HOW ARE CONCEPTS OF SPACE AND TIME POSSIBLE IN KANT’S PHILOSOPHY?

Anguel S. Stefanov
Bulgarian Academy of Sciences

Abstract. The subject ideality of space and time has been thoroughly set out in the transcendental aesthetic. They are defined as pure intuitions, or *a priori* forms of sensibility, so that special concepts of them, as if they are objectively existing entities or relations among things, have no appropriate place within the conceptual framework of Kant’s philosophy. Yet the answer to the question “How is the birth of concepts of space and time possible from within the context of transcendental philosophy?” has a specific meaning and significance. Surmounting the criticism that Kant’s philosophy does not concur with contemporary scientific concepts of space and time (or space-time) is my first, but not basic motive for the claim that concepts of space and time can be formed within transcendental philosophy. My basic aim is to show how this is possible, that is to say, how space and time are susceptible to conceptualization. It is not a mere and only result of extrapolation from experience, but presupposes their aprioristic role in the very formation of experience.

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1. What Have Concepts of Space and Time to Do with Kant’s Transcendental Philosophy?

It is no surprise to say that Kant’s transcendental philosophy has no need of either empirical or theoretical concepts of space and time. The subject ideality of space and time has been thoroughly set out in the transcendental aesthetic. They are defined as pure intuitions, or a priori forms of sensibility, so that special concepts of them, as if they are objectively existing entities or relations among things, have no appropriate place within the conceptual framework of Kant’s philosophy. Yet the answer to the question “How is the birth of concepts of space and time possible from within the context of transcendental philosophy?” has a specific meaning and significance.

Kant’s conception of space and time has been subjected, for a long time down to the present day, to a negative assessment that has been transformed into a well-known critical refrain. It is based on a simple, but stubbornly repeated claim that Kant’s conception falls in contradiction with later theoretical results in mathematics, physics, and cosmology. These results do not only admit and elaborate formal characteristics of non-Euclidean geometries, but they also labor the application of one such geometry, through physical theories, to the space-time architecture of the universe. There is no room, however, for these widely accepted theoretical novelties within Kant’s conception of space and time, so it must be declared to be obsolete and wrong. Such ‘blunders’ are declared, by F. J. Zucker for instance, as his a priori arguments in support of Euclidean geometry, absolute space and Newtonian mechanics, and ‘spell the collapse of Kant’s entire attempt’ (1969: 480). An error is imputed to Kant that he defends the validity of Euclidean geometry to the world, and thus he excludes, in an aprioristic manner, the applicability of some other geometry to physical space. Rudolf Carnap, being a more benevolent critic of Kant (than F. J. Zucker is) writes that Kant should not be blamed for his error because, in his day, non-Euclidean geometry had not been discovered. It was not possible for him to think about geometry in any other way.¹

It could be shown that the above critical refrain against Kant’s conception of space and time is an irrelevant piece of criticism, because it rests on misunderstandings of the ontological and epistemological pretensions of Kant’s transcendental idealism. I have tried to do this elsewhere², so I’ll not present my argumentation here. As for R.
Carnap’s remark that ‘it was not possible for Kant to think about geometry in any other way’, it will be shown in the third section of the paper, that such a verdict on Kant is inappropriate as well.

Notwithstanding the relevance of the critical refrain, however, Kant’s conception of space and time can meet another type of criticism, though milder than the first one. ‘Well’, it can be stated, ‘transcendental aesthetic may not really contradict Einstein’s theory of relativity, but it does not exploit concepts of space and time, and to this effect it holds aloof of contemporary scientific knowledge.’

At first glance this really seems to be a kind of criticism of Kant’s transcendental conception. At a second glance, however, the attempted criticism turns out to be a superficial critical argument. Indeed, the pretention of Kant’s transcendental philosophy is primarily gnoseological, while the pretention of physical and cosmological theories is primarily ontological. Kant’s transcendental philosophy has no need of specific concepts of space and time, simply because it chases no aim at presenting a scientific picture of the spatio-temporal structure of the universe.

Although the following contention is valid on primarily psychological grounds, but ‘staying afar from scientific knowledge’ is not the best label for a philosophical system, even if the opposite label be a superfluous mark for it. This is why removing this “negative” label is my first, but not basic motive for the claim that concepts of space and time can be formed within transcendental philosophy. My basic aim is to show how this is possible. This means that I’ll try to show that space and time are susceptible to conceptualization. It is not a mere and only result of extrapolation from experience, but presupposes their aprioristic role in the very formation of experience.

In two recent papers Stephen Palmquist defended the interesting claim that *Einstein’s worldview had an essentially Kantian grounding*. As he argues in the first of his papers

By relating my argument primarily to Einstein’s *worldview* (i.e., to the set of background assumptions that guide one’s thinking on almost everything), I am not claiming that Kant had a direct influence on the development of Einstein’s specific *scientific* discoveries… What we have established up to now is only that certain key features of Kant’s worldview seem to have informed Einstein’s background assumptions. (Palmquist 2010: 53)
In his second paper, then, he shows Kant’s influence promoting Einstein’s rejection of absolute simultaneity and his embracement of the relativity principle. It is due to the fact that:

Kant did recognize that in order to resolve the very different simultaneity paradox that did arise for Newtonian physics, one of Newton’s basic assumptions had to be abandoned: space and time could no longer be regarded as absolute realities that exist apart from their relation to the human observer’s mind. (Palmquist 2011: 100)

If S. Palmquist is right, then the revision of classical physics leading to the birth of special and general relativity theories, accomplished by Einstein, would require a conceptualization of space and time in accordance with Kant’s transcendental setting. This is why I’ll try to show in the following two sections that Kant’s philosophy does not refuse the formation of concepts of space and time.

2. Empirical Concepts of Space and Time
Strangely enough, but Kant himself speaks, although rarely and warily, of concepts of space and time in connection to sensibility. When presenting the principles of a transcendental deduction in general, he writes:

We have already become acquainted with two totally distinct classes of concepts, which nevertheless agree in this, that they both refer a priori to objects, namely, the concepts of space and time as forms of sensibility, and the categories as concepts of the understanding. (Kant 1966: 69; CPR, A 85, B 118)

There is also a place in the Prolegomena, where Kant puts on a par the conceptions or notions of sensibility (space and time) and ‘those of the understanding’, in their quality of being ‘pure elements (containing nothing empirical) of the human cognition’: On investigation of the pure elements (containing nothing empirical) of the human cognition, I first succeeded, after long reflection, in distinguishing and separating with confidence the elementary conceptions of sensibility (space and time) from those of the understanding.

I’ll try here to suggest how space and time could acquire the use of empirical concepts, and in the next section to dispel the mentioned criticism that Kant’s philosophy can have no touching points with theoretical constructs of space and time that are being successfully exploited by physics and cosmology.
The first step for defending the claim that space and time could be analyzed as empirical concepts is to bring out their necessary role for the constitution of all objects of experience. The argument for this step has been provided by Kant himself, and it is worth noticing that he feels again the linguistic “pressure” to attach the word ‘concept’ to space and time:

Even space and time, however pure these concepts may be of all that is empirical, and however certain it is that they are represented in the mind entirely \( a \ priori \), would lack nevertheless all objective validity, all sense and meaning, if we could not show the necessity of their use with reference to all objects of experience. Nay, their representation is a pure schema, always referring to that reproductive imagination which calls up the objects of experience, without which objects would be meaningless. The same applies to all concepts without any distinction. (Kant 1966: 131; CPR, A 156, B 195)

So, though space and time have an \( a \ priori \) representational status of a ‘pure schema’, they are constitutive for all objects of experience. Space and time ‘would lack objective validity, all sense and meaning’, if they (through the reproductive faculty of imagination) did not ‘call up the objects’. Every object of experience appears as having a specific shape of its own, two or more objects are spatially related, they are perceived or imagined to coexist in some common part of space, and within some common time interval. The transcendental ideality of space and time provides the very possibility of every empirical intuition, and to this effect, space and time are “empirically real”. Shapes and durations, spatial relations and time intervals could, then, be taken as belonging to a general concept of space and to a general concept of time, in the sense that these concepts being formed as extrapolations out of experience: space and time are notions of what still remains even when substantive bodies are driven away, or when a body is imagined to grow of volume or of temporal duration to infinity. This transformative act gives birth to space and time, as utmost empirical concepts, by forming the belief that extensions of objects and their outer relations, as well as their successive temporal order do really exist, just because of the existence of space and time.

The second step in defense of my claim is the answer to the question ‘How this right-minded ontologization, no matter how much illegitimate it is from the standpoint of transcendental aesthetic, is possible?’

The only feasible answer is that pure forms of sensibility, which make experience possible and thereby are formative for experience in ‘calling up its objects’, can be extracted back from experience as concepts of entities, pretending to have an
independent existence. In a brief remark concerning the use of the notions of cause and effect in the section about the second analogy of experience within his first Critique, Kant admits the way of formation of concepts by emergence out of experience, pointing again to the concepts of space and time:

The case is the same as with other pure representations a priori (for instance space and time), which we are only able to draw out as pure concepts from experience, because we have put them first into experience, nay, have rendered experience possible only by them. (Kant 1966: 158; CPR, A 196, B 241)

Thus the mechanism of emergence of the “empirical”, better say of the “Intuitive”, concepts of space and time is but their backward extraction out of experience, only because, as cognizing subjects we have already put spatial and temporal qualities within the representations of objects, i.e. we have provided some local space and local time order for the objects of every real and possible experience. And if this is true for every experience, then the formation of “empirical” concepts of space and time follows as a natural step.

3. Theoretical concepts of Space and Time

Empirical concepts of space and time can take up an additional ontological burden, in order to play the role of basic concepts within philosophical views about nature, or the role of theoretical constructs within physical theories that describe the kinematical and the dynamical aspects of moving bodies. Ready examples for this are the Newtonian and the Leibnizian concepts of space and time. While Newton supports a substantival view, Leibniz defends a relational view about space and time. Kant was well aware of the debate between S. Clarke (who defended the substantival view) and Leibniz. ‘There is no doubt that the debate between the Leibnizians and the Newtonians concerning the status of space and time forms part of the essential background to Kant’s views throughout his career.’ (Janiak 2009: 2.1) There are interpreters, who share the opinion that accepting neither of these views Kant developed his transcendental conception of space and time to surmount the weak points of the combating views. I am not going to enter any historical details here. The reminder about the substantival and the relational concepts of space and time is a mere illustration of how concepts of space and time can possess clear and sharp ontological commitments.
Here is the place for a comment on an interesting episode in the development of Kant’s own conception of space and time. In his first work *Gedanken von der wahren Schätzung der lebendigen Kräfte*, referring to his pre-critical period, he considers space as an ontological concept, as a natural extension, determined by the inherent force exhibited by substances within the world. Kant sees a basic connection between the existence of precisely three spatial dimensions and the mathematical expression of the universal force of attraction – Newton’s inverse square law of gravitation. According to him, this well-known law could be of some other kind. Instead of it – Kant speculates – God could have chosen another law, such as, for instance, that the force of attraction is inversely proportional to the cube of the distances among material bodies.

An extension with other properties and dimensions would also spring from the other law. The science about all these possible kinds of space would be the highest geometry, which a limited understanding could undertake (...). If it is possible for extensions with other dimensions to exist, then quite probably God has indeed situated them somewhere.⁵

I mentioned that this position of Kant concerning the concept of space is ‘interesting’, for two reasons. The first one is the fact that Kant himself has operated with ontological concepts of space and extension, but the second reason is more important. The quoted lines can be qualified as a bold prophecy for the birth of ‘the science about all these possible kinds of space’, of the science about ‘extensions with other properties and dimensions’, or in other words, for the birth of geometries different from the three-dimensional Euclidean geometry, and their application to other possible worlds. Kant’s hypothetical reasoning was demonstrated, at that, before the discovery of non-Euclidean geometries in the nineteenth century, and before Ehrenfest’s conclusions in 1917 that the stability of planetary orbits and atomic structures is essentially dependent on the dimensionality of space. It is worth noticing that the critics of Kant’s conception of space and time, mentioned in the first section of the paper, seem to be unaware of this theoretical prediction of Kant, which has outstripped his time far ahead.

My argumentation here is not accomplished so far, because I would like to show that being a Kantian does not preclude the possibility for a theorist to accept a corroborated contemporary conception about the spatio-temporal structure of the universe, e.g. to accept the concept of *space-time* from Einstein’s general theory of relativity. The latter concept is of the kind of concepts often bearing the name ‘theoretical constructs’. They are abstract concepts of directly unobservable objects,
which are basic constituents of the ontology of contemporary scientific theories. Terms like ‘electron’, ‘quark’, ‘string’, and the like, represent theoretical constructs in the field of quantum theories. Space-time in the general theory of relativity is also a theoretical construct, or an abstract theoretical concept, because it refers to an imperceptible (as a whole, at least by humans) four-dimensional entity with variable curvature from place to place.

Now, the problem is how such kinds of ontological notions are acceptable within the framework of Kant’s philosophy. An answer to this problem will demonstrate that Kant’s philosophy does not put a conceptual barrier to the theoretical constructs successfully exploited by contemporary science, including the abstract concept of space-time.

Let me firstly remind that Kant himself accepted the correct usage of abstract concepts being already formed by the theoretical speculation of his epoch. Thus in the preface to the second edition of Kritik der reinen Vernunft (1787) he admits the reality of ‘the invisible force (the Newtonian attraction) which holds the universe together’6, and speaks with confidence about the invisible magnetic matter (Kant 1966: 175; CPR, A 226, B 273). How do these abstract concepts have a legitimate use, if they have no directly observable referents in experience?

Such kinds of concepts emerge as representations of hypothetical entities. However, Kant repeatedly brings out that ‘in the mere concept of a thing no sign of its existence can be discovered’ (1966: 175; CPR, A 223, B 270). No matter how clear and complete a concept our faculty of imagination could produce, the concept per se gives no warrant for the existence of the referent of the concept. A scientist, however, can be highly convinced of its existence, and use the abstract concept in a legitimate manner, if the hypothetical entity, presented by its concept, agrees with the formal conditions of experience, from the one side, and is an essential part of the explanation of the observable features of the phenomena under research, on the other side. This is exactly the case with the concept of a magnetic field, or of ‘magnetic matter’, as Kant once called it.

A concept preceding experience implies its possibility only; while perception, which supplies the material of a concept, is the only characteristic of reality. It is possible, however, even before the perception of a thing, and therefore, in a certain sense, a priori, to know its existence, provided it hang together with some other perceptions, according to the principles of their empirical connection (analogies). For in that case the existence of a thing hangs together at least with our perceptions in a
possible experience, and guided by our analogies we can, starting from our real experience, arrive at some other thing in the series of possible perceptions. Thus we know the existence of some magnetic matter pervading all bodies from the perception of the attracted iron filings, though our organs are so constituted as to render an immediate perception of that matter impossible.\textsuperscript{7}

It becomes clear now that Kant’s transcendental idealism, valuing so high the productive faculty of imagination, does not raise any conceptual barrier to the intellectual production of theoretical constructs. Anyhow, they have to be produced in a very careful mode, since they have to satisfy certain requirements; and the Einsteinian construct of space-time makes no exception. Firstly, theoretical constructs must agree with the analogies of experience, or in broader terms (to attract the properties of the non-classical quantum objects as well), to follow a settled experiential pattern. Secondly, this is crucial for theoretical constructs to account for the features of observable phenomena, just like the magnetic field accounts for the specific arrangements of iron filings. And thirdly, their introduction into a theoretical ontology must be guided by some well-articulated regulative idea, pretending to lend completeness to experience. Thus the idea that natural forces have a common source and origin has lead once to the successful unification of the electrostatic and of the magnetic field into an electromagnetic field, and nowadays, to the unification of electromagnetic, weak, and strong interactions within a common theory, known as the Standard model of the quantum domain.

Abiding by the requirements just stated does not guarantee, by itself, the real existence of putative entities outside the limits of experience. Thus phlogiston, introduced in chemistry in the end of the 17th century to explain the process of burning, is expelled from contemporary science, in spite of the fact that it has practically satisfied the above requirements. Their violation, however, which allows the understanding to wander freely beyond the bounds of experience, can lead, most probably, through the dance of the fantasy, to the birth of imaginary or transcendent objects. Such objects, no matter how tempting our belief they might be, do not enlarge our knowledge. This is why Kant warns in the Prolegomena, that ‘the understanding begins its aberrations very innocently and modestly’, to come in the end to the construction of a whole fictitious world. ‘This is the reason that young thinkers are so partial to metaphysics of the truly dogmatical kind, and often sacrifice to it their time and their talents, which might be otherwise better employed.’ (Kant 1997: Sect.35; 2.317)
But in spite of the fact that Kant is so stringent concerning the usage of the understanding, he is at the same time benevolent with respect to the faculty of imagination: The imagination may perhaps be forgiven for occasional vagaries, and for not keeping carefully within the limits of experience, since it gains life and vigor by such flights, and since it is always easier to moderate its boldness, than to stimulate its languor (Kant 1997: Sect.35; 2.317). And this is so, since deprived of ‘flights’, imagination would not stimulate the production of theoretical knowledge, which is the core of the scientific enterprise.

Anguel Stefanov
angstefanov@abv.bg

ENDNOTES
1. (Carnap 1966: 181), my italics.
3. I use ‘CPR’ here and in the next pages of the paper as a standard abbreviation for Kant’s first Critique – *Critique of Pure Reason*.
4. (Kant 1883: §39, 71). At the corresponding place in the *Prolegomena* Paul Carus’s translation is: ‘After long reflection on the pure elements of human knowledge (those which contain nothing empirical), I at last succeeded in distinguishing with certainty and in separating the pure elementary notions of the Sensibility (space and time) from those of the Understanding.’ (Kant 1997: Sect.39; 2.323) The original excerpt is: ‘Bei einer Untersuchung der reinen (nichts Empirisches enthaltenden) Elemente der menschlichen Erkenntniss gelang es mir allererst nach langem Nachdenken, die reinen Elementarbegriffe der Sinnlichkeit (Raum und Zeit) von denen des Verstandes mit Zuverlässigkeit zu unterscheiden und abzusondern.’ (Kant, AA IV, S. 323)
5. (Kant 1922: 25), my translation.
6. (Kant 1966: XXXV-XXXVI; CPR, B XXII, fn.), my italics.
8. ‘But the understanding which ought to think can never be forgiven for indulging in vagaries’ (Kant 1997: Sect.35; 2.317).
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