The stage on which our ingenious play is performed: Kant's epistemology of *Weltkenntnis*

Abstract

This paper focuses on Kant's account of physical geography and his theory of the earth. In spelling out the epistemological foundations of Kant's physical geography, the paper examines 1) their connection to the mode of holding-to-be-true, mathematical construction and empirical certainty and 2) their implications for Kant's view of cosmopolitan right. Moreover, by showing the role played by the mathematical model of the Earth for the foundations of Kant's Doctrine of Right, the exact relationship between the latter and physical geography is highlighted. Finally, this paper shows how, in Kant's view, the progress of physical geography can be assured if and only if the free circulation of human beings is established and regulated by law. Therefore, examining the mutual relationship between the theory of Earth and the foundations of right opens new perspectives on the relationship between epistemology and practical philosophy within Kant's system.

Keywords: Kant; Earth Sciences; Physical Geography; Epistemology; Doctrine of Right

Highlights:

- Clarifies Kant's view of physical geography as pragmatic knowledge of the world
- Identifies the main epistemological aspects of Kant's conception of scientific investigation based on empirical certainty
- Sheds light on the connection of Kant's physical geography to the *Metaphysics of Morals*

1. Introduction: Physical Geography as *Weltkenntnis*

Recent studies on Kant's physical geography, such as Stark (2011), Elden (2009, 2011), and Louden (2014), have emphasized its relevance within Kant's system and suggested possible ways of reading it in terms of a "propaedeutic to practical reason" (see Elden 2011, 3), especially in relation to Kant's *Anthropology from a pragmatic point of view* (see Louden 2015, 486).[1] Physical

[1] References to Kant's texts follow the pagination of the Academy edition (Ak). References to the *Critique of the power of Judgement* are abbreviated as CJ, whereas those to the *Critique of pure Reason* use the standard abbreviation CPR, followed by the A/B editions pagination. Translations are from the Cambridge Edition of the Works of Immanuel Kant unless stated otherwise.

geography was the topic on which Kant lectured for 40 years from 1756 to 1796 (Kuehn 2001, Elden 2011). Contrary to other subjects that Kant taught, the course of physical geography was not based on a textbook (Adickes 1911). This indicates that Kant shaped this discipline in an original way and contributed to its dissemination until the end of the 18th century. Two central notions of Kant's account of physical geography are those of: the world; and its pragmatic knowledge. In 1775, in *On the different races of man*, Kant defined the knowledge of the world (*Weltkenntnis*) provided by physical geography in terms of a cognition that embraces the relationship between human beings and the world *as a whole* (*im Ganzen)* (see Ak 02:443).[2] *Weltkenntnis* thus refers to the way in which human beings apply their knowledge to the physical world and to our planet in particular, in order to act within it. Physical geography, along with anthropology, is a key discipline for the cultivation of citizens of the world (see Ak 02:443). This is due to the fact that physical geography offers a description of the world that is not based merely on observation, but rather is meant to enable the application of the laws of right on this planet and the realization of Kant's ethicoteleology in the historical dimension. According to Kant, physical geography leads to the awareness that "the world is the foundation (*Substrat*) and stage on which our ingenious play is performed" (Kant, Ak 09:158). One possible reading of Kant's conception of *Weltkenntnis* consists of highlighting its consequences for practical philosophy, e.g., for "impure ethics" (Louden 2002) and for the pragmatic dimension, as examined by Elden (2011).

By contrast, I shall primarily focus on an epistemological analysis and explore the extent to which Kant's conception of empirical knowledge can lead to a deeper understanding of the role that the lectures on physical geography played within his system. To reach this goal, I shall examine the relation of this conception of knowledge to Kant's philosophy of right and clarify why Kant defined the world as a *Substratum* in his lectures on physical geography. I shall do so by analyzing the development of his epistemology both in his writings on natural science and logic (both in the Pre-Critical and more importantly in the Critical period), as well as in the *Metaphysics of Morals*. This move in turn offers a novel perspective in the systematic study of Kant's philosophy, but also the possibility to reflect upon how the epistemology of physical geography relates to the practical sphere, especially to cosmopolitan right (*ius cosmopoliticum*). Cosmopolitan right is defined by Kant as "the right of offering to engage in commerce with any other based on the possible union of

[2] It is worth emphasizing that in physical geography and in anthropology, the idea of the World (*Welt*) is not to be understood as an idea of pure theoretical reason. It is rather to be taken from a pragmatic perspective, as an idea leading to the representation of the Earth as a *Globus terraquaeus*, as the territory in which human beings freely interact and move, and therefore as an idea of practical reason.

all nations" (Ak 06:352).[3] As we shall see in the next sections, one of the conditions of possibility for thinking of this unity lies precisely in the mathematical representation of the Earth that is used in Kant's physical geography. In what follows, I first examine Kant's writings on natural science, with an emphasis on those discussing his theory of the Earth (Section 2), and those on physical geography (Section 3). Then I shall expound the epistemological aspects underlying physical geography which emerge in the Critical period (Section 3.1) and the characterization of collective knowledge in physical geography (Section 3.2). Finally, in Section 4, I shall show which model and methods of physical geography Kant used for the foundations of his doctrine of cosmopolitan right in the *Metaphysics of Morals*, such as his use of a mathematical representation of the Earth in order to justify the possession of land for all human beings.

2. The Theory of Earth in the Pre-Critical Writings

The widespread interpretation of Kant's early writings on natural science, including lectures on physical geography, is that they were distant from the attitude of the Critical period, in which transcendental philosophy is meant to ground natural science in a systematic way. This reading is plausible only if we consider each of Kant's Pre-Critical works in isolation. Marcucci (2004) noticed that even if Kant's early Pre-Critical works of natural science (1754-1757) are not strongly based on philosophical assumptions, still they already contained most of the major topics of natural science that Kant would develop in the following 40 years. The present paper does not discuss this interpretation in depth, but takes up an important point underlined by it, namely that each work of the cluster of Kant's mid-18th-century writings on natural science should be read in connection with each other. If one assumes this perspective, then it is easy to notice that one of the main preoccupations of the young Kant was the attempt to reconstruct a theory of the Earth from a physical perspective, including a study of its structure and its evolution within the solar system.

In 1754, Kant published *Examination of the question whether the rotation of the earth on its axis […] has undergone any change since its origin and how one can be certain of this.* Originally conceived as a prize essay to be sent to the Academy of Sciences in Berlin, it was rather published in ten issues in a local popular magazine of Königsberg, the *Wöchentliche Königsbergische Frag- und Anzeigungs-Nachrichten*. Starting from Euler's studies of the Earth as a spheroid, Kant proposed a subtle and precise argument in support of the change of the Earth's momentum in the

[3] This characterization of cosmopolitan right has been an object of studies on Kant and colonialism (Flikschuh and Ypi, 2014). A recent attempt at discussing cosmopolitanism in geography is Harvey (2011). However, unlike the present contribution, it does not account for the development of Kant's epistemology to study such a connection.

calculations of its rotation. This essay introduces an important point that will also be present in *Universal Natural History and Theory of the Heavens* (1755). In Kant's view, the use of a mathematical model, i.e., the Earth represented as spheroid, together with the inclusion of physical effects, i.e., the oceans' water mass, enables the application of the laws of physics to the rotation of the planet and the prediction of the behavior of celestial bodies. Kant, who is fascinated by the application of mathematics and physics to fields that were previously interpreted on the grounds of traditional and religious narratives, expresses the same attitude in two works from 1754 (Kant 1754a, 1754b), which suggests that the two writings are meant to complement one another. The first work describes the Earth's motion and predicts its features on the basis of physical laws, whereas the second attempts to reconstruct the earth's evolution. Therefore, *The question, whether the Earth is ageing, considered from a physical point of view* not only includes a theory of planetary formation, but also discusses the interaction between human beings and the environment (see Kant 1754b, Ak 01:197).

However, unlike in Kant (1754a), *The question, whether the Earth is ageing, considered from a physical point of view* raises an important topic for the foundation of physical geography. Whereas there is no problem in applying the laws of physics to determine the present and the future behavior of planetary motion, the same cannot be said for the history of the planet and its changes throughout history. There is a degree of uncertainty that is related to geological phenomena and therefore not eliminable. Kant himself describes the different epochs of nature that dictated the cycle of the Earth's evolution in terms of an inner cycle subject to sudden changes. Not all the factors determining such a change are immediately predictable (see Kant 1754b, Ak 01:200-202).

The uncertainty related to the evolution and history of the planet is shown by the unpredictable character of phenomena, such as earthquakes.[4] The uncertainty concerning earthquakes and most other subterranean phenomena is expressed in a simple remark: "We have another world beneath our feet with which we are at present but little acquainted" (Kant, 1756b, Ak 01:432). The simple fact that the inner structure of the planet we inhabit is unknown does not however limit completely the capacity of natural science to explain and clarify phenomena, thereby positively influencing human life. Indeed, according to Kant, when an earthquake occurs at least the

[4] This view was reinforced in 1756 when Kant published *On the cause of earthquakes* in three essays, soon after the catastrophic earthquake in Lisbon of 1755. Many philosophers, at first astonished, later commented on this event, producing several ethical works between them. However, Kant did not simply comment on the earthquake from an ethical standpoint: "But at least we can say that they are not pleasing to the natural philosopher, for what hopes does he have for ascertaining the laws according to which changes occur in the air when a subterranean atmosphere is interfering with their effects, and can one doubt that this must take place frequently, for how else may we explain the fact that there is no regularity in the changes in the weather, because the causes of these changes are partly constant and partly periodic?" (Kant 1756a, Ak 01:426).

propagation of effects (shockwaves) is known according to the laws describing the behavior of wave propagation. Thus, in constructing his theory of earthquakes and tidal waves, Kant describes the way in which the seismic waves propagate and, by assuming the spheroidal shape of the planet, he is able to draw some conclusions about their effects on the surface and the damage that they can produce.[5]

In the mid-1750s Kant believes that the world cannot be thought of as an ideal environment for human beings (see Kant 1756b, Ak 01:431). In his view, the final goals of human aspirations are located outside the realm of nature: natural laws do not contribute to the ethical completion of human beings, for instance of their duties and rights. However, any teleological reading of the history of the planet should be disregarded. For Kant, recognizing this fact is something positive: it allows human beings to know their limits and develop new skills, and strengthens their existing abilities. The same attitude is also present in the *New notes to explain the theory of winds* (Kant 1756d), where Kant talks about the advantages that navigation obtains from the knowledge of the atmosphere and winds (Kant 1756d, Ak 01:501). Kant himself proposed a new explanation for the generation and characters of the western winds and monsoon, but he also assumed that the empirical laws of winds would be the result of complex mechanisms that were yet to be discovered. In other words, only the development of a theory of the atmosphere would have been capable of explaining winds and other phenomena studied by meteorology. In the meantime, according to Kant, it was possible to rely on well-known laws that helped natural scientists to model atmospheric phenomena by assuming, for instance, that the atmosphere responded to Bernoulli's law of pressure for fluids and its description of moving columns of air (see also D'Alembert 1747 and Euler 1755a, 1755b, 1755c; see also Darrigol 2005, Darrigol and Frisch 2008).

Now, is Kant's approach concerning geophysical processes, such as earthquakes and winds, the same that he assumes in the physical geography? In *Plan and announcement of a series of lectures on physical geography* (1757), Kant maintains that there are three ways of looking at the Earth:

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[5] Kant's theory of the Earth assumes an original chaos which governed the natural processes in the planet. Then the progressive cooling down of the surface allowed for the orogeny and for the Earth to become inhabited. However, in agreement with De Mairan's theory, Kant also believed that the interior of the Earth was extremely warm and that it was responsible for the emission of heat. This theory was in contrast with Buffon's theory of the planet. The latter, similarly to Leibniz, stressed the fact that the interior of the Earth was cold and governed by processes of stratification and crystallization. Even if Kant rejected Buffon and Leibniz's views of the interior of the planet, he still accepted Leibniz's hypothesis concerning the structure of the upper level of the crust. He believed that there were cavities beneath the surface of the globe and that under the action of earthquakes these cavities were falling down, thereby enabling the propagation of seismic waves throughout large regions of the surface.

a) The mathematical approach which portrays the Earth as an approximately spherical heavenly body.
b) The political approach which focuses on peoples, mutual exchange among communities, religions, governments and customs.
c) Physical geography that expounds the natural characteristics of the globe (seas, dry land, mountains, rivers, the atmosphere, human beings, animals, plants, minerals, etc.); its method consists in the comparison of observations, which typically resulted from the "curiosity of a traveler" (see Kant 1757, Ak 02:03).

One can immediately notice that the activity of producing mathematical models of the Earth (which is fundamental in Kant's considerations on geophysics, see 1754a, 1756a, 1756b, 1756c, 1756d) is not included among the methods of physical geography. Already in the mid-1750s Kant included the theory of winds in physical geography, but excluded, at least in the Pre-Critical period, phenomena such as earthquakes and the planetary evolution of the Earth.[6]

What about phenomena such as meteorites, earthquakes and tidal waves, that were unpredictable but terribly important for the history and the development of the planet and of life therein? In the 1750s, they had no place in Kant's physical geography, but belonged to a different level of understanding of the Earth through natural laws. It is for this reason that in the 1750s Kant sharply distinguished between the method of physical geography, which was mostly concerned with observation, and the method of studying the atmosphere in its complexity. In the 18th century, meteorology included all phenomena of the terrestrial atmosphere, such as winds, rain and so forth, phenomena occurring under the crust (earthquakes) or in the sea (tidal waves), and external objects interacting with the atmosphere, such as meteorites. Meteorology also included the study of gases (pneumatics) and climatology (Frängsmyr, Heilbron & Rider 1990, 143ff.). One may wonder whether what Kant called 'physical geography' would be a part of what was called 'meteorology' in the 18th century. From our discussion, it will emerge that this was not the case. Kant established physical geography as autonomous, but at the same time claimed that it had to rely on the results obtained by meteorology and its sub-fields. On the one hand, physical geography has its proper domain and strongly relies on natural science and empirical observations; on the other hand, it reconstructs the idea of the world as a *substratum*, which is meaningful not only for our scientific

[6] Rink's 1802 edition contains a brief section on the epochs of the Earth (see Ak 09:296ff.). Its inclusion in the field of physical geography in the Critical period also depended on the fact that Kant changed his mind on natural history (*Naturgeschichte*) in a less favorable direction (see Marcucci 1986, and for a discussion of earlier views of Marcucci, see Düsing 1984). Indeed, Kant weakened the epistemic status of the 'history of nature' and gave theoretical preference to the 'description of nature' (*Naturbeschreibung*) (Sloan 2006).

activities, but also from a practical standpoint. As we shall see in the next sections, Kant progressively included the practical standpoint in physical geography and so he gradually revised his account such that it would reflect the developments of his critical philosophy and his theory of empirical knowledge.

3. Kant's Physical Geography: an Open Question

The doctrines of the theory of Earth and its history, as well as the theory of the atmosphere and winds, form part of Kant's lectures on physical geography. It is of crucial importance to reconstruct Kant's view of physical geography in its epistemology and its foundations. However, the reconstruction of Kant's doctrine of physical geography is not a simple task, because its textual basis is disputed. This has been discussed by recent studies, such as Stark (2011), Elden (2011), Reinhardt (2011), Louden (2014) and by older ones, such as Adickes (1911; 1925, 373 ff.).

The problem in a nutshell is the following: Rink's edition of Kant's *Physical Geography* cannot be taken as representative of Kant's doctrine since the first volume is based on lectures dated from 1775 (see Ak 9:156-273) and the second (see Ak 9:273-436) is based on prior lectures held between 1758 and 1759 (see Adickes 1911; Louden 2011, 192 footnote 5). It is also true that Kant commissioned the 1802 edition to Rink and therefore part of the material is originally taken from Kant's manuscripts and lecture notes. Kant's aim was also to avoid the publication of materials without his permission, as was the case in 1801 with the publication of Vollmer's *Kant's physical geography* (see Ak 12:372). We also have other sources that can be compared with Rink's edition, such as Herder (1763-1764), Hesse (1770), Kaeheler (1774), Messina (1778), Dönhoff (1782), Dohna (1992) or the manuscript *an-Holstein-Beck*, which is believed to be the closest to Kant's *Diktattext*.[7] For the purpose of the present paper, which focuses on the epistemology of physical geography, we should at least consider whether Kant's approach to physical geography changed from the Pre-Critical to the Critical period both with respect to the development of Kant's doctrine of empirical certainty and to the systematic role that physical geography assumes as a propaedeutic of philosophy. Let us start with the last point. Adickes (1911) had already shown that Rink's 1802 edition of *Physical Geography* roughly follows upon the 1775 lectures in describing the possible approaches to geography. These are:

[7] Kant gave private lectures on physical geography during the Winter of 1772-1773 in the home of the Herzog Friedrich von Holstein-Beck before a mixed circle of auditors. Stark (2011) finds it likely that Kant had a copy made of his own text to present to Holstein-Beck; Kant added various *marginalia* and made some corrections to personalize the copy. The literature agrees that this manuscript is the closest copy of Kant's *Dictata*, the texts that he prepared from 1757-1759 and which served as the basis for his lectures, and which are now lost: see Louden (2012).

1) Mathematical geography
2) Moral geography
3) Political geography
4) Mercantile/commercial geography
5) Theological geography

We immediately notice that in Rink's 1802 edition there is a difference with respect to the 1757 lecture examined in the previous section: mathematical geography is now part of physical geography, whereas before it was an alternative approach to the knowledge of the world, different from physical geography (Kant 1802, Ak 09:164-165). In *Vorzügliche kleine Schriften und Aufsätze. Nebst Betrachtungen über die Erde und den Menschen aus ungedruckten Vorlesungen* (1833), Starke, a pseudonym for Johann Adam Bergk, reports the definition of physical geography used by Kant in 1791 during his lectures:

"The world can be treated as it is now or as it was (in the past); the former is Cosmography whereas the latter is World history. Cosmography is either the description of the world as object of our senses or as the complex of objects with which we could come together, but over all possible celestial bodies it is only the Earth that we need from our perspective and that we could change. The description of the Earth (geography) is the knowledge that concerns what can be found now on Earth and can be treated either as natural or political description" (Kant, Bergk, 1833, p. 262).[8]

Therefore, in the 1790s, Kant offered a definition of worldly knowledge (*Weltkenntnis*) as the combined experience of nature and of human beings acting upon it. This meaning is also present in Rink's edition of *Physical Geography*, where the knowledge of the world consists in considering "how to apply one's knowledge and make use of it in a manner appropriate to one's understanding and present situation, or to provide practical use for one's knowledge" (Kant 1802, Ak 09:157).

Differently from the Pre-Critical period, however, Kant further clarifies the cosmographic point of view, according to which the knowledge of the world is a pragmatic knowledge of the

[8] Translation is mine. The original reads: "Die Welt kann betrachtet werden, wie sie jetzt ist oder wie sie gewesen ist; jenes ist Kosmographie, dieses Geschichte der Welt. Die Kosmographie ist entweder Beschreibung der Welt als Gegenstand unserer Sinne oder der Inbegriff der Gegenstände, mit denen wir in Gemeinschaft kommen können, aber unter allen übrigen Weltkörpern ist dies nur die Erde, welche wir allem nach unseren Absichten brauchen und verändern können. Die Erdbeschreibung (Geographie) ist Kenntniß desjenigen, was jetzt auf der Erde angetroffen wird, und kann entweder als Natur - oder als politische Beschreibung betrachtet werden".

Earth and of human beings as a whole (see Kant 1802, Ak 09:157). The cosmographic standpoint is the only one that allows the systematic knowledge of the world as the sum total (*Inbegriff, complexus*) of objects of experience, and as a *Substrat* on which human beings act, as introduced in Section 1. Thus, in the Critical period, physical geography offers the possibility of systematically knowing the world, understood as the sum total of our experiences and as the stage on which we perform. Furthermore, physical geography contributes to the understanding of connections among phenomena, is systematic and guides pragmatic knowledge of the world (see Kant 1802, Ak 09:158).

To this pragmatic view of *Weltkenntnis*, Kant added important elements that clearly emerge in the 1790s: both geography and history become part of physical geography as knowledge of the world. This excludes that the method of physical geography must be based on observation only, because it can rely on descriptions offering historical certainty and on pragmatic knowledge or know-how that in turn is grounded in the mathematical modeling of the Earth. Mathematics, I claim, enters into play in a systematic way in the physical geography and ensures that it is not based on observation only. Furthermore, from the epistemological perspective, physical geography progressively includes explanatory elements and the transformation of opinion based on empirical knowledge into higher levels of certainty, including holding-to-be-true, objective probability and so forth.[9] Precisely in this progressive inclusion can one identify the architectonic function of the concept of physical geography as *Weltkenntnis*: physical geography has a regulative function to orient human activity on this planet.

3.1 Physical geography: Knowledge and methods

Let us now analyze the epistemological underpinnings of physical geography. My analysis focuses on published works, such as the *Critique of the Power of Judgement*, and on passages of students' manuscripts of Kant's lectures on logic and metaphysics that can shed light on Kant's lectures in physical geography.

First, let us examine the conundrum according to which, for Kant, physical geography as knowledge-of-the-world would not be a historical narrative, but a mere study of space (Hartshorne 1958) realized through the description of our planet and its parts (e.g., topography, chorography,

[9] In the CPR these levels of certainty are discussed in the *Doctrine of Method* (see CPR A820/B848-A831/859). In particular, Kant describes how one can pass from opinion to belief, and from holding to be true to knowing (see CPR A822/B850). I also discuss this aspect in section 3.1.

orography, hydrography).[10] However, Kant included the history of the Earth and its epochs in his lectures on physical geography in the Critical period. How can the history of our planet be a part of physical geography, given that for Kant history implies a temporal narrative rather than a pure description? This question can be resolved by considering Kant's epistemology and his definition of certainty given to geography in both his published and unpublished writings.

We can choose two basic questions to investigate Kant's doctrine of explanation and probability in order to show how it assumes more and more importance for physical geography in the Critical period:

1. Are there explanations in physical geography?
2. Which kind of certainty, and therefore knowledge, can physical geography offer?

The first question can be answered by considering that empirical knowledge is for Kant associated to the mode of holding-to-be-true (*Fürwahrhalten*).[11] We have seen how taking account of uncertainty is crucial in Kant's natural writings since the Pre-Critical writings and, from the epistemological perspective, it becomes an even more pressing question in the third *Critique*. In the Critical period, indeed, Kant describes the explanation offered by physical geography as *an approximation to certainty* on the ground of his doctrine of holding-to-be-true.[12] The latter is associated with probable cognition in Kant's lectures on logic, as follows:

"To the doctrine concerning the certainty of our cognition pertains also the doctrine of the cognition of the probable, which is to be regarded as an approximation to certainty. By probability is to be understood a holding-to-be-true based on insufficient grounds which have, however, a greater relation to the sufficient grounds than do the grounds of the opposite. By this explanation we distinguish probability *(probabilitas)* from *mere plausibility (verisimilitude),* a holding-to-be-true

[10] For a discussion of historical narratives and geographical description in Kant's physical geography, see Marcuzzi (2011).

[11] Kant defines this mode as follows: "Taking something to be true is an occurrence in our understanding that may rest on objective grounds, but that also requires subjective causes in the mind of him who judges. If it is valid for everyone merely as long as he has reason, then its ground is objectively sufficient, and in that case taking something to be true is called conviction. If it has its ground only in the particular constitution of the subject, then it is called persuasion. Persuasion is a mere semblance, since the ground of the judgment, which lies solely in the subject, is held to be objective. Hence such a judgment also has only private validity, and this taking something to be true cannot be communicated. […] The touchstone of whether taking something to be true is conviction or mere persuasion is therefore, externally, the possibility of communicating it and finding it to be valid for the reason of every human being to take it to be true" (CPR A820/B848).

[12] See footnote 12.

based on insufficient grounds insofar as these are greater than the grounds of the opposite" (Kant, *Jäsche Logic*, Ak 9:81).

With probability, then, the ground of holding-to-be-true is *objectively valid,* while with mere plausibility it is only *subjectively valid.*[13] Probability is an approximation to certainty, because with it there must always exist a standard in accordance with which one can estimate it. This standard is *certainty* (see Kant, *Jäsche Logic*, Ak 09:82). I shall come back to this question about explanation in the following section, but for now it is worth noticing that for Kant explanations in physical geography are either approximately certain or probable.

As to the second question, we notice that in the 1770s Kant claims that physical geography offers not only belief or opinion but also knowledge:

"In speculative philosophical cognition one can indeed hold opinions, but not believe. In mathematical cognition one can neither hold opinions nor believe, but only know. In empirical or historical cognition, all three. In practical cognition, only belief" (Kant, *Refl. 2450. 1764–68? 1769–70? (1772–75?) V, 43, at §157*, Ak 16:374).

This is because physical geography as worldly knowledge can be based on experiments and speculations which lead to opinions (e.g., the composition of high strata of the atmosphere), but it is also based on mathematical cognition (e.g., the Earth represented as a spheroid, the atmosphere modelled as a fluid and so forth) and therefore implies knowledge (*Wissen*). Finally, as we shall see in the next sections, in the context of physical geography, cognition can also assume the connotation of belief, because it is genuinely based on the trust that one has in the words of experts and explorers. Furthermore, in the early 1770s, physical geography is characterized beyond doubt by empirical certainty (Kant, *Refl. 2454.* (1769–70? 1771–75? V, 44, opposite §162), Ak 16:375) and is classified as historical cognition.[14] In the 1780s, in particular in the *Vienna Logic*, Kant deepens his conception of historical knowledge with respect to his notion of a system and attributes

[13] In the CPR Kant distinguished between an external (communication and agreement of judgments) and an internal source of certainty (truth) for the mode of holding-to-be-true (see CPR A820/B848-A821/B849). In the *Jäsche Logic,* it emerges that Kant is clearly looking for an additional source of objective validity (certainty) for this mode that is able to lead to knowing (compare CPR A822/B850).

[14] In Kant's view, to hold an opinion is different from but not opposed to knowing. Believing is rather opposed to knowing, in the same way that only historical cognition is opposed to rational cognition, see Kant, Ak 16:374.

to physical geography a specific kind of empirical certainty which he calls historical certainty (Kant, *Vienna Logic*, Ak 24:891).[15]

In the *Jäsche Logic* empirical certainty is *original (originarie empirica)* to the extent that one becomes certain of something *from one's own* experience, and *derived (derivative empirica)* insofar as one becomes certain through *someone else's* experience (see Kant, Ak 09:71). The latter is called *historical* certainty and does not rest on our own experience, but on testimony.[16] This implies a social dimension of knowledge and the possibility to communicate it through language (see also Kant, *Refl. 5645*, Ak 18:291). In other words, the knowledge of the world provided by physical geography assumes the existence of an exchange (*commercium*) among human beings and a reciprocal interaction (*Wechselwirkung*) that is also fundamental for the foundation of the Doctrine of Right (see Section 4).[17] The character of this collective knowledge is based on the doctrine of holding-to-be-true, as described in the *Blomberg Logic*:

"We have two methods for grounds of holding-to-be-true. The *agreement* of other men with our opinions, and the testing of our thought according to other men's sentiments, is really a most

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15 "Sciences are historical sciences or sciences of reason. It is not good that the author understands by science only a cognition of reason. For a system can be given for historical things, too, namely, by my setting up an idea, in accordance with which the manifold in history is to be ordered […]. The idea could be this. Human actions derive from human nature, in order to fulfill completely its determination if I take as my idea how human nature has developed in various ages, and how it has gradually gotten closer to its determination, i.e., to the completion of all the purposes that are prescribed for humanity on earth, then I bring a system to mind, in accordance with which I can order history. Certainty is either 1. empirical certainty. This rests either on one's own experience or that of others, when I hold the thing to be certain on account of their testimony. It is also called historical certainty. It is just as good empirically as my own experience, however. For often I must not trust my observations as much as those of some other man, of whom I know that he is an attentive man, and that I am probably overlooking something in the matter. The certainty is all the stronger. For there are some things that I do not attend to as much as another man does" (Kant, *The Vienna Logic*, Ak 24:891).

16 In *The Vienna Logic* (Ak 24:899) it is reported that certainty can be grounded in the testimony of other people, as history and geography are grounded therein. For Kant's notion of testimony and its relevance for a theory of knowledge, see also Gelfert (2006). Also Scholz (2000) can be very helpful in understanding the epistemic limits of testimony in Kant's view.

17 In *The Blomberg Logic* (Ak 24:245-246) we find the following passage: "Just because the whole of men's *commercium* would be removed if no one asserted the truth, since then no one would trust anyone else; because a lie is something harmful, too, and asserting the truth is the most certain path for avoiding disdain. E.g., geography, physics, history, and other sciences always presuppose the experiences of others. In common life one must not believe the common man in regard to such cognitions as do not affect the interest of all men, but are rather indifferent. For in such cases it is all the same to him whether something is thus or otherwise, since he does not have insight into the importance of the cognition. The learned man, however, has far more credibility in this kind of cognition, for to him even the slightest matters in all cognition will be important[;] he will also be more inclined, from love of honor, to assert everything precisely as he has experienced it, since otherwise he would lose his credit". This passage should be compared with the *Metaphysics of Morals* (Ak 06:352) where Kant offers the juridical definition of *commercium* among human beings in the *ius cosmopoliticum*. From the comparison of these passages it emerges that historical certainty can be objectively valid on pragmatic grounds. Its objective validity is grounded on the objectivity of right and not on pure theoretical grounds.

outstanding logical test of our understanding by the understanding of others. Man needs this communication of his cognitions very much in order to be able to pass judgment on them rightly. Men have a natural inclination to communicate to others the judgments that their understanding has made, and merely from this arises the writing of books, whose cause has otherwise been set down to vanity, to ambition, by other critics of the human race, who would happily interpret everything most unfavorably. Men who separate themselves from all human society necessarily find, in the end, when they begin to investigate their condition and the causes of their misanthropy, that they do not themselves have enough means to distinguish the true from the false. The freedom to communicate one's thoughts, judgments, [and] cognitions is certainly the only most certain means to test one's cognitions properly, however, and to verify them. And he who takes away this freedom is to be regarded as the worst enemy of the extension of human cognition, indeed, of men themselves" (Kant, *Blomberg Logic*, Ak 24:150-151).

To fully specify the importance of the collective dimension of knowledge which characterizes Kant's physical geography, I shall now consider other published works, such as the *Critique of the Power of Judgment*. In particular, the second edition gives us an important hint concerning Kant's mature view of geography:

"For although we can have faith in that which we can learn only from the experience of others by means of testimony, it is not on that account intrinsically a matter of faith; for in the case of one of those witnesses it was still real experience and fact, or presupposed to be such. Further, it must be possible by means of this route (of historical faith) to arrive at knowledge; and the objects of history and geography, like everything else that it is at least possible for us to know given the constitution of our cognitive faculties, belong not among matters of faith but among facts. Only objects of pure reason can be matters of faith in any case, but not as objects of mere pure speculative reason; for then they could not even safely be counted among the matters, i.e., objects, of possible cognition for us" (Ak 5:469, CJ p. 333).

In the second edition of the third *Critique*, Kant added this reference to geography. Thus, in 1791 Kant explicitly claims that the objects of geography can be known in conformity with the constitution of our cognitive faculties. That our faculties are constituted in a certain way and not in another one is a *factum* (*Thatsache*). Furthermore, knowledge of the object of geography, i.e., the Earth as terrestrial globe (*Erdglobe*), can also make use of testimony, but it is not grounded in it. The specific form and constitution of our planet also constitute a factum for the pragmatic

knowledge of physical geography. Experience can enrich the determination of the world as object of geography, but this process must be founded in Kant's doctrine of theoretical proof, because "every matter of fact is grounded in theoretical proofs" (CJ Ak 05:469). Kant explicitly appeals to his doctrine of holding-to-be-true as the epistemological ground of belief for pragmatic cognition:

"They [i.e., proofs, author's note] must ultimately ground all holding-to-be-true on a *factum* (*Thatsache*), if it [i.e., holding-to-be-true, author's note] is not to be fully groundless; and the only difference among proofs is thus whether the holding-to-be-true of the consequence drawn from this fact can be grounded on it as knowledge, for theoretical cognition, or mere belief for practical cognition. All facts belong either to the concept of nature which proves its reality in the objects of the senses that are given (or can possibly be given) prior to all concepts of nature, or to the concept of freedom, which sufficiently proves its reality through the causality of reason with regard to certain effects in the sensible world possible by means of it, and which are irrefutably postulated in the moral law (Ak 05:475, CJ, pp. 338-339)".[18]

However, this passage also suggests consequences for the interpretation of the structure and exposition of physical geography. Indeed, since every fact is grounded in theoretical proofs, that the Earth is a terrestrial globe is itself a fact grounded in theoretical proofs. This fact depends on our capacity to give a mathematical representation of the planet. It is for this reason that in both Kant's lectures and in Rink's edition of *Physical Geography*, the exposition always starts with the mathematical representation of the Earth. But this representation is not only related to physical geography and geophysics, it is also fundamental in characterizing the foundations of Kant's doctrine of right, as well as the methods followed in the act of division of land according to quantity, i.e., in constituting property rights (see Section 5).

3.2 Kant's Epistemology of Earth Science: The Collective Dimension

[18] I modified Guyer's translation in this passage, because the term *Fürwahrhalten* is to be translated with "holding-to-be-true" and *Glauben* with "belief" rather than faith. The original German text reads: "Auf Thatsache muß sie alles Fürwahrhalten zuvörderst gründen, wenn es nicht völlig grundlos sein soll; und es kann also nur der einzige Unterschied im Beweisen Statt finden, ob auf diese Thatsache ein Fürwahrhalten der daraus gezogenen Folgerung als Wissen für das theoretische, oder bloß als Glauben für das praktische Erkenntniß könne gegründet werden. Alle Thatsachen gehören entweder zum Naturbegriff, der seine Realität an den vor allen Naturbegriffen gegebenen (oder zu geben möglichen) Gegenständen der Sinne beweiset; oder zum Freiheitsbegriffe, der seine Realität durch die Causalität der Vernunft in Ansehung gewisser durch sie möglichen Wirkungen in der Sinnenwelt, die sie im moralischen Gesetze unwiderleglich postulirt, hinreichend darthut".

What is the moral that we can draw from the analysis of Kant's works? Let us first note that the epistemological questions behind these texts have been left implicit by the literature. If we look at the debates on the current epistemology and scientific methodology of the earth sciences, we note that the literature is replete with discussions of the kind of explanation which pertains to earth science. In particular, the notion of explanatory narratives played an important role as a possible candidate to characterize the methodology of geography and the typical explanation in earth science. But this is an old problem that was already present in the early history of geography.

In Kant's view, the order of explanation should be reversed. One must first identify the conditions of possibility for the trust implied by physical geography; only then can one proceed to the analysis of its epistemological underpinnings. Consider the following examples. Even if I have never been to Alaska, I have information about its climate; even if I have never been to Beijing, I know where it is. Thus, from a Kantian perspective, the community of geographers, explorers and other experts that communicate this kind of knowledge must be trusted,[19] but on grounds that constitute a matter of fact, e.g., the constitution of our faculties, the fact that we share language and the occupation of soil on the same planet. These underpinnings pertain, in Kant's view, not only to the epistemological but also to the ontological level. Indeed, for him, the scientific methodology of physical geography makes ontological assumptions prior to investigating the explanatory capacity of the models employed therein.[20]

Could we define Kant's view of physical geography as a field mainly engaged with the descriptions of our planet and appealing mainly to narrative explanations? Consider what Kant wrote in 1754:

"If one considers the durability encountered in the really large-scale phenomena of creation, which approaches infinity, then one is led to conclude that the passage of five or six thousand years in the

[19] Otherwise there would have been no geographical knowledge, because in the 18th century it was simply impossible to have a direct experience of all topics covered by physical geography.

[20] However, there are various ways to model explanation in the earth sciences. This has led to debate concerning how the earth sciences present themselves as both natural-historical and as nomological (Laudan 1987). A more recent account characterizes explanation in earth science as narration through historical descriptions (Kleinhans et al. 2005). In contrast to physics and chemistry, but in analogy with biology, an important part of theories of earth science consists of descriptions of contingent states of nature (Beatty 1995) or distributions (Waters 1998). Thus, in order to be genuinely explanatory, narratives in earth science do not need to be reduced to physical causal-law explanations. It is argued that the practice of earth science shows how a domain can be ontologically dependent on another deeper domain (i.e., the physical), while at the same time being explanatorily autonomous (Kleinhans et al. 2005). Physical processes of plate tectonics and glaciation, for instance, are captured as contingent regularities with only local reductions to physics and chemistry.

time span allotted to the Earth is perhaps not even what a year is in relation to the life of a human being" (Kant 1754b, Ak 01:195).

Also in the essay *On the rotation of the Earth on its Axis,* Kant refused to use history in earth science: "I shall not seek to obtain elucidation by means of history" (Kant, 1754a, Ak 01:185-186), for the reason that the history of the human race is not comparable with geological periods.[21] However, the laws of physics are reliable knowledge. Therefore, the dependence of meteorological phenomena (whose description can be included in physical geography) on physical and chemical laws is unavoidable, in Kant's view, when approximating certainty in physical geography.[22] For instance in his 1794 essay *Something on the influence of the Moon on the weather* the importance of chemistry for the study of the atmosphere is clearly stated (Ak 08:323-324). In order to explain atmospheric phenomena and different climates at different latitudes, in the 1790s Kant began to appeal to chemistry and to a more fundamental level of these emergent phenomena. For instance, he sought explanations in the oscillation of the ether and the action of fundamental forces (e.g., magnetism, electricity and so forth). Such forces could have explained emergent atmospheric phenomena. In turn, it could have contributed to a new science meant to link the metaphysical principles of natural science and empirical physics (the unpublished project known as the *Transition from the metaphysical Foundations of Natural Science to Physics*; see Ak 21, 22).

In Section 2, however, we have seen that in the Pre-Critical period Kant made some epistemological assumptions that remain present in his Critical work. In particular, he maintained that when theorizing about the earth scientific explanation must take into account a necessary aspect of uncertainty, e.g., we do not know and cannot directly experience the interior of the planet. This makes us view regularities as contingent necessary facts,[23] leaving open the possibility of employing models taken from other fields, e.g., biology or chemistry, in order to make terrestrial phenomena intelligible and to approximate certainty. Finally, in Kant's view, in order to predict and

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[21] This paper does not discuss Kant's reflections on the concept of race; for a discussion that nicely fits to my reading of Kant's view of physical geography in connection with the CJ and his late works on moral philosophy and ethics, see Huneman (2005).

[22] However, accounting for a transition to explain and classify this dependence remained a *desideratum* in Kant's system. We have only a draft of it in the pages of the *Opus postumum*, where Kant talks about a science of "Transition" (*Opus postumum*, Ak 21, 22). This shift towards filling the gap between the metaphysical foundations of natural science and physics is also due to the increasing relevance that Kant attributed to chemistry for natural science (see Friedman 1992).

[23] Contingent necessary facts happen according to a rule, and we can obtain information about them, but we are unable to justify in an absolute, necessary way, their existence. This view depends on Kant's doctrine of empirical certainty, as can be seen by considering the following passage: "All empirical certainty is bound up with consciousness of the contingency of the truth; for experience very well teaches that something is constituted in one way or another or that something has happened, but never teaches that it could not have been constituted or happened otherwise" (Kant, Refl. 5645, Ak 18:290).

explain phenomena, any science of the Earth must be based on an idealization: our planet must be represented as a spheroid.

These foundational aspects of Kant's theory of the Earth remained throughout his career. However, there is an epistemological change in the status of explanation in the earth sciences in the 1790s, that is the result of Kant's mature doctrine of empirical certainty and probability. This change was influenced by the advances in empirical science that Kant witnessed throughout the 1780s. In particular, in the Critical period, Kant thought that empirical certainty could be attributed to models of the Earth. However, we also know that, in Kant's system, mathematical construction leads to apodictic certainty. Thus, physical geography can contain apodictic certainty in its judgements based on the mathematical model of the Earth as a spheroid; therefore, it leads to objective knowledge, or at least is able to approximate it. Precisely this part of physical geography, i.e., that of the mathematical representation of the globe, plays a central role in the *Metaphysics of Morals*.

4. From *Physical Geography* to Cosmopolitan Right

In the Pre-Critical period, Kant connected in a non-systematic way his studies on physical geography and geophysics to pragmatic and practical considerations. In his discussion of earthquakes, for instance, Kant suggested the possibility of obtaining indirect advantages from unfortunate events, namely gaining more and more awareness of our status as contingent beings (see Kant 1756b, Ak 01:460-461).[24] He endorsed a view that was widespread in the 1750s, namely that natural disasters foster humility and astonishment, pity and fear, but that these effects are not merely negative: the disclosure of the power of nature leads us to the sublime.

In the 1790s, Kant aimed to show that the awareness of ourselves as necessary contingent beings on the Earth is one premise for the realization of moral ends.[25] To indicate the role played by

[24] "We demand that the Earth's surface should be so constituted that one might wish to live on it forever. In addition, we imagine that we would better regulate everything to our advantage, if fate had asked for our vote on this matter. Thus we wish to have e.g. the rain in our power so that we could distribute it over the whole year in accordance with our convenience […]. But we forget the wells, which we cannot do without and which would not be maintained under this system. Equally we do not know the use which is brought to us by the same causes that frighten us in the case of earthquakes, and yet we should like to see the latter abolished" (Kant 1756b, Ak 01:455). Kant's statement "Whatever damage earthquakes may ever have caused for man, they can easily replace with interest" (Kant 1756b, Ak 01:458) fully manifests his view in the 1750s.

[25] In the 1795 essay *Toward perpetual peace* (Ak 8:362-364), Kant develops his reflections on teleology within the framework of his political theory. The cases discussed are taken from earth sciences and descriptions of phenomena included in the physical geography. According to Kleingeld, Kant's assumption of a teleological model of history is also justified from a theoretical perspective, because without this theoretical ground the practical (moral) belief of the moral agent might be disconnected from phenomena in the empirical world (Kleingeld 2006, xxii). It is worth noticing a subtle point here (a point that also leads to

the foundations of physical geography within this picture, I shall now show how Kant in the 1790s emphasized the role played by the mathematical representation of our planet in the *Metaphysics of Morals* (1797). In particular, the most important consequences of such a move throw new light on Kant's doctrine of cosmopolitanism.

For Kant, there is a substantial reason for presuming a direct connection between the mathematical model of our planet and his doctrine of right. As will be shown in Section 4.2 below, the collective dimension of knowledge in physical geography and the trust of the public in the explorers and experts in this field were not based on mere observation but stood in need of an a priori grounding. Indeed, whereas the mathematical representation of the planet has apodictic certainty, for most other notions discussed in physical geography Kant faced the problem of grounding trust in testimony and of justifying the condition of possibility of collective knowledge.

In other words, there was no a priori ground to guarantee that the pragmatic knowledge of the world would remain collective and reliable in its results. This suggested that geography could not claim even empirical certainty. However, in the mid-1790s, the possibility to test and verify the knowledge of physical geography found an a priori foundation not only in Kant's claim that the constitution of our faculties is a fact, but also in the practical dimension of the sphere of right.

Let us examine, then, the relevant concepts of Kant's doctrine of right. First, in order to be effective, the idea of right must rely on the law of a reciprocal coercion (*Zwang*) in necessary agreement with the freedom of everyone:

"Under the principle of universal freedom is as it were the construction of that concept, that is, the presentation of it in pure intuition a priori, by analogy with representing the possibility of bodies moving freely under the law of the equality of action and reaction" (Kant 1797, Ak 6:232-233).

Since the opening of the Metaphysics of Morals, Kant draws an analogy between mathematics and the idea of right (right line – *rectum*) (Kant 1797, Ak 06:233). He continues by clarifying the condition of possibility for property right (§§11-17) and the definition of land (understood as all habitable ground), according to which "just as in a theoretical sense accidents cannot exist apart

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the rejection of May's (1970) criticism of Kant's geography and that explains why Kant did not explicitly use teleology in his physical geography): to assume nature as teleologically driven only leads to belief and not to holding-to-be-true; which is to say that empirical certainty is not reached by representing nature teleologically. Therefore, from the perspective of pragmatic knowledge of the world, one can portray nature either as a sum total of phenomena or as a teleologically oriented whole that includes freedom and the realization of moral ends. In this way the foundations of geography, history and other sciences is guaranteed by the epistemology of empirical certainty, but at the same time the possibility of thinking teleologically about nature leaves open the possibility of belief and hope for the moral agent acting in this world (see also Marcucci 1997).

from a substance, so in a practical sense no one can have what is movable on a piece of land as his own unless he is assumed to be already in rightful possession of the land" (Kant 1797, Ak 06:261). At this point, the mathematical representation of the Earth comes into play in a fundamental manner:

"All human beings are originally (i.e., prior to any act of choice that establishes a right) in a possession of land that is in conformity with right, that is, they have a right to be wherever nature or chance has placed them. This kind of possession is a possession in common because the spherical surface of the earth unites all the places on its surface" (Kant 1797, Ak 06:262).

It is therefore in the sections devoted to the property right that Kant starts using the mathematical representation of the Earth of physical geography, in order to justify the possession of land for all human beings. Furthermore, this original possession of land is something that inevitably implies a collective dimension of the use of land according to a practical concept of original possession in common (*communio possessionis originaria*) (see Kant 1797, Ak 06:265). Moreover, Kant explicitly connects the possession of land to the will to use it (*communio fundi originaria* (Kant 1797, Ak 06:267)): all men are originally in common possession of the land of the entire Earth and each has by nature the will to use it (*lex iusti*).[26] Now, the characterization of this use also includes the scientific research and the use of the planet's resources. However, the limits to our will and to our possession of the land are given precisely by the mathematical representation of the Earth of physical geography and this clearly emerges in the section devoted to the cosmopolitan right (*das Weltbürgerrecht*):

"This rational idea of a peaceful, even if not friendly, thoroughgoing community of all nations on the earth that can come into relations affecting one another is not a philanthropic (ethical) principle, but a principle having to do with rights. Nature has enclosed them all together within determinate limits (by the spherical shape of the place we live in, a *globus terraqueus*). And since possession of the land, on which an inhabitant of the earth can live, can be thought only as possession of a part of a determinate whole, and so as possession of that to which each of them originally has a right, it follows that all nations stand originally in a community of land […] they stand in a community of possible physical interaction (*commercium*)." (Kant 1797, Ak 06:352)

[26] For a discussion of this aspect, see Edwards (2011).

Now, in Rink's edition of *Physical Geography* as well as in the Pre-Critical manuscripts of his lectures, Kant also talked about "mercantile geography", namely about the exchange of materials and commodities deriving from the exploration and exploitation of lands. Traces of the foundation of mercantile geography can also be found in Kant's account of cosmopolitan right. Indeed, in Kant's view the collective use of land and its regulations are to be ascribed to a mercantile society that can be said to be cosmopolitan only if it is capable of securing peace:

"It can be said that establishing universal and lasting peace constitutes not merely a part of the doctrine of right but rather the entire final end of the doctrine of right within the limits of reason alone; for the condition of peace is the only condition in which what is mine and what is yours are secured under laws for a multitude of human beings living in proximity to one another and therefore under a constitution." (Kant 1797, Ak 6:355)

Thus, in Kant's view, cosmopolitan right and peace constitute the a priori condition of possibility for thinking of the pragmatic knowledge of the world (*Weltkenntniss*). Only if the cosmopolitan right is guaranteed together with the free circulation of human beings is physical geography as practical cognition conceivable, because the condition for attaining empirical certainty by means of trust is thereby guaranteed *de facto*. Nevertheless, without the mathematical representation of the Earth as *globus terraquaeus* there would not be a quantitative foundation of the doctrine of right, i.e., of the property right.

This aspect is clarified by considering that worldly knowledge in geography implies belief in the validity of testimony. The collectively shared knowledge of the world is not possible if there are effective boundaries that interfere with the exchange of information among people and that make it harder to communicate with each other and to share common strategies and techniques to act in the world to modify it. In this sense, Kant's pragmatic representation of our globe as offered by physical geography is necessary for and mutually linked to cosmopolitan right and its foundations, as a means of ensuring knowledge of the world and the cultivation of its citizens.

5. Concluding Remarks and Perspectives

In this paper, I have offered some reason to believe that for Kant, the mathematical representation of the planet is conditioned by the foundations of the doctrine of right, which allow dividing and/or fixing a quantity of land to be distributed (Kant 1797, Ak 06:261-262). As noticed, however, the mathematical model of the Earth is susceptible to different uses depending on the context, i.e., in

the 1754 physical theory of the Earth or in physical geography. This can be explained by the fact that for Kant a mathematical model *per se* does not directly imply a practical use, but the way in which a model is used determines its link to a practical dimension. I have also shown that Kant's doctrine of right represents a condition for the trust needed for sharing knowledge in physical geography and that the mathematical representation of the planet is needed to represent the unity of nations in the doctrine of rights. Thus, by analyzing this mutual interaction between the doctrine of right and physical geography, this paper sheds light on Kant's idea of the world as "a *Substrat* of our ingenious play". The latter can be portrayed as the notion of a virtual space through which one can think of a community (*Gemeinschaft*) and of an exchange of information among human beings, as well as of the inclusion of the crucial aim of modifying the environment to realize our moral destination on the Earth.

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