of the elliptic movements of celestial bodies into a parabolic course. If the big axis of the ellipse is extended, then the ellipse cannot be distinguished from a parabola in the observation (see again figure 3).

These movements of celestial bodies in the form of circular, elliptical, and parabolic courses around the sun are gained based on the hypothetical use of reason. Which means all three theories of the movement of celestial bodies are developed from “several particular cases” derived from the field of possible experience. In the course of this, these particular cases are tested by a general rule “to see if they flow from it”. If all particular cases can be explained by this rule, “then the universality of the rule is inferred, including all subsequent cases, even those that are not given in themselves” (A 647/B 675). In this sense, all theories of the movement of the celestial bodies, that is the circle, the ellipse and the parabola, build a thought-entity which Kant terms the focus imaginarius. Based on this, the observation has a systematic context; from this principle all diversities can be explained.

In the words of the analogy, borrowed from Newton, all these theories of the movement of celestial bodies – circle, ellipse, and parabola – build objects behind the looking glass (a). They are ideas and therefore not perceptible in the field of experience (A). In contrast to the categories, they are not constitutive but regulative principles. As regulative principles, they have an influence on the investigated objects in the field of experience. These theories are necessary for the observer to gain a systematic framework for the empirical research. That means, the regulative ideas do not replace the constitutive principle from the Transcendental Analytic or rather § 38 of the Prolegomena but complement it.

Based on this necessity of the regulative principles, Kant expands the already explained historical progress in astronomy, when he writes as follows:

Thus under the guidance of those principles we come to a unity of genera in the forms of these paths, but thereby also further to unity in the cause of all the laws of this motion (gravitation); from there we extend our conquests, seeking to explain all variations and apparent deviations from those rules on the basis of the same principle; finally we even add on more than experience can ever confirm, namely in accordance with the rules of affinity, even conceiving hyperbolical paths for comets in which these bodies leave our solar system entirely and, going from sun to sun, unite in their course the most remote parts of a world system, which for us is unbounded yet connected through one and the same moving force.

Under the guidance of the principles of homogeneity, specification and continuity, it is possible to conclude from the particular empirical cases to a “unity of genera in the forms of these paths” and the

---

118 Ibid., A 662/B 690.
119 Ibid., A 662/B 690.
120 Ibid., A 662/B 690.
121 Ibid., A 662/B 690.
122 Ibid., A 664/B 674.
123 Ibid., A 664/B 674.
124 Ibid., A 663/B 691.
125 Ibid., A 663/B 691.
“unity in the cause of all the laws of this motion (gravitation)”\textsuperscript{126}. Insofar, it has to be underlined that this is a conclusion which is beyond all experience. Based on this unity, Newton deduces Kepler’s laws of planetary motion. By means of the law of gravitation as focus imaginarius, it is in addition possible to imagine hyperbolic paths (d) of celestial bodies. In such hyperbolic curves, the comets leave the solar system entirely and move from sun to sun. Thereby, they move to remote parts of a world system “which for us is unbounded yet connected through one and the same moving force”\textsuperscript{127}.

To sum up, astronomy supposes a whole of cognition ordered according to principles. Of course, these principles do not constitute an object in the field of experience but they offer a regulative concept to classify different empirical observations under a general rule. In the example of the \textit{Appendix of the Transcendental Dialectic}, the cone symbolizes the systematic unity. On the strength of this unity, it is possible to think of a continuous transition between a circle, an ellipse, a parabola and even a hyperbola, and in doing so to make a historical progress between the different theories of the movement of celestial bodies.

### 3.3 Object in a rational and proper natural science

In the explication of the questions, what is an object of experience and how can we guarantee objectivity in the strict sense of a rational and proper natural science, Kant develops two different concepts of objects and combines them. Both objects create different forms of lawfulness which complement each other.

Answering the question, \textit{How is pure natural science possible?}, as well as in his explanation of the \textit{Regulative Use of Ideas of Pure Reason}, Kant refers to one and the same example from astronomy. In § 38 of the \textit{Prolegomena}, Kant explains, based on the example of the conic sections, the pure part of astronomy and the constitutive functions of understanding. These functions justify astronomy as a proper science in the sense of the \textit{Metaphysical Foundations of Natural Science}. In the \textit{Appendix of the Transcendental Dialectic}, Kant describes the systematic unity of cognition using the same example of astronomy. In doing so, he develops the possibility for a comprehensible theory of historical progress of the underlying assumptions in astronomy. This means, the geometry of the cone establishes in § 38 the objects of astronomy as a possible object of a \textit{proper science} and in the \textit{Appendix of the Transcendental Dialectic} as an object of \textit{rational natural science}.

Kant accepts two irreducible forms of law to constitute an object of experience in the framework of the \textit{Critique of Pure Reason}: first, the subsumption of a particular case under a given law, that is, the \textit{principle of understanding}\textsuperscript{128}; second, a heuristic conclusion from several particular cases to a not yet given law and the anticipation from possible cases based on this law, that is the \textit{principle of reason}\textsuperscript{129}.

An object of experience, gained in an empirical science, such as the objects with which astronomy is concerned, must include both. First, and in regard to the field of experience, such an object needs constitutive principles of understanding by which the manifoldness is combined through cause and effect. Second, such an object needs regulative principles which formulate maxims of research and thereby a systematic unity of all possible observations.

### 4 Conclusion

Kant’s entire theoretical philosophy can be understood as a theory of objects. This becomes particularly obvious through the proposition that all guidelines rely on different concepts of objects and their combination. Thereby, the object of experience is at the core of Kant’s investigation. It is a combination of intuition and the formal conditions of thought. Kant differentiates two of the latter: the concept of

\textsuperscript{126} Ibid., A 663/B 691.

\textsuperscript{127} Ibid., A 663/B 691.

\textsuperscript{128} Ibid., A 154/B 193-A 158/B 197.

\textsuperscript{129} Ibid., A 648/B 676; A 649/B 677; A 666/B 694.
understanding and the concept of reason. The first refers to sensible objects and the second to intelligible objects. Therefore, an object of experience in the strict sense of rational and proper natural science includes the undetermined object of an empirical intuition as a given manifold and also intelligible objects which are merely thought entities. Or under the terms of Newton’s looking glass metaphor, an object of experience includes the object in the field of experience (A) as well as the merely imagined object (focus imaginarius) behind the mirror (a).

With these two different objects, combined in the concept of an object of experience, Kant develops a unique theory of objects. In this he combines the possibility of historical changes and an apodictic claim in our experience. Kant’s theory of objects is based on the model of affection through the thing in itself. Therefore, experience depends on perceptions and is changeable. At the same time, objects of experience are not merely passively received, and for this reason, something which is produced from ourselves. This means, these objects are not something that is merely a composition of perceptions, but rather that each of them is an a priori determined entity. Thereby, the principles of understanding guarantee the apodictic claim and the principles of reason ensure the possibility for a rational explanation of the historical change. In contrast to the skeptical argument “that the existence of things outside us [...] should have to be assumed merely on faith”\(^{130}\), Kant demonstrates not only an apodictic claim in our experience of objects but declares also its historical progress.

References


Caimi, Mario. “Gedanken ohne Inhalt sind leer.” *Kant-Studien* 96 (2005), 135-146.


\(^{130}\) Ibid., B XXXIX.


