

INQUIRIES IN CARNAP'S *AUFBAU* (II)*

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1. Carnap was one of those logicist thinkers who tried to build a world system upon a phenomenal basis. A noteworthy influence on Carnap had Bertrand Russell's work, especially *Our Knowledge of the External World*. Through his analytico-logical method, Russell wanted to provide a scientific character for his philosophy. The idea that philosophy can also have a ground on logic crossed Russell's mind while pondering upon the problems of *Principia Mathematica*. Akin to mathematics, the main purpose of philosophy was to shed some light on the logical form of facts. This aim is best undertaken by turning down the classical aristotelian logic, and substituting it by a more adequate logic of relation.

In *Our Knowledge of the External World* the grounds of construction are sensorial facts and the laws of logic. Sensorial facts represent our own sensorial data to which one adds some spatial and temporal relations.¹

In *Der logische Aufbau der Welt* the construction is founded also on the sensorial data, conceived, this time, as a stream of experience, unitary and unanalysable, although sectioned methodologically in temporally ordered elementary experiences. Here the ground is the relation of recollection of similarity (Rs) between elementary experiences.

We clarified some of the constructional aspects, in the first part of this research,² where we approached the state of things at the first two levels of constitution (the abstract and psychic ones). In this second part we will focus on the passing to the third physical level recalling briefly a few traits of the Carnapian undertaking (section 2), restating shortly the ideas of our first part (section 3), and directly approaching the physical level (section 4).

2. It must be said, from the very beginning, that in the first part of this paper we established three planes of reading the *Aufbau* (the psychological, the real, and the ideal constitutional ones); on the real constitutional plane we distinguished four

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¹ B. Russell (1910), *Our Knowledge of the External World*, trad. fr. *Notre connaissance du monde extérieur*, in: *La méthode scientifique en philosophie*, Payot, 1973, 2nd ed., 87-88.

² Cf. I. D. Toader, G. Vacariu (1997), *Inquiries in Carnap's Aufbau* (I), *Revue Roumaine de Philosophie*, 41, 3-4.

levels: the methodological, the psychic, the physical and the one of physics. At all these levels there are distinct relating elements of the *Konstitutionssystem*, as in the following table:

methodological I	local signs	undetermined color ³ (quality)	elementary experiences
psychic I	places	color (quality)	sensations ⁴
physical I	world points	colored objects	events
of physics I	n-tuples	state magnitudes	processes

To each of these levels a spatial, a qualitative and a temporal order correspond. The abstract spatial order (§25)⁵ is, even though Carnap does not say it, the local sign order. This is a bidimensional order that can be laid out by Cartesian coordinates. The preliminary spatial order is supported by the abstract one, and orders the visual field places. The physical spatial order is tridimensional as a world points order. Finally, the spatial order of the level of physics is the order of the n-tuples which determine each world point. Two elementary experiences x and y are part-similar if they contain two undetermined quality A and B , whose local signs a_1, b_1 and a_2, b_2 , respectively, have the coordinate values included into the stipulated similarity intervals: $a_1 \in [m, n]$, $a_2 \in [m, n]$, $b_1 \in [p, q]$, $b_2 \in [p, q]$. The measure of this interval can be taken as an essential characteristic of the system.

3. One of the most important steps of the *Konstitutionstheorie* is the one that passes from the preliminary level to the physical one. The exegetes of Carnap's work emphasized the fact that this passing represents the weakest point of the whole system.⁶ The constitution of the third level presupposes the passing from the visual bidimensional field to the tridimensionality of the physical space, in Gerhards' words: from *phenogramma* to *ontogramma*. In constituting the physical space, one has to take into account not only the bidimensional preliminary space order, but also the bidimensional space order of local signs. One can find answers to this problem in Russell's and Whitehead's works. The former considered as basal units the aspects of visible things; he failed to pass from the bidimensional space to the tridimensional one, because he understood the bidimensional order as given. Or, more subtly, Carnap logically derives both the bidimensional order of the visual field and the tridimensional one of physical space, out of the abstract order of local signs. But neither offers he a complete solution to this issue.

Now, the main element of the constitution of the physical world is the color assignment to the world points.

³ Undetermined color means that it has only two spatial dimensions without the other qualitative three (brightness, hue, saturation); until now, it was denoted as color spot.

⁴ See note 2.

⁵ All references to the *Aufbau* are by paragraph number.

⁶ Cf. W.V.O. Quine (1951), *Two dogmas of empiricism*, in *From a Logical Point of View*, Cambridge, Mass., and Zane Parks (1973), *On the Construction of the Physical World in the Aufbau*, in *Philosophical Studies*, 24, 424-426.

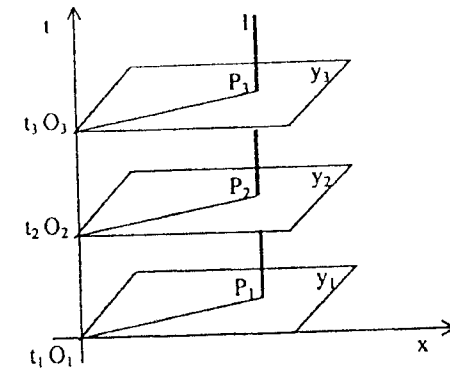


Fig. 1

In fig. 1, l means, in Carnap's terminology, a world line. O_1, O_2, O_3 are viewpoints (*Ausblickpunkte*), which correspond to the time coordinates t_1, t_2, t_3 , respectively. By y_1, y_2, y_3 are denoted tridimensional spaces, here rendered in a minkovskian manner as bidimensional. P_i are world points, and OP are lines of view (*Blicklinien*). At a single moment t_i there is a space class (*Raumklasse*) formed by the simultaneous world points that correspond to y_i . To each visual sensation belonging to an elementary experience at a moment t_i there is a line of view $O_i P_i$ assigned, corresponding to the O_i viewpoints, so that to the in visual field near placed sensations one assigns lines which form a very small angle between them. The color of a sensation is assigned to a world point corresponding to a line of world. This world point is called the seen color point (*gesehener Farbpunkt*). Each of the seen color points belongs to a line of view. World points can be seen color points or unseen color points. An unseen color point cannot be located between a view point and a seen color point on the same line of view. This can never belong to a line of view.

The next step after the assignment of colors to the world points is the assignment of other sense qualities to these points. In this way, what appears as visual-tactile things, and among them the human body. The perceptible world is constituted through this assignment of qualities to the individual points (§ 13.4).

The ascent from the second level to the third one can be approached in phenomenal and/or a physical way. The premises of the phenomenalist explanation are related with the fact that the derivation of the visual field is achieved on the basis of "the similarity of local signs of proximity places" (§ 92). The relation between local signs and world points, intermediated by the visual field places, is a many-one function which describes a homomorphism between the two sets of them.

In Carnap's *Dreidimensionalität des Raumes und Kausalität*, the stipulation of causality is the logical ground of the physical tridimensional space: "The fiction of space tridimensionality is a logical inference out of the fiction of physical causality".⁷

⁷ Cf. R. Carnap (1924), *Dreidimensionalität des Raumes und Kausalität*, in *Annalen der Philosophie*, IV, 105-110.

The physical approach takes place in an opposite direction, starting from the tridimensional space towards the bidimensional one. The lines of view are in a physicalist reading *light rays*, which being reflected by physical objects, fall on the retine forming a bundle of rays of a second order, *i.e.* bidimensional. The two approaches represent the two sides of the same process of *swing* between the autopsychical level and the physical one. Namely, a *swing* of information between the framework of the "psychical and foremost the physical regularities" (§ 87) and the scheme offered by the laws of light. In the constitutional plane, to this swing a temporal sequence of elementary experiences corresponds. The swing presupposes a selection of information operated by the subject, a processing of it, and then a projection upon the physical world. This swing takes place at a temporally very narrow interval, in fact from one sensation to another; a sensation is determined by projecting upon it the information selected from a previous sensation. We recall that a psychological sensation has the constitutional counterpart in an elementary experience. At the preliminary level the qualitative, spatial and temporal orderings are discontinuous. Carnap sustains they are supplemented, at the physical level, by the regularities of the physical processes. This suppletion also refers to the assignment of other sense qualities to the world points.

As we sustained above, world points are constituted out of local signs. The similarity of local signs presupposes that the Cartesian coordinates values of two local signs (which order two color spots) belong to the same similarity intervals, respectively.⁸ The discontinuities at the preliminary level are due to the color spots having the coordinates outside the similarity intervals. At the physical level, if there were only seen color points constituted *viz.*, those situated on lines of view, the discontinuity would be persistent. But, the unseen color points being also considered, the discontinuity is taken aloof. Let us get a little closer to this problem. We have seen the color points are obtained by assigning colors to the world points. What does this assignment really mean? How is it fulfilled? Color is a preliminary qualitative determination. It is obtained by successively superposing color spots, under the condition of similarity between the local signs of each spot. That is by including the Cartesian coordinates of the two knowing subjects and the real physical subject, which in turn, has as a result the *perceived object*. A color is more complete chromatic information, until an equilibrium is attained: the fitness position.⁹ At this point, the chromatic information does not suffer any further changes, although the selection and the projection are still on.

The regularities of physical processes are stipulations as substantiality, causality, etc. They belong to the hypothetical-deductive arsenal of the theories of

⁸ Cf. I.-D. Toader, G. Vacariu (1997), *Inquiries in Carnap's Aufbau* (I), *Revue Roumaine de Philosophie*, 41, 3-4.

⁹ The following remark is relevant to this point: "If you close one eye, stare at some bright color for 30 seconds, and then blink your eyes successively, you will note shifts in the chromatic appearance of most things. The adaptation difference between the two eyes vanishes quickly, so the effects will soon disappear [...] Discriminations made with the adapted eye will match those made with the unadapted eye." (A. Clark (1993), *Sensory Qualities*, Oxford Clarendon Press, 167, *apud* F. Dretske (1995), *Naturalizing the Mind*, MIT Press, 65)

physics. There are also metric representations as structure preserving maps, which take elements from the physical objects set to the measurement units.

4. In order to depict more clearly the physical state of things in Carnap's system, let us take an example from Russell's *Knowledge of the External World*, to compare the two conceptions.

In Russell's view, a table as a physical object can be seen from many perspectives. While the table stays the same, it is nevertheless true that the perspectives upon it are continuously changing with the alteration of the visual and muscular sensations. The meaning of all this is that a color spot is not generally changed abruptly by another, but *smoothly* replaced by it. Russell defines the aspect of a thing as the way in which it appears from a certain perspective. So, a thing is conceived as a class of various aspects of it. The table has a multitude of aspects obtained from a lot of perspectives. As we see the matter, the geometrical place of all these perspectives is a sphere with the table as center. In a single perspective ("from which", *i.e.*, from the viewer's place), one can have a view upon several objects, but the aspect regards only one of them ("at which", *i.e.*, at spots in the same similarity intervals, respectively). Sequently, to assign a color to a world point means to find out a many-one function from the local signs of the spots forming that color to the world point. In other words, one uses a homomorphism between the model of the physical world and an abstract Cartesian model. Fig. 2 below represents the image of the successively superposing (in a quasianalytical way) the elementary experiences, which renders the colors (*i.e.* clusters of subnuances).¹⁰ These clusters are obtained through the similarity intervals. So, the unseen color points are due to those spots having local signs with coordinates outside the stipulated similarity intervals. As can be seen in fig. 2 the elimination of the empty spaces between points-clusters is the elimination of the preliminary discontinuities.

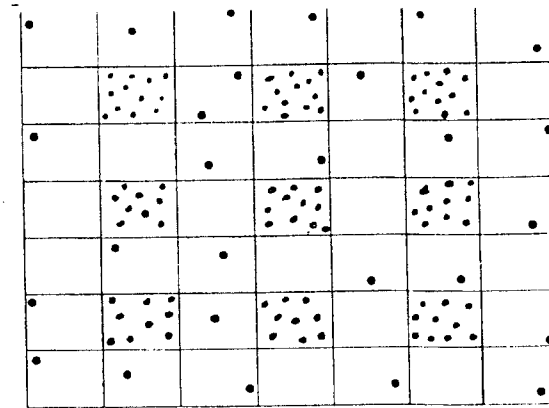


Fig. 2

¹⁰ Cf. I.-D. Toader, G. Vacariu (1998), *Color similarity in Carnap's Aufbau*, in "Krisis" special forthcoming issue with the Proceedings of the International Colloquium on Philosophy of Science, Logic and Cognitive Science, Predeal, 1997

The superposing on the constitutional plane, whose final outcome is the constituted physical object, has its correspondent in the *Konstitutionsystem*, in the process information swing between the places of the thing. Consequently, the viewer's geometrical place is the intersection of those spheres, which each respond to a single thing around, *i.e.*, the point towards which all the spheres rays are going. Russell understands the aspect in two ways: first, belonging to the thing (as it is seen by the physicist), and second (as it is conceived by the psychologist), from the viewer's perspective. The table is, therefore, on the one hand, a psychological object when the aspects are considered from the viewer's perspective, and, on the other hand, a physical object when the aspect is regarded as belonging to the thing.

This is how Russell makes the passing from the psychological to the physical state of things, by postulating the physical aspects as a counterpart to the psychological ones.

In § 124, Carnap refers to various possibilities of constituting the physical space, among which the Russellian one. As was presented above, the visual individual things (*i.e.* physical aspects) are obtained out of psychological aspects of them; but, alternatively to this possibility, Carnap thinks that these psychological aspects are constructed from elementary experiences. The constitution of physical objects does not occur individually for each of them, but the whole visual world is constituted concomitently (*auf einmal*). Now, considering again fig. 1, P_i represents an individual point of the table in temporal sequence, which becomes seen color point through the assignment of a color. The same holds for all the other world points of the table. To these points one assigns also other qualities (tactile, etc.). The table is, in a Carnapian definition, the class of perceived quality points and of nonperceived quality points. These nonperceived quality points result from the fact that the qualities (only spatially determined, but not qualitatively) assigned to them, have local signs with the coordinates situated outside the stipulated similarity intervals (see fig. 2). Only, the table appears continuously at the physical level on account of the information swing between the knowing subject and the perceived object, where there are stipulations like substantiality, causality, etc. (§ 135).

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