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Geography's "World view": The ontological issues of geography

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Abstract: Contemporary science philosophy suggests that discussing ontological problems is of fundamental significance broadly within certain specific disciplines. Natural and social science research are inseparable from philosophical guidance; for instance, the philosophy of geography is the ideological basis for geography. The traditional philosophy of geography is methodology-oriented, which primarily emphasizes the "logical structure of geography explanations," and ignores the discussion of its ontology. This study, in the context of the philosophy of science, explores the relationships between methodology, ontology, and the philosophy of geography, defines the connotations of geographical ontology, analyzes the links and differences between philosophical ontology and scientific ontology of geography, clarifies the nature of geographical ontology, and summaries its theoretical values. The ontology of geography incorporates the philosophically ontological beliefs of geographers and geographical schools and the ontological commitment of the theory of geography. As different geographers hold different philosophical viewpoints, their ontological beliefs are different; one geographical theory asserts an ontological commitment of "what is there," which determines the nature and types of objectives the theory references. The ontological beliefs of geographers determine their epistemology, methodology, and axiology, and the ontological commitment of a geographical theory is the premise and basis of that theory.

Keywords: geography; philosophy of science; ontology; pluralism; methodology; theoretical value

1 Introduction

The term ontology originates from ancient Greece. Etymologically, "onto" means "being," and "logy" (logos in Greek) means "science." Therefore, ontology is a discipline that researches "being" (Lawson, 2015), and is also a science researching the general nature and law of being (Yu, 2012). Scholars in computing and information have introduced philoso-

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phical ontology into their own disciplines and specifically define it as a science that investigates the object type, structure, attributes, process, and relationships within all substantial fields (Smith, 2003). The broad philosophy of science defines the ontology of science as, "'what exists in the world' according to the theoretical idea which is widely accepted by the current science" (Worrall, 1994). Philosophers regard ontology as a synonym for metaphysics (Smith, 2003). For example, Heidegger (1996) believes that "all metaphysical thoughts are ontology, or they are nothing."

Modern research on (social) philosophy of science shows that ontology is an essential theoretical issue in philosophy of science and theoretical research in specific disciplines (Burian and Trout, 1995) and each empirical science requires certain metaphysical foundations (Esfeld, 2006; Dilworth, 1996). With the contemporary renaissance of ontology (Yu, 2002), the ontologies of economics (Mäki, 2001), politics (Stanley, 2012; Chatterjee, 2011), history (Pang, 1988), natural science (scientific realism) (Worrall, 1994), mathematics (Tymoczko, 1991), physics (Harre, 1997) and so on are widely and deeply discussed. These philosophical discussions promote the theoretical development of the relevant disciplines. Compared with the broader ontology, which is the basic research content of the philosophy, discipline-specific ontology reflects the researcher's basic belief and concept about the research object.

Since the conception of modern geography, geographical nature and methodology have been discussed throughout its development (Liu, 2013). Immanuel Kant examined the knowledge system and nature of geography very early, and proposed the field of geography as "science about space." It was these philosophical ideas that formed the geographical methodology of the successive geographers Hettner (1983) and Hartshorne (1958) to some extent, and was the beginning of systematic philosophical research into geography. After the 1920s, with the philosophy of science maturing and influencing geography, a dispute between the methodologies of Hartshorne (1958) and Schaefer (1953) appeared, which initiated a quantitative revolution aimed at theorization. After the 1970s, the appearance and development of humanistic geography, radical geography, and post-modern geography diversified philosophical and methodological research in geography. Geographers began to show an interest in the methodological principles of different philosophical schools within geographical research, and comprehensively discuss their philosophical beliefs and the ontology of philosophy (Johnston, 1986). With the wide application of spatial analysis methods to geography, some scholars began to realize that discussions on the ontology of geography had been neglected (Johnston, 2003).

Systematic philosophical research on geography in China dates back to the *Philosophy of Geography*, written by Bai in the Republic of China (Ma and Fang, 2010). However, while the domestic geography made great achievements after the founding of the People's Republic of China, philosophical research and high-level theoretical research in geography consistently lagged within academic circles (Cai, 1992; Ye and Cai, 2009). Bai (1995) attributed the source of this neglect to the philosophical poverty of geography. Scholars, such as Cai and Ye, called to strengthen the discussion and innovation of geographical methodology (Tang, 2010; Ye and Cai, 2010) and philosophical and theoretical research in geography (Li, 2003; Ye and Cai, 2010). Some researchers have engaged in discussions of geographical methodology and certain progress has been made (Cai *et al*., 2011; Tang, 2010). However,

philosophical research on geography still generally lags behind as a whole, and examining the ontology of geography is still not taken seriously. The lack of interest is directly related to the historical development of ontology; however, it also reflects the poor development of geographical philosophy in China. Due to the prerequisite status of ontology compared with epistemology and methodology (Liam, 2012), discussing the ontology of geography is of vital significance. The objective of this work is to discuss the definition, connotation, and nature of the ontology of geography and its relationship with methodology from the perspective of the philosophy of science. Furthermore, it summarizes the value and practical significance of research on ontology for the theoretical and philosophical development of geography.

2 Significance of methodology and ontology of geography

Science and philosophy circles hold similar views that scientific research requires philosophical guidance, contemplation, and a certain metaphysical foundation (Fry, 2012). Physicist Max Plank (1989) pointed out that "general philosophical thought of researchers will have certain impacts on their scientific research work from beginning to end." Philosopher Wittgenstein(1996) emphasized that the basic target of philosophy is to clarify thought logically and define it. Geographers also realize the role of philosophy in geography. For example, Hill (1981) pointed out that "all researches are guided by the philosophical belief, which impacts or initiates the selection of the research topic and method to complete the research with constant evolution. In short, the philosophical issues permeate into all aspects of the geographical research." Anuqin (1994) hypothesized that the "theory of geography was connected in one way or another with philosophy throughout time and in every country."

Geographical methodology is always a core content concern in geographical philosophy. Several significant disputes occurred in the history of geography, which facilitated the innovation of geographical thought and enriched geographical philosophy. Different scholars have discussed the significance of geographical methodology in geography from different perspectives. For example, Schaefer (1953) hypothesized that "methodology properly deals with the position and scope of the field within the total system of the sciences and with the character and nature of its concepts," and Hettner (1927) pointed out that "the scientific research on methodology is more important than scientific definition." However, varying hypotheses have been proposed for the connotation of methodology. Johnston (1986) proposed that methodology is "a set of rules and procedures indicating how the research and argument go in the discipline," while Cai *et al*. (2011) proposed that methodology is the scientization of method.

Geographical research requires both methodology and a complete philosophical framework. Harvey (1971) suggested that "only to select a methodology with logical coherence cannot solve the geographical problems and more things are required. 'More things' means appropriate geographical philosophy … If a philosophical decision is not made for certain research target object in advance, it is impossible to make a better methodological decision." Here, the "philosophical decision" for "certain research target object" implies a definition of a certain ontology. Johnston (1986) hypothesized that "every disciplinary philosophy contains both an epistemology and an ontology… these are used to define a *methodology*."

Kitchin and Tate (2013) instead defined methodology as, "a set of rules and procedures to investigate and research certain phenomenon or situation (subject to the epistemology and ontology within this framework)," while the ontology is "a series of specific assumptions supporting the theoretical and ideological system." While discussing the methodology of geographical science, Qian Xuesen required compliance with the logical principle of the unification of general ontology and methodology (Sun *et al*., 2013).

In short, methodology is one aspect of research on geographical philosophy. Geographical philosophy both investigates methodology and discusses ontology. These actions comply with a logical philosophical relationship and internal requirement for improving and developing geographical philosophy. After the founding of the People's Republic of China, geographical philosophy in China was discussed within the framework of epistemology and methodology, which trapped some scholars in a misunderstanding of geographical philosophy as epistemology and methodology in a narrow sense; this muddled the relationship between geographical philosophy and epistemology and methodology, needlessly narrowing and discriminating scholar's understanding of geographical philosophy. Therefore, this may have limited innovation in geographical theory to epistemology and methodology, and neglected the fact that the source of geographical ideological transmutation is a revolution of a geographer's "world view" and ontology. Therefore, examining the ontology of geography is helpful for scholars to fully understand geographical philosophy, systematically develop it, and provide new dimensions and paths for the theoretical development of geography.

3 Philosophical and logic basis for research on ontology of geography

3.1 The renaissance of ontology and research gaps

Ontology was once the core of traditional western philosophy. Modern western philosophy began with the realization of the opposition of thought and being. Namely, people cannot correctly perceive the ontology of world from the opposition of the subject and object. With the epistemological focus of the modern philosophical research, traditional ontology has gradually faded away. Logical positivism divides the proposition into the empirical proposition and metaphysical proposition, judges the latter with the standard "verified with experience" and hypothesizes that it is impossible to verify or falsify it, which is meaningless, and thus rejects all metaphysical and ontological propositions. From this process, research on ontology declined.

Willard Van Orman Quine revived the issues inherent in ontology (Yang, 2008), and the criticism on "two doctrines" of logical empiricism shifted its theoretical foundation. Quine hypothesized that the basic ontology may be simply summarized to "what is there," and ontology is necessary to make theoretical statements and establish the knowledge system (Quine, 1953). Martin Heidegger suggested that philosophy must first address the truth of being itself by distinguishing being from beings (Zhang, 2005). Through these proposals, ontology recovers its deserved status. Compared with traditional ontology, pursuing the origin and root, modern ontology emphasizes relativity, subjectivity, and constructiveness. In the era of post-logical positivism of the philosophy of science, "paradigm theory" of Kuhn(1996), "research tradition" of Laudan (1991), "research programme" of Lakatos (1978), and "scientific realistic theory" of Bunge (2001) acknowledge the fundamental and

prerequisite role of ontology in scientific theory. Timothy Williamson demonstrated the inevitability of ontology (Liu, 2016). The ontology of Martin Heidegger hypothesizes that scientific practice relies on a transcendental understanding of the physical "being" in this field, which determines the methodology and conceptualization of science (Rouse, 2015). Scholars have discovered that science must be based on certain metaphysics (Plank, 1989; Li, 2008), and scientific explanations requiring ontological commitment has become consensus of most scholars (Wu, 2006).

Traditional geographical philosophy focuses primarily on methodology, or the range of study is generally limited to methodology and epistemology, and thus the issues discussed are often limited to the framework of the "logical structure of the geographical explanation," or stress the ontology of philosophy (see Johnston, 1986, 2003). This lacks elaboration in the ontology of geography, a common problem in China, with reasons as follows. First, there is a lack of interest in the philosophical research of geography. Second, empiricism (and positivism) has always dominated the geographical research (Tang, 2009). For example, in a comparative analysis of geographical methodologies of the regional school and logical positivism, scholars only select them according to different philosophical standpoints and methodologies for analysis and interpretation. They do not comprehensively discuss the essential differences between ontological ideas in geography that reflect their philosophical standpoints. The last outstanding point is geographical computationalism. When people simulate and forecast the geographical system using computer, cellular automation, multi-agent and related technology, they proceed without examining the application premise, nature, and effects in terms of ontology, which generally reflects the lack of the research on the ontology of geography.

In the geography discipline, ontology has not drawn attention from the public, and research results that reflect on and discuss modern geographical theoretical and philosophical problems from an ontological perspective are rare. However, some geographers have pointed out the lack of published ontological discussions. For example, Johnston (2003) submitted that "epistemology of the spatial analysis is an important issue. However, comparing with the condition that most people apply the statistical methods following the tide of quantitative revolution, almost nobody discusses the epistemology and ontology in detail." In China, Li *et al*. (2010) compared classical geography and geographical ontology and methodology from a complex scientific perspective and the ontology of geography has drawn attention from some scholars (Li *et al*., 2010; Liu, 2013).

3.2 Philosophical and logical basis of research on ontology of geography

Philosophy is a systematic and theoretical worldview and methodology[1] and ontology is, in essence, a worldview (Zhang, 1995; Zhou, 2003). The ontology of philosophy examines universal being, while the ontology of science examines a specific being in a certain field. Therefore, their relationship is between the general and individual, and the ontology of philosophy guides the ontology of science (Sun, 1985). To explore unknown natural or social subjects, science must first presuppose an ontological premise for the external world (Wu, 2006). When researching the object and content of specific science, the specific content,

[1] Karl Marx defined the philosophy as systematized and theorized world view and methodology, and it is widely believed in the domestic philosophical circle that his ontology is the material ontology.

range, type, mode of existence, and nature of the research object and their mutual relationships are presupposed and researchers' ontology is established. For example, when researching the geographical issue of "peasant household" in geography, the concept "peasant household" acknowledges its existence. Subsequently, the nature and type are assumed, which are the specific geographical ontological presuppositions.

Modern science philosophers have proposed theories that incorporate ontology. For example, the "paradigm shift" proposed by Thomas S. Kuhn mainly consists of three parts, namely, ontology, methodology, and axiology; the root cause lies in the fundamental change of the world view and ontology of the scientific community (Laudan, 1984); the "research tradition" proposed by Laudan (1991) consists of ontology and methodology (Meng, 1989), "in short, a research tradition is 'what to do' and 'what not to do' of a set of ontology and methodology." Hanson's (1958) "theory-laden observations" also point out that the observation depends on theory, and the theoretical basis and determination of the observation object and range are the observer's ontological presupposition (Lund *et al*., 2011). In geographical research circles, Harvey (1996) hypothesized that the worldview and philosophical belief are decisive for geographical research, "the key point of our current purpose is to indicate that such philosophy depends on the belief … However, we cannot make analysis without its foundation … Therefore, the philosophical belief or geographical nature is decisive for engaging in the material geographical work." Anuqin (1994) hypothesized that "the theoretical concepts of geographers mirrored the views of certain philosophers." Furthermore, Johnston (2000) proposed that the "use of the methodology allows the accumulation of a disciplinary store of knowledge, the resu1ts of work aimed at comprehending a particular topic and which are accepted as valid because they were collected within the criteria of epistemology and ontology that are part of the relevant philosophy."

The paradigm of any natural and social science has consistent principles and stands at the ontological level. These fundamental and transcendental ontological presuppositions for "what is there" in a specific field fundamentally restricts and defines the selection of the corresponding methodology and paradigm. Furthermore, they provide a framework for researching relevant specific issues. Ontology constitutes the key components of metaphysics. Generally speaking, metaphysics is different from a specific science that solves correspondingly unique problems, and advocates releasing limitations from individual experiences and examines problems with a long-term perception. In modern scientific research, philosophical and scientific research influence each other. With further expansion of the research field and requirements for theoretical development, a reasonable ontological solution becomes a basic premise to solve other problems. Similar to other sciences and social science, geographical research is conducted under the guidance of a certain philosophical framework, in which the ontology is the prerequisite and fundamental status. The ontology of geography is its "world view," which presupposes both existence and a mode of existence, which is the metaphysical foundation of geography.

It is recognized within scientific philosophy and geographical research circles that ontology and worldview are basic factors in scientific research. Geography explores the unknown geographical world and the basic concept of geographers for "what exists" in this geographical world reflects the ontological presupposition of the external geographical world. Without clarification of this basic premise, the selection of any geographical research and

methodology will exhibit blind behavior without basis and logical premise. Metaphysical interpretations and analyses are very common in geographical research. Philosophers, geographers, and geographical scholars often use various metaphysical facts when criticizing, evaluating, supporting, and interpreting the geographical practice. With the ontological prerequisite for methodology and entire philosophical framework, geography urgently requires ontological examination and reflection compared with methodological innovation.

4 Connotation and nature of ontology of geography

4.1 Two levels of connotation for the ontology of geography

Philosophical ontology is the "theory and research of the basic nature of all realities" (Yu, 2012). The philosophy of science internalizes the research on "what the object world is" for certain disciplines, i.e., "what is its nature." According to Quine (1953), basic ontological issue may be summarized into a question of "what is there?" and its nature. Therefore, the ontology of geography addresses "what is there in the geographical world?" Different answers to this question reflect the different ontological beliefs of geographers and geographical theories. For example, geographers (such as Ratzel) that favor social biological ontology (social Darwinism) hypothesize that "a state is a biological organism," which is similar to an organism or biological organic organization form, and whose behaviors comply with biological rules. Geographers favoring ontology of mechanism hypothesize that "the geographical world is a machine" and relationships between objects in the geographical world are mechanically deterministic. Geographers favoring computationalism ontology hypothesize that the "geographical world is a computer" and regard the geographical system as a cellular automaton.

For geographers, the ontology of geography is reflected in their basic beliefs regarding the geographical world, and their basic definition of the geographical being when geography is researched. This presupposes the object, range, content, nature, and characteristics of the geographical world. For example, what are the elements of the geographical world? Are they material or spiritual? What geographical entities do they include? How they are combined? Which kind of principles control their functions and change? What is the nature of the geographical causal relationship? Is the determinism of geographical environment correct? What is the relationship between geographical elements? How has the geographical world evolved and developed? The ontology of geography first reflects the worldview of geographers, i.e., their general opinions and concepts, which may be called the geographical world of geographers. That is, the geographical world is a part of the world, which has its own range and is distinguished from other worlds. The history of geographical thought tells us that the range and content of the geographical world for different geographers are uncertain, are continuously changing as the discipline develops.

What kinds of other biological, physical, and social beings are presupposed as beings of the geographical world? What kind of dependent relationships exist between geographical phenomena in the geographical world, i.e., deterministic, indeterministic, simple linear or complex non-linear? The existence of a strict geographical law in the geographical world is also an important ontological question. Is the geographical object the "location" (Bunge, 1991), "landscape" (Williams, 1989), "regional difference" (Hartshorne, 1959) or "areal

system of man–earth relationship"? It is an ontological presupposition and implies certain transcendental statements of an object's nature. The content, range, and nature of the geographical object are determined by the ontological commitment held by the geographer. The set of such ontological commitments has a systematic worldview nature, which determines how the content relating to geography from this world is selected. Furthermore, this worldview defines the basic characteristics and nature of the geographical being and its relationships. Such ontological commitments of geographers have a fundamental role, more fundamental than other factors in the belief system. Moreover, once they are obtained, it is difficult to correct them. Meanwhile, they are obtained through presupposition, rather than inference. When a geographer faces a specific problem, such philosophical belief is converted into the presupposition of the specific geographical problem, namely "what the research object involved is (what exists)." In addition, according to Quine's ontological argument, theoretically, "The question of the ontological commitments of a theory , then, is the question what, according to that theory, there is." (Quine, 1966). Therefore, the ontology of geography is "about what the object of certain geographical theory is or which kind of geographical things exist according to certain geographical theory?"

Therefore, the connotation of the ontology of geography shall include at least two aspects. The first is the philosophical ontological belief of a geographer or geographical school. The ontology of philosophy researches the overall being, which masters their nature and law. Different geographers and geographical schools have different worldview and ontological beliefs. The second aspect is the ontological presupposition of a geographical theory. Namely, what kind of geographical beings does this theory presuppose (which kind of realities)? What is their nature? What is the relationship between elements? How they are evolved and developed? The former is the philosophical ontology of geography and the latter is the scientific ontology of geography. Moreover, the philosophical ontology is traditionally regarded as taking precedence over the scientific ontology in terms of logic and epistemology (Zhang, 2000). Based on the basic perspective of philosophical ontology, the scientific ontology of geography is the basic assumption of geographical theory.

The philosophical ontology of geography reflects the basic concept and philosophical standpoint of the geographer and geographical school for the being. For example, the ontology of empiricism is that "the things that we experience are the things that exist," the ontology of humanism is that "what exists is that which people perceive to exist" (Johnston, 1986). Given that spirit is the source of the world, the ontology of idealism is that "to be means to be perceived." In contrast, given materials as the source of the world, the ontology of materialism is that spirit is the "objective reflection of the material." The ontological presupposition of geographical theory is its premise, namely, what geographical beings (realities) are presupposed by this theory? What is their nature? What is the relationship between geographical elements? How do they evolve and develop? The core conceptual structure of this theory is reflected in form.

The first aspect may be summarized into a general form: "what are the ontological and worldview beliefs of a geographical school or geographer?" or "what ontological belief does the 'humanistic geography' have?" The latter may be summarized into, "what does the geographical theory T presuppose for P?" Specifically, for example, the "classical agricultural location theory" in economic geography presupposes that the freight of a single factor de-

termines the location of agricultural land utilization and its core conceptual structure is "agricultural location, the single factor of distance, determinism, and isolated state, as well consistent conditions." In comparison, the "modern agricultural location theory" presupposes that factors, such as technology, nature, society, economy, and behavior, determine the agricultural location and its core conceptual structure is "agricultural location decision, 'natural, social, economic, technical and behavioral multi-factor', incomplete determinism, and regional difference." When specific geographical problems are solved, the ontology at both of these levels will be fully reflected.

4.2 Diversification, relativity and openness of the ontology of geography

Varying ontological choices for different geographers reflect their different worldview beliefs about the geographical world and their ontological premise when researching specific geographical problems and theory. Specifically, these choices will include the kind of entity and object geographers presuppose for specific fields or problems – their nature, structure, process, and relation – and the theory and model basis employed for problem analysis, which are the logical research starting point for a geographer. Different geographers and geographical schools philosophically hold different ontological concepts. Moreover, they hold different ontological commitments at the level of geographical theory, reflecting their diversity.

When specific geographical problems are faced and solved, different answers to the ontological question of "what exists" reflect the use of different theoretical frameworks, conceptual systems, cognition paths, and selection of different methods and procedures. For this problem, Johnston (1986) advocated that, "science is the pursuit of systematic and formulated knowledge, and as such is not confined to any particular epistemology." For example, the philosophical foundation of positivist geography is logical positivism, which rejects the ontological issue, or in other words, it is committed to "only things which may be directly observed are acceptable evidence" (Johnston, 1986). It hypothesizes that the existence of certain geographical phenomenon entails the existence of certain experiences, which require evidence to certify their existence; logical positivist is the realist of certain experiences. Humanistic geography is philosophically based on phenomenology, which requires that the phenomenon is the starting point of all ontologies, "appearance" is "reality," the subject and object are unified in phenomenon perception, and people perceive the existence of certain geographical phenomena.

With the development of science and practice, society's view of the world has also changed. Ontology has also gone through modern "spiritual ontology" (such as Hegel) and "material ontology" (such as Marx), rejection of ontology by the modern logical positivism, rebuilding of ontology by Quine and colleagues, phenomenological ontology with "phenomenon" and "reality" unified from the ancient "primordial ontology". Ontology was finally followed by the development of negation of negation (Zhang, 2000). The history of ontology shows that ontology is relative, open, and developing. Therefore, the ontology of geographers shall also be relative, open, and developing. In the history of geographical thought, different viewpoints of the human–earth relationship, geographical worldview, and nature of geographical objects are the primary expressions of ontological difference. The gradual development process of geographers' cognition of the ontology of geography is re-

flected in the following changes: from a "simple and rigid" geographical worldview to the "complex and systematic" geographical worldview, from the ontological presupposition of "mechanical determinism" of the "determinism of geographical environment" to "dialectical determinism" of "probabilism" and ontological commitment of "harmony theory", from the ontological separation of "nature" and "economy" to unified geography.

4.3 Prerequisites, fundamentality, and limitation of the ontology of geography

Philosophically, ontology is a basic constitution of philosophy. If ontology were the root of a big tree, then philosophy, epistemology, axiology, and other philosophical ramifications may be regarded as branches of this tree (Liu, 1996). Ontology determines the epistemology, and is its presupposition, and limits and guides its direction and mode. The direction and path difference of epistemology are the mark and inclination of ontological difference (Zhang, 1995). As methodology and ontology are unified, the method is a medium to reach reality. Methodology is the ways to solve problems based on a particular worldview or in agreement with ontological principles. Therefore, ontology determines the answers to methodological and epistemological questions, determining the selection of the research method (Cuba and Lincoln, 1994).

Any scientific theory and thought require certain ontological foundation, namely, basis, principle, and logical starting point constituting this theory and thought. As Quine (1961) said, "One's ontology is basic to the conceptual scheme by which he interprets all experiences, even the most commonplace ones," "Our ontology is determined once we have fixed upon the over-all conceptual scheme which is to accommodate science in the broadest sense." More specifically, all scientists' theories hold particular ontological standpoints and imply a denial or acknowledgement that the ontological presupposition "something exists." As Peet (2007) argued, "the so-called theory means a narrative system, which has epistemological judgment, ontological definition, and special experience demonstration, establishes a definite conceptual range and expresses a set of consistent viewpoint content." Each independent science has its own special research object and understanding and defining it are basic ontological issues, which determine the basic worldview and standardize the category of the research object. Therefore, the specific building of the ontology of geography determines the starting point of the corresponding geographical theory, corresponding methodology, logical structure, and theoretical form. For geographers, ontology is the main content of their worldview, which is also basic judgment and presupposition of the geographical research object, and plays a fundamental guiding role with its internal uniformity with methodology.

Geographers have proposed various theories that may be partially interpreted as fact because of an ontological commitment. The reasonable answer to the question of the ontology of geography is a premise and decisive factor for the theoretical development of geography. In answering geographical questions, if the idea of philosophical ontology, basic theory and model presupposition, range, reality, attribute, process, and relationships of research objects and other ontological questions are deviated from or do not comply with the geographical fact, the conclusion will be unreliable no matter the type of method employed. This is the fundamental and prerequisite role of ontology. Geographical thought, interpretation, theory, and methodology contain certain ontological assumptions. Moreover, the epistemology and

methodology cannot be philosophically and logically separated from the ontological presupposition. There are no epistemologies or methodologies with neutral ontologies, which reflect the limitation of ontology.

5 Theoretical value of the ontology of geography

For geographical interpretation, theoretical development, and solving of specific problems, the value of ontology lies in answering the following questions: What is the philosophical ontology of certain geographical thought? What are the ontological presuppositions of certain geographical theory? How are such presuppositions limited and determined from geographical worldview beliefs of geographers? Are these presuppositions reasonable? How can we verify and judge them? Do certain geographical phenomena exist? Answers to these questions are the basic starting point for theoretical and practical applied research in geography, which reflect the basic ideas of the research object of the geographers or researchers. Their fundamental value lies in establishing an ultimate basis for solving geographical problems; therefore, our selection of epistemology and method is made on a reliable and reasonable basis. During practice, the realization of the theoretical value of ontology of geography is reflected in the ontological analysis, introspection, and criticism.

5.1 Analysis of the ontology of geography

During geographical research, ontology is the basic idea and presupposition of geographers regarding a research object. To interpret the objective geographical world, geographers must definitely or implicitly presuppose an ontology answer to the fundamental question "what exists in the geographical world?" Such presupposition is very common and necessary for geographers. For certain geographical theory and thought, the ontology is the premise and foundation to make a point. Without such presupposition, it is impossible to perform basic theoretical analysis and logical reasoning. Therefore, to analyze a basic idea in geographical theory and school, ontological analysis is a very useful method. With such analysis, we may essentially master the basic idea, presupposition, and ideological connotation of the geographical theory and relevant school thought. Furthermore, we may reveal its reasonable and unreasonable points and space, approach, and measures for theoretical improvement. Geographical interpretation must be based on the premise of basic presuppositions of the geographical reality for geographers. Analysis of this premise may help us select reasonable geographical theories for interpretation and analysis, making the theoretical and interpretative ontological premise consistent. For specific problems, the value of analyzing geographical ontology lies in determining the boundary for specific geographical problems and providing a basis for the geographical theory and model employed. The objective geographical world is changing and developing, which requires us to analyze the ontological characteristics of the research object when researching geographical issues. We must require that the theoretical presupposition and analysis premise comply with the objective reality, resulting in more scientific and reasonable assumptions and interpretations. The basic ontological analysis methods include language analysis, conceptual analysis, and historical analysis.

5.2 Introspection on the ontology of geography

When geographers contemplate and implement geographical research, introspection on on-

tology is the ontological examination, introspection, and reflection for the geographical thought, theory, model, and method employed. Generally, this self-selection is made based on geographical fact assumptions and the main components of their basic academic accomplishments. Geographers' philosophical ontological beliefs, scientific ontological commitments of geography, and ontological presupposition of geographical problems are very important, and directly impact their interpretation results. Negligence of the ontological issue of geography and emphasizing the significance of methodology results in insufficient concern and contemplation for the ontological presuppositions made to research and interpret geographical issues. Certain deviations from basic premise definitions of the specific geographical problem, judgments on the practical nature and relationships of the geographical object not complying with the objective world, or theory and model employed not complying with the actual situation can all result from neglecting ontology.

The ontological introspection on geography also includes the ontology of philosophy and science. Introspection on the ontology of philosophy reflects the introspection of the philosophical standpoint that we employ. In comparison, introspection on the ontology of science reflects the theory, model, and problem presupposition employed. For example, is our philosophical standpoint idealistic or materialistic? Is it mechanical deterministic or is a complicated system worldview employed? These questions belong to the former introspection on philosophy. Do certain geographical phenomena exist? Is it appropriate to use this model? Is the theory used suitable for the specific geographical phenomenon? These questions belong to the latter introspection on science. The assumptions have a certain ontology status, which is a basic judgment on geographical things. Such judgment impacts the basic analysis result. The essence of the geographical model is that it has theoretical ontological status, which summarizes the essential relationship between geographical things. Changing the geographical phenomenon and reality, or the nature and relationships, i.e., the corresponding objective reality is changed, the judgment of the basic nature and relationships of geographical things does not comply with objective facts, or the theoretical ontological assumption is used by adhering to a previous assumption, it is impossible to perform a reasonable analysis that complies with objective fact. This is a typical error from ontological presuppositions.

5.3 Criticism in the ontology of geography

In the philosophical context, the meaning of criticism has been impacted by Immanuel Kant. Criticism is generally defined as the reflective inspection of the effectiveness and limitation of the human's capacity or a series of philosophical propositions. In philosophy, the ontological criticism is often the reflective inspection of the ontological rationality premise for other philosophical thought foundations, which is the speculative application of critical thinking. With reference to the meaning of philosophical criticism, the ontological criticism of geography is a systematic examination, which is an overall review of the thought foundation and theoretical basis for certain convictions. Criticism, in this context, is designed to understand the effectiveness, limitations, and applicability of geography.

The ontological criticism of geography is the main approach to reflectively understand and tentatively apply various geographical thoughts, basic concepts, and various theoretical premises and assumptions. There has always been a relatively lack of critical courage, spirit,

and practice in geographical academic circles in China, which causes a lack of critical thinking given to domestic research on geographical thought and theory, and insufficient dialogue (Tang, 2010). This situation is unfavorable for further development of theory and thought. Constructive criticism of theory and thought requires ontological criticism, which is favorable for the healthy development of academic controversy and creation of healthy academic environment for academic innovation, which will lead to the development and advancement of new ideas and theories.

6 Conclusions

Geographical philosophy is the philosophical reflection and summary of geography. Similar to other natural and social sciences, philosophical research in geography incorporates ontological issues. The ontology of geography is its "worldview," which presupposes existence in the geographical world, mode of existence, and mutual interaction. Proposing and examining ontological issues in geography is important for philosophical and theoretical research. The development of geographical theory and practice, and innovation in geographical methodology are impossible without innovation in philosophical thought and breakthrough in ontological and epistemological frameworks. The prerequisite and fundamental status of ontological issues for geographical philosophy and theory and specific geographical problem suggests certain requirements. We should adopt ontologically cautious attitudes for addressing specific geographical problems, have receptive and experimental temperaments when engaging in geographical theory, and provide critical and opening perspectives for philosophical problems.

Innovation in contemporary geographical theory, concepts, and methodology also requires systematic thinking and reflection from the perspective of ontology. Developments in geographical philosophy are the source and the driving force of theoretical development and advancing the geography disciplines. Geographical philosophy has remained a weak link in fundamental geographical research. In contemporary geography, investigating philosophical problems in geography from an ontological perspective provides both systematic observations and new avenues of exploration. This is helpful for establishing the correct ontological premise and methodological innovation when researching specific geographical problems, enriching philosophical concepts in geography, and enhancing the philosophical consciousness of geographical research.

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