

Chapter 2

A Philosophical Framework Applied to Cartography

2.1 Introduction

In this chapter we want to refer to one of the most prominent philosophers: Immanuel Kant. In a cartographic context his contributions to the field of geography and the concepts of *space and time* are very important. For Kant, space as well as time are only “a priori” concepts to understand phenomena, similar to intuition. Kant postulates that space and time are not real, but only a sensible projection of the sense of symmetry of our own corporality and of our own sense of change with the objective to put all phenomena into an order.

Further, two great philosophers of logical positivism are analysed: Ludwig Wittgenstein and Karl Popper. We are going to ask how cartography grasps epistemological aspects of knowledge construction. Neither Wittgenstein nor Popper wrote explicitly about cartography and mapping, but their legacy has an important impact on our understanding of maps. The evolution of contemporary cartography from an epistemological point of view can be considered to be equivalent to Wittgenstein’s trajectory (his First and Second Philosophy). On the other hand, cartographic products and the different stages of map creation can be linked to Popper’s Three World Theory.

2.2 Immanuel Kant

2.2.1 *No Epistemology Without him: Kant’s Role for Spatial Sciences*

Having lived at a time of major successes and advances in natural sciences by individuals like Robert Boyle, Alexander von Humboldt, Carl Friedrich Gauss, and Isaac Newton, Immanuel Kant (22 April 1724 – 12 February 1804) as simply the most famous German philosopher and one of the most influential of all times, cannot be neglected when writing about spatial facts and their graphical depiction. Kant proposed that human knowledge could be organised in three ways: by

classifying facts according to the type of the objects studied, by examining the temporal dimension and looking at things in terms of their history, and by understanding facts relative to (their) spatial relationships. The latter fact represents nothing but the field of knowledge commonly known as geography (Amodeo 2005).

Further, Kant divided geography into the sub-disciplines of physical, moral, commercial, and theological geography. He described geography as a discipline that synthesises the findings of other sciences through the concept of space. He taught geography for 30 years, explaining each sub-disciplines by clarifying the position of geography among the many fields of learning (cf. Buchroithner and Azócar 2011). The idea that geography deals with the differentiation of places was fundamental to Kant's understanding of the world. He also saw a clear distinction between history and geography (Amodeo 2005). "Nichts bildet und kultiviert den gesunden Verstand mehr als Geographie" ("Nothing educates and cultivates the common sense more than geography.") This statement by Immanuel Kant made during his lectures in Physical Geography is bequeathed through the handwritten notes of one of his students and clearly shows the importance he assigned to the science of geography (Stark and Brandt 2009).

When Kant gave classes on physical geography, he focused on the interconnection of phenomena as a way of causally explaining them in space and time. In Kant's philosophical framework, his lectures represented the result of thought about the differentiation and movement of the mentioned phenomena.

Kant is also important for cartography because he involves perception in mapping in a twofold sense: for the mapping and surveying in the field (respectively, nowadays, by remote sensing) and for the perception of ready-made maps. Kant defines his theory of perception in his influential 1781 work *The Critique of Pure Reason (Kritik der reinen Vernunft)*, which has often been cited as the most significant volume of metaphysics and epistemology in modern philosophy. He maintains that our understanding of the external world had its foundations not merely in experience, but in both experience and a priori concept, thus offering a *non-empiricist critique of rationalist philosophy*, which is what he and others referred to as his "Copernican Revolution" (cf., e.g., "Kant, Immanuel" in *The Columbia Encyclopedia*, Sixth Edition).

2.2.2 Kant's Philosophy: An Epistemological Frame for Geography and Cartography

José Ortega Valcárcel analysed Immanuel Kant and Geography within an epistemological framework. For him, Kant as geographer does not initiate modern geography, but rather culminates the representation of the earlier medieval world. Nevertheless, Kant's postulates on human knowledge influence the conception of space and geography of modern geographers. The theoretical-methodological considerations that Kant develops work like an introduction with regard to the human knowledge, its forms, origins, and classification, and have had notable aftereffect (Ortega Valcárcel 2000).

For Kant, the process of arranging our experiences as knowledge, that is, the rational process, takes place in accordance with concepts or according to time and space. Kant calls the classification of knowledge according to concepts a *logical classification*. He names classification in accordance with time and space *physical classificacation*. The first one represents a natural system, (like e.g. the one by Carolus Linnaeus); the latter one, a physical description of nature.

Ortega Valcárcel concludes that Kant framed geographical knowledge in this way. He called it the “physical description of the Earth”, in other words, “physical geography” (Ortega Valcárcel 2000: 111). For Kant, the physical description is the foundation of knowledge of the world. The world is the substratum and foundation on which our knowledge must arise.

The above statements lead to the first manifestation of *formal cartography*, i.e. the cartographic representation of the physical world through topographic or reference maps. These types of cartographic products were created firstly, to depict the physical elements and processes of the world. Here one can refer to the metaphor of *the map as a reflexion of nature*. Only subsequently were other elements belonging to the social, economical, and political world (i.e. thematic map) been integrated. But the traditional substratum in cartography is physical. All the other components of reality are constructed on cartography’s physical layer.

As mentioned in various books about Immanuel Kant, he himself stated in 1800 that he had been giving lectures in Physical Geography “for some thirty years” (“einige dreißig Jahre hindurch”). Needless to say, Kant is one of the most influential scholars of the science of geography. In his seminal book “History of the Geographic Science” (“Geschichte der geographischen Wissenschaft von den ersten Anfängen bis zum Ende des 18. Jahrhunderts”) Josef Schmithüsen (1970) devotes as many as eight densely printed text pages to the role of Kant in the science of geography. However, no single statement can there be found about cartographic depictions of geo-phenomena. Also an in-depth search in the literature about Kant will not yield any findings about his importance for cartography (cf. Hartshorne 1958; Nesher 1997; Amodeo 2005).

2.3 Ludwig Wittgenstein

2.3.1 Wittgenstein’s Early Work “Tractatus logico-philosophicus”

Ludwig Wittgenstein (26 April 1889 – 29 April 1951) is considered to be one of the main philosophers of all times who influenced development of philosophy since the twentieth century (cf. i.a. Schulte 2005). Although he was not a member of the Vienna Circle, Wittgenstein’s philosophy belongs to the logical positivistic approach. He published his contribution to the history of thought in two important and controversial books: “*Tractatus logico-philosophicus*” (English version 1922)

and “*Philosophical Investigations*” (1953; Richter 2004a). Much has been written in philosophy about these two books of Wittgenstein (Monk 2005).

Wittgenstein never directly addressed philosophy issues regarding cartography and mapping. Nevertheless, the philosophical and epistemological aspects of his reflexions in relation to cartography will be discussed in this chapter. Here, any further considerations are only suggestions that are subject to deeper analysis.

According to Wittgenstein, the relationship between language and the world can be presented through a model *by proxy*.¹ Thus, a relationship by proxy between a model of reality and the reality itself is established. These claims are of critical importance for understanding the world through language. The most important of Wittgenstein’s contributions to the world knowledge is: *language is a model of reality*, and reality is comprehended by us through language. Similarly, if these insights are critical to Wittgenstein’s thought, then cartography, *conceived as a model of reality*, will also have important epistemological considerations. In this sense there are many visual models to depict reality in cartography. Consequently, these models establish a relation by proxy between their components and the external elements which are represented in a map form (relation of object to image).

Therefore, a general reading of Wittgenstein’s first works, more precisely in his *Tractatus*, leads to understanding a relation between its content and the nature and objectives of cartography. Several of the propositions defined by Wittgenstein can be applied to cartography and mapping, because one of the traditional objectives in cartography is to represent reality (i.e. to depict) and primarily to depict the physical objects of the world. This representation is made through certain material and digital devices. Similarly, there is also the parallel creation of an image of the external world, but this image is inside our internal worlds of the mind.

The map is then a representation of reality, and the map must be created. There is a one-to-one (biunique) correspondence between what is represented and the reality: the symbol on the map represents in this case the objective element that belongs to reality. In general terms, Wittgenstein’s early philosophy assumes a coincidence with the first stage in the development of modern cartography: In both the positivistic and neo-positivistic context, the map is considered to be an objective, accurate, and genuine means to depict the real physical world. The most important contributions of the *Tractatus logico-philosophicus* are the *picture theory of meaning* and the *doctrine of logical atomism*.² These theories are intimately connected. The picture theory states that language draws a picture of reality (Richter 2004b). The pictorial nature of thought and language is analysed by Pasquale Frascolla as a way to understand Wittgenstein’s approach. Essentially this picture theory of meaning states that “our language and our thought have

¹ A *proxy* is generally understood as a person who represents another person. In other words a person authorised to act for another (Thesaurus Dictionary year?). This analogy is applied here to the relationship between language and world.

² Bertrand Russell conceives *logical atomism* as the view that reality consists of a great many ultimate constituents or “atoms”. “Logical” atomism is an attempt to arrive through reason at what must be the ultimate constituents and forms constituting reality (Carey 2008).

sense and reference, because there are paintings, figures, or representations of the things of the world” (Frascolla 2007).

From an epistemological perspective, Wittgenstein’s main contribution is not only about language, but about a theory of the world, namely the *theory of knowledge of the world*. In his atomistic view, Wittgenstein claims that the world is composed of facts, states of affairs, and objects, each one having a correspondence in language: propositions, elements of propositions, and names respectively. Names refer to the objects of reality, and hence *the meaning of the object is in its reference* (Clack 1999).

Some important and representative propositions from the *Tractatus* (cf. Richter 2004a, digital text: no pagination) are³:

1. The world is all that is the case.
- 4.01. A proposition is a picture of reality.
- 4.0312. ... Propositions *show* the logical form of reality. They display it.
- 4.5. ... The general form of a proposition is: This is how things stand.
- 5.4711. To give the essence of a proposition means to give the essence of all description, and thus the essence of the world.
- 5.6 *The limits of my language* mean the limits of my world.

If language is a perfect analogy of the world, the *cartographic language*—in the context of map symbols—is an important epistemological contribution to the theory of knowledge. According to Yu Liansheng, map symbols belong within a category of scientific symbols, and at the same time possess the features of visual images. He describes the philosophical aspects of map symbols and the exploration of their information function (Liansheng 1997). Consequently, the essence of a map symbol, its characteristics, its poly-functions, and its informational function are all perfectly related to the one-to-one relationship established by Wittgenstein between language and world (here, as already mentioned above, the world is conceived as reality).

On the other hand, within the context of information exchange among people, Pavel Neytchev points out similarities between the units of natural and of map languages in the realms concerning the syntactic components of cartographic sentences. He claims that the map language is a double-articulated code, and later on defines the syntactic patterns of cartographic sentences (Neytchev 2001). Neytchev’s contribution can be perfectly compared to Wittgenstein’s claim, presenting the function of the cartographic language in the context of grammar and syntax. There is a connection among “map language” (Schlichtmann 1985, 2009; Ramírez 2004; Neytchev 2001), natural language, and knowledge of the world or reality.

Both authors, Liansheng and Neytchev, are important to understand the cartographic language about the knowledge of the world. Liansheng establishes the philosophical levels of map symbols and the exploration of their information

³ The numbers at the beginning of the listings correspond to the respective chapter and subchapter classification in the *Tractatus logico-philosophicus* (cf. Wittgenstein 1921, 1922, 2005).

Table 2.1 Knowledge of the world and language according to Ludwig Wittgenstein

World	Language	Units of map language	
		In text reading	In map language use
Objects	Names	Separate cartographic sign (cartographic word)	Component of cartographic utterance
States of affairs	Elementary propositions	Compound cartographic sign (cartographic sentences)	Cartographic utterance
Facts	Propositions	Map (cartography textual work)	Cartographic <i>communiqué</i>

Adapted from Clack (1999) and Neytchev (2001)

function by analysing the essence, characteristics, function, and laws of operation from ideological, cultural, and philosophical considerations. Neytchev compares the units of natural language (in linguistic systems, in texts, and acts of speech) to units of map language (in cartographic systems, in text, and in map language). An important aspect of Neytchev’s work is the use of units of language: basic sign, combined sign, and assembled sign. They correspond to the components used by Wittgenstein in his description of the elements that belong to language: propositions, elementary propositions, and names (see Table 2.1).

2.3.2 Wittgenstein’s Late Work “Philosophical Investigations”

In the second phase of Ludwig Wittgenstein’s work (also called Wittgenstein’s later philosophy), he carried out a critical analysis of his first major monograph, the “*Tractatus*”. This critique is compiled in the book “*Philosophical Investigations*” published in an English translation of the original German “*Philosophische Untersuchungen*” by Elisabeth Anscombe in 1953, two years after of the philosopher’s death. Although this later phase of his work was more remote from science, it was a source of inspiration for many philosophers and scientists because of its scope and considerations (cf. Richter 2004b).

This part of Wittgenstein’s philosophy is considered by his followers to be postmodern.⁴ Wittgenstein rejects the supremacy of *declarative language* and essentialistic vision of the language. Using language, more things can be done than

⁴ *Postmodernism* is a term that designates a wide number of artistic, cultural, literary, and philosophical movements of the twentieth century which are critical and in conflict with the modernist period.

only describe the physical world. In this way, Wittgenstein considers numerous problems and puzzles in different fields such as semantics, logic, philosophy of mathematic, philosophy of psychology, philosophy of action, and philosophy of the mind. His main contribution is the idea of *language-games*, namely that language functions in the context of known-rules; all prepositions that are out or beyond these rules are inconceivable and meaningless. The meaning and reality of the world belongs to several contexts; therefore, descriptive language is only one aspect. In this context, the aim of philosophy for Wittgenstein is to clarify these *rules* or *language-games* for the understanding of the world. Consequently, all concepts which fall outside of these rules are considered to be contradictions, antinomies, meaningless, or senseless (Richter 2004a). This part of Wittgenstein's work is more flexible than the rigid approach of his *Tractatus logico-philosophicus* where, in the ideal of language, a meaning must correspond to every word and vice versa. Now, the meaning of the words depends on the context.

Since the 1990s, important contributions in cartography have been coming from sources outside the discipline, or are frequently not unique in the academic context. Therefore, these contributions are framed within the deconstructionist or post-structuralist approaches. In this sense, there arises strong criticism of how mapping has been practiced and developed until the end of the 2000s. The main exponent of this development is J.B. Harley who considered cartography to be far from an objective and accurate discipline, as is regarded by the positivistic approach. On the contrary, cartography is full of subjectivities, and maps, in particular, are full of intents and inaccuracies. The meaning of maps is, however, valid according to the social context in which they are used or incorporated (Harley 1989).

This new movement in the development of cartography is called *critical cartography*. For Crampton and Krygier (2006), this trend challenges academic cartography by linking geographic knowledge with power. During the post-war period, cartography underwent a significant solidification as a science, while at the same time other mapping practices were occurring. The authors focus their analysis on the critical theoretical and *critical mapping practices* in historical perspective.

At this point, it is also important to consider Tomasz Zarycki's pragmatic approach to map analysis. He points out obvious differences between *map semantics* and *map pragmatics* in the context of traditional divisions of semiotics (semantics, syntactics, and pragmatics).⁵ He claims that while the semantic analysis of maps will concentrate on the extent to which the criteria of the objective map-making—or *the rules of objective representation*—are fulfilled by particular maps; *pragmatic analysis* should concentrate on establishing the nature

⁵ *Semantics* deals with the meaning of the symbols (relationships between the sign and vehicle or referent); *syntactic/syntax* deals with the formal proprieties of signs and symbols (relationships sign-vehicle/sign-vehicle); and *pragmatics* deals with all the psychological, biological, and sociological phenomena that surround the functioning of cartographic signs (relationships between the sign and vehicle or interpreter). *Referent* is the object. *Interpreter* implies the concept (thought or reference). Extracted from Freitag (2001), Kavouras and Kokla (2008), and Gartner (2009).

of actual social contexts and other criteria of acceptability of maps (cf. Zarycki 2001a).

In Zarycki's map semantics approach, he writes that the 'map is conceived as a tool for the description of reality'; on the other hand, in the map pragmatic approach, the 'map is conceived as a form of creation/negotiation of reality'; the 'map is considered to be a tool of symbolic domination'. The 'rules of cartographic communication are objectively given and must be respected' in map semantics; whereas in map pragmatics the 'rules which govern the cartographic communication are unstable and must be established, analyzed and related to some social context of their existence'. Finally, in the map semantics approach, 'maps are created by a cartographer on the basis of his/her knowledge about reality'. In the map pragmatic approach 'maps are designed not only by those who make them but also by the interests of those whom they serve. The map appears to be under the direct and indirect influence of the potential or actual users' (Zarycki 2001a: 69).

When Zarycki describes the characteristics of the semantic map and of the pragmatic map, there is a connection between Wittgenstein's earlier approach and the later approach described by Wittgenstein. This means that the features of map semantics belong to the strict criteria of objectivity when Wittgenstein sets up a one-to-one relation between language and reality. Nevertheless, the conceptions of map pragmatics are different. These elements coincide with the evolution of thought of the later writings of Wittgenstein, when he claims that the descriptive language is only one part of the different kinds of languages. The maps are pragmatically analysed in the context of post-structuralism and social theory,⁶ which claim other alternatives for seeing and understanding the world.

In summary, Wittgenstein's thought evolution (*first- and second Wittgenstein* or his *early and later philosophy*) is manifested in a semiotic approach to cartography when map semantics and map pragmatics are confronted (see Table 2.2). Hence, it can be claimed that the philosophy of Wittgenstein's *Tractatus*, when applied to cartography, belongs to the scientific and objective cartographic approach. On the other hand, Wittgenstein's thought in *Philosophical Investigations* corresponds to critical cartography,⁷ namely to an alternative cartographic approach. The first cartographic approach belongs to the traditional positivism or neo-positivism of sciences, and the second one goes beyond academia, namely post-structuralism or deconstructionism.⁸

⁶ *Social theory* refers to the use of abstract and often complex theoretical frameworks to describe, explain, and analyse the social world (New World Encyclopaedia).

⁷ *Critical cartography* aspects will be analysed in the section of this book called "Critical Cartography in the Context of Post-Modernism".

⁸ These perspectives belong to the postmodern period. *Post-structuralism* and *Deconstructionism* will be analysed in the following chapters of this section and in the section "Critical Cartography in the Context of Post-Modernism".

Table 2.2 Parallelism between Wittgenstein’s philosophy and the evolution of cartography during the modern and postmodern periods (After Azócar 2012)

Ludwig Wittgenstein’s philosophy	Cartographic perspective
“Early Wittgenstein”: “ <i>Tractatus logico-philosophicus</i> ” (1921) Key aspect: <i>Language and World</i>	Modern cartography Scientific cartography Positivism and Neo-positivism approach of mapping (e.g. semantic maps)
“Late Wittgenstein”: “ <i>Philosophical Investigations</i> ” (1953) Key aspect: <i>Language-games</i>	Postmodern cartography Critical cartography Deconstructionism and Post-structuralism approach of mapping (e.g. pragmatic maps)

2.4 Karl Popper

Karl Raimund Popper (28 July 1902–1917 September 1994) was intellectually and ideologically close but actually never invited to participate in the *Vienna Circle*, the Viennese school of logical positivism, (Keuth 2004) and wrote basic books on the philosophy of science (cf. Moritz 1995). One of Poppers’ major contributions to the theory of knowledge is about the various worlds of knowledge. Already in 1934 he published his book about ‘Logik der Forschung’,⁹ twenty-five years later published as ‘The Logic of Scientific Discovery’ (Popper 1934/35, 1959). These two seminal books actually also served as a basis for Thomas Kuhn’s reflections. For Popper there exist basically two kinds of knowledge: *subjective knowledge* and *objective knowledge*. Popper, together with John Eccles, introduced the Three Worlds Model in their book *The Self and its Brain* first published in 1977 (Popper and Eccles 1993).

Popper’s theory of the three worlds establishes a distinction among the *world in itself*, the *subjective world* and the *objective world*. The world itself remains, in Kantian language, a *noumenon*,¹⁰ that is unknowable to the human. From this world we can only study the phenomena. The Second World is that of the individual conceptions of thought, a completely subjective world, exclusively dependent on the individual’s point of view. The Third World is an objective world because of its inter-subject validation of conceptions which initially had an individual character (Mejia Soto 2004).

⁹ Imprint ‘1935’, actually already published in 1934.
¹⁰ A *noumenon* may, according to Wikipedia [include reference], be described as a posited object or event as it appears in itself independent of perception by the senses. Noumenon is the thing in itself, reality per se (it remains unknowable). According to the Theory of Knowledge of Immanuel Kant, presented in his *Criticism of the Pure Reason*, the intellect does not know the things as they are in themselves (*noumena*) but as they construct themselves (*phenomena*).

In his description of the three worlds Popper formulates:

First, there is the physical world – the universe of physical entities – ... this I will call “World 1”. Second, there is the world of mental states, including states of consciousness and psychological dispositions and unconscious states; this I will call “World 2”. But there is also a *third* such world, the world of the contents of thought, and, indeed, of the products of the human mind; this I will call “World 3” (original emphasis, Popper and Eccles 1993: 38)¹¹

In this way, World 3 ‘is inhabited by the set of products of all our cultural activities and comprises all human works from the point of view of their logical and objective content’ (Gattei 2009). ‘One may say that World 3 is man-made only in its origin, and that once theories exist, they begin to have a life of their own: they produce previously invisible consequences, they produce new problems’ (Popper and Eccles 1993).

Helmut Moritz deepens Popper’s three worlds and their characteristics; the reality of World 3 in the field of mathematics and logic and their relation with exact thinking in the context of philosophy for scientists (Moritz 1995). Referring to cartography/GIS, Manfred Buchroithner, on the other hand, analyses potential multimedia geo-information in the overall system of Popper’s Three-World-Model (Buchroithner 1997).

2.4.1 Popper’s Three Worlds Theory and Cartography

Carla Lois (2009) analyses cartographic images and geographic imagery, and her claims have important impacts. She states that the presence of the map makes the absence of the object that the map represents visible. For instance, we cannot see the entire Earth because of its spherical form and size other than from space, but by means of maps (e.g. world atlases) we can view it well. In other words, the object is present (we are even standing on it) but it is not totally visible, we cannot see it as a whole.

This means that there is a visual absence but not an absence of the object. But the object’s representation is an image that not only pre-exists the object which, however, having been constituted in a permanent mediation, replaces it: the *representation builds the object*.¹² (emphasis added, translated by the authors from Lois 2009).

¹¹ Elements that belong to World 1 are for instance: stars and planets, atoms and molecules, tables and chairs, trees and animals, etc. To World 2 belong feelings, emotions, thoughts, pains, joys, wishes, etc. According to Gattei (2009); among others, words and prepositions; books and symphonies; laws; numbers and triangles (also problems, theories, and arguments) belong to World. 3. Indeed, elements of World 3 (e.g., a symphony) can have a physical presence in World 1 (a symphony recorded on a compact disc); it still belongs, however, to World 3.

¹² “Es decir, es una ausencia visual y no una ausencia del objeto. Pero la representación del objeto es una imagen que no sólo preexiste al objeto sino que, al constituirse en una mediación permanente, lo reemplaza: la representación construye al objeto.” (Lois 2009, digital text: no pagination).

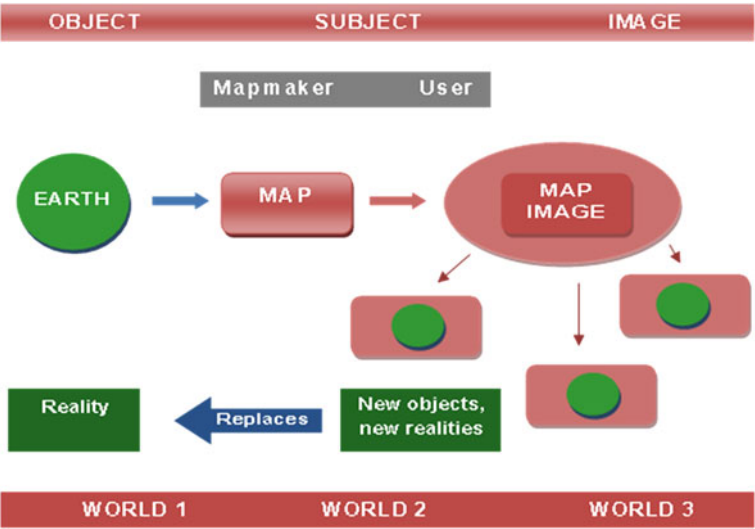


Fig. 2.1 Interaction between Popper’s Three Worlds Model and the construction of new realities through maps in an ontological approach

If this quote is analysed in the light of Popper’s interaction between World 2 and World 3, then it has important ontological and epistemological implication. A map depicts elements that belong to World 1 (e.g. the Earth). In this sense, the interpretation of the map’s content (World 2) generates a map image¹³ which belongs to World 3. The map as a device belongs to World 1 (artificial), but the map image belongs to World 3. Popper postulated that elements of World 3 acquire independent existence or autonomy. Thus, in the epistemological relationship between object-subject-image, the map image becomes the object. This means that the various map images that depict the objects, are transformed into objects themselves. In other words, the images are objects of reality and the images are themselves reality.

Figure 2.1 depicts the “Earth” as an object belonging to World 1 which is knowable through cartography. The subject is represented by the interaction between the mapmaker and the user through the map, and the latter belongs to World 2. The mapmaker designs and creates the map and the user reads and interprets it. Then the user generates a *map image* which belongs to World 3. From this mental image, new images are generated by the user. These images are regarded as *new objects* or *new realities* (belonging World 3) because they replace the phenomena of World 1.

Another aspect of the relationship between Popper’s Three Worlds Model and cartography has to do with the term map (see Table 2.3). Cauvin et al. (2010) say

¹³ In this case, we consider *map image* equivalent to “mental map” or “cognitive map”.

Table 2.3 Parallelism between Popper’s Three Worlds Model, products of cartography, and definitions and components of maps (after Azócar 2012)

Popper’s three worlds model (*)		Cartography’s product	Definition and component of map						
			(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>World 3</i> (the products of the human mind)	Work of art and science (including technology)	Map mental image	X	X				X	
		Map model	X	X				X	
	Human language	Map language			X				
<i>World 2</i> (the world of subjective experiences)							X		X
<i>World 1</i> (the world of physical objects)		Map device				X			

(1–7) extracted from Cauvin, Escobar and Serradj (2010) (*) from Popper and Eccles (1993)
(1) Map is a geometric representation (of the planet; with relative positions; with non-spatial attributes)
(2) Map is a constructed model (reduction; selection; generalisation)
(3) Map is a graphical, iconic model using symbols (visual; audio; tactile; others)
(4) Map basis (permanent; temporary; virtual)
(5) Map at a given time within a context (historical; social; technological; scientific)
(6) Map with specific purposes (presenting and transferring information, providing locations; exploring patterns; revealing visible or invisible relations; exchange and consultation)
(7) Map involving choices (scientific; subjective; empirical)

that the name of the product of cartography is ‘map’ which is more familiar and more ancient than the discipline itself. They define the map concept and divide it into seven components (see Table 2.3). In comparison, the same table shows the content of World 3 by Popper and Eccles (1993) broken into ‘work of art and science, and technology’ and ‘human language’. The cartographic products such as: map, mental image, and map model and map language (or cartographic language) fall into this classification. These elements belong to World 3 because of their cognitive nature.

Table 2.3 shows most of the criteria defined by Cauvin et al. (2010) within the table portion “Definition and components of map” which belong to World 3 (map, mental image and map model). The map belongs to these categories when they are regarded as a geometric representation, as a model by generalisation and selection, and for specific purposes (this task involves new information and decisions derived from map analysis). When a map is considered as a cartographic language (graphical and iconic model using symbols and signs), this implies that the map belongs to human language as a product of the human mind. If we look at Table 2.3, two criteria fall in the content of World 2: map at a given time within a context, and the map involving choices. These criteria are subjective because

feelings and decisions are involved (for more details, there exists a wide body of literature authored by J.B. Harley). Finally, only one criterion belongs to World 1: the map considered as a permanent basis (i.e. material) implies independent of whether it is temporary or virtual. In this respect, Robinson et al. (1995) mention six major technological revolutions¹⁴ starting at the time that cognitive images were first transcribed into tangible cartographic products (Robinson et al. 1995).

The criterion “Maps with specific purposes” requires a closer view. They are considered to belong to World 3 because they contain creations of new information by means of the map. This new information is as real as the previous one stemming from the set of input data. But the specific proposals which motivate this information quest can have different viewpoints (scientific, political, educational, etc.). As a result, these purposes can be subjective and experiential, and would therefore fall within the realm of World 2.

2.4.2 *Three-Worlds Model of Popper and Multisensory Cartography*

World 1 represents the “objective”, “real” world determined by physical, chemical (and biological) laws. *World 2*—Buchroithner (1997) is, for reasons obvious to cartographers but not discussed in more detail by him, inclined to call it “*World 3*”—is controlled by our mental and emotional processes, our sentiments and feelings: Based on the information perceived by our various senses, our thoughts and emotions (again, based on these sensations) we are building our own, “subjective” world or worldview. *World 3* finally consist of our scientific but also artistic activities describing the physical (“real”) world. They represent the underpinnings of our individual episteme (“*World 3*”).

Together with the epistemological approaches of the British philosopher, logician, mathematician, historian, and social critic Bertrand [Arthur William] Russel (18. 5. 1872 – 2. 2. 1970), with whose works Karl Popper dealt in a positive-critical way (cf. Russel 1948), Popper’s Three-Worlds Model forms an ideal background for both the information derivation from remote sensing imagery and for a cartographic information-transfer model, because it can be ideally combined with the concept of a spatial multimedia system (Buchroithner 1997).

Inspired by the idea to view, ‘in times of increasing interconnectedness and multimedia technologies, the science of cartography resp. geoinformatics not isolated any more but especially in the light of psychology and philosophy’, Buchroithner (1997: 31) crafted a German version of Fig. 2.2. There the author tried to realise a new view of cartography and to visualise the generation of our

¹⁴ Mapping in the Western World has seen the following technical advances: manual, magnetic, mechanical, optical, photo-chemical, and electronic technologies (Robinson et al. 1995). All these technologies had impacts on the map as a tangible device belonging to Popper’s World 1.

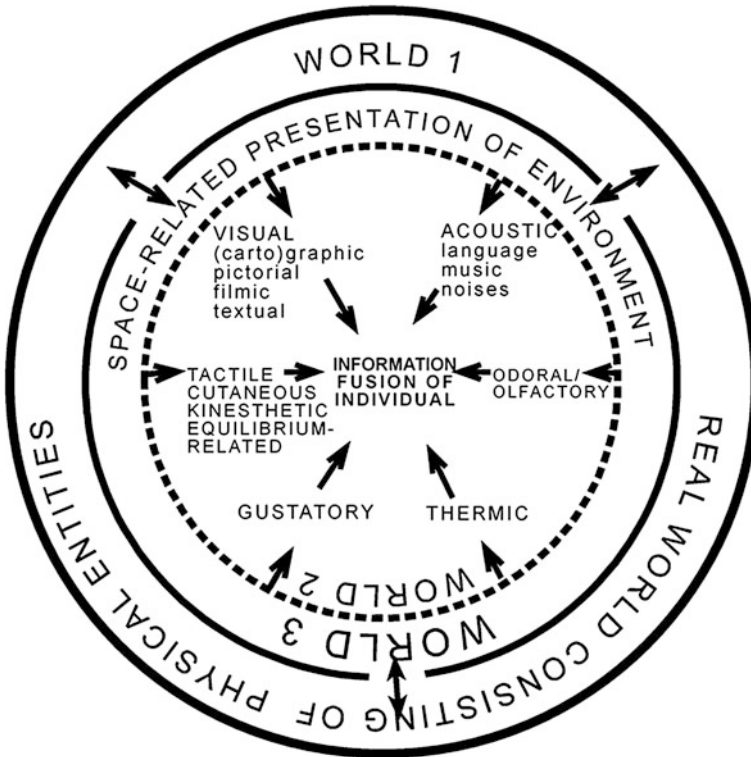


Fig. 2.2 Potential multimediale (multi-“sensory”) spatial information within the overall system of the Three-Worlds Model (Popper and Eccles 1977) Further explanation see text below. (After Buchroithner 1997: 31)

subjectively perceived *World 2* out of information of *World 3*, which describes our physical environment, Popper’s *World 1*. In the context of this figure it may be noted that, in addition to various other multi-“sensory” information transfers, since the end of the 20th century also sensations of smell have been conveyed together with visual and acoustic ones. In Fig. 2.2 the spatial information transmissions of common and well-tested types are represented by solid lines, sporadically materialised sensations by broken ones, and perceptions which are so far rather unlikely by dotted lines. A good example for the transmission of haptic, cutaneous or equilibrial sensations in a virtual three-dimensional world are flight simulators where also kinaesthetic sensations are, partly in an exaggerated way, addressed (Buchroithner 1997).

Paradigms in Cartography

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