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Research article

Realism in Carnap's *Aufbau* vs Antirealism in Goodman's *The Structure of Appearance*

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Abstract:
Although Nelson Goodman's *The Structure of Appearance* is the only contemporary successor of Rudolf Carnap's *Der logische Aufbau der Welt*, a comparison between them has not yet been sufficiently made. In this paper, I provide a comparison to find their fundamental, ontological difference. First, the differences concerning the following four formal aspects are determined: (1) the scope of the system, (2) formal tools allowed in constructing the system, (3) extralogical primitives of the system, and (4) the criterion of accuracy of definition given in the system. I argue that (4) is most related to their ontological difference. That is, this kind of difference is based on the further, more fundamental difference in their vision of system construction: Carnap constructs a system to objectively specify objects, whereas Goodman does it to make a world. This difference indicates their ontological difference, namely, the more realist Carnap vs the more antirealist Goodman.

Keywords:
Realism, Antirealism, Logical construction, Rudolf Carnap, Nelson Goodman

1. Introduction

Rudolf Carnap's *Der logische Aufbau der Welt* (Carnap 1928; hereafter, *Aufbau*) is a milestone of the logical positivism movement, not only in terms of its strong influence, but also in that it was the first and largest project with the aim of providing a formal system for reconstructing our knowledge of the world. Nevertheless, formal analysis and revision of the *Aufbau* program, in the sense of providing alternative systems, were not seriously attempted

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until Nelson Goodman's *The Structure of Appearance* (Goodman 1951; hereafter, *SA*). *SA* is thus the only contemporary successor of the program.[1] However, the program of *SA* has fundamentally different aspects from that of *Aufbau*. Moreover, these differences are rooted in their ontological difference, namely, the more realist *Aufbau* vs the less realist *SA*. Because these differences have not yet been fully studied, I will present a study of them.

Discussion will proceed as follows. First, I present the four formal differences between *Aufbau* and *SA* in Section 2. In Section 3, the last of the four differences is diagnosed to be rooted in the programs' ontology, namely, the more realist *Aufbau* and the less realist *SA*.

2. *Aufbau* vs *SA*

2.1 Construction of the World vs that of Appearance

As its title shows, *SA* is a formal study of the structure that psychological appearance has, or, more accurately, it is a study *only of* the structure of psychological appearance. At this point, its difference from *Aufbau* is already present because *Aufbau* is the logical construction *of the world*, not only of appearance. *Aufbau* is a project providing formal definitions for *all the objects* dealt with in various kinds of science and thus trying to show that the object domain of science is unified.[2] Goodman in *SA* gives up such an attempt from the beginning:

> To construct the entire physical object or a cross section of it out of presentations means, in effect, bringing in 'possible' as well as actual presentations […] This immediately involves us in a difficult set of problems that have in recent years been studied very earnestly but with little success. However, the problem of constructing either the physical object or its cross sections out of presentations (or conversely, the presentations out of physical objects) lies beyond the scope of this book. (*SA*, 94)

1 Goodman's Ph.D. dissertation, *A Study of Qualities* (Goodman 1941), can be counted as another example. Recently, *Aufbau* has been reevaluated and the "successors" of the *Aufbau* program can be found in Leitgeb 2009 and Chalmers 2012.

2 Note that "object (*Gegenstand*)" in *Aufbau* is "always used in its wildest sense, namely, for anything about which a statement can be made. Thus, among objects we count not only things, but also properties and classes, relations in extension and intension, states and events, what is actual as well as what is not" (*Aufbau*, §1; translation by Rolf A. George). Note, in particular, that objects include psychological and cultural objects as well as physical ones. The construction of the world thus means the construction of the world including all the kinds of object, rather than the construction only of *the physical world*.

The examples showing that some difficult problems "have in recent years been studied very earnestly but with little success" are, according to Goodman, Carnap's "Testability and Meaning" (Carnap 1936–37) and Goodman's own "Problem of Counterfactual Conditions" (Goodman 1947). What is at issue is that, if we try to construct physical objects from psychological appearance, we would be involved in the very difficult problem of how to "project" actual appearance to non-actuals, which is essentially the problem of induction. This kind of "projection" is indeed performed in *Aufbau*, §§125ff., where physical objects are constructed from autopsychological objects (*Eigenpsychisches*). This is the point at which Quine's famous criticism was leveled (Quine 1953/1961, 40; 1969, 76f.). Goodman decided not to deal with this cumbersome process in *SA*.

This difference between *Aufbau* and *SA* is the difference concerning (1) the *scope* of the system. Other formal differences between them include the differences concerning (2) *formal tools* allowed in constructing the system, (3) *extralogical primitives* of the system, and (4) the criterion of *accuracy of definition* given in the system. Naturally, the differences in (2) and (3) are closely related to ontological differences between *Aufbau* and *SA*, but I argue that (4) is the most fundamental point of difference in their ontology.

2.2 Platonism vs Nominalism

Differences in (2) and (3) have been pointed out.[3] First, consider point (2). The formal existences utilized in *Aufbau* are *classes* and *relations*, whereas, in *SA*, classes and relations are not allowed and only *individuals* are permitted. *SA* thus uses mereology ("individual calculus"), not set theory ("class calculus"), as a formal tool (*SA*, Chap. 2).

Goodman's choice is based on his *nominalism*. That is, he chooses individual calculus because he does not want to make an ontological commitment to any entity other than individuals. Note, however, that his nominalism means nothing but this. First, (i) he never claims that only individuals exist nor that there are no entities such as classes. He means only that he decided to construct a system without commitment to any entity other than individuals (*SA*, 26). Furthermore, (ii) there is no characterization of what kind of entity an "individual" is (*SA*, 28). What an individual is depends on the interpretation of a system.

"Nominalism" in the context of the traditional realism–antirealism dispute is the position that denies universals or abstract objects. "Nominalism" typically refers to the position that takes particulars as the only acceptable entities and denies the existence of universals such as redness and integrity, or the position that accepts only concrete objects and denies the existence

3 See Cohnitz and Rossberg 2006, Chaps. 4 and 5 for a concise and precise summary.

of abstract objects such as numbers and forms. In contrast, Goodman's nominalism denies neither the existence of universals nor abstract objects, which can be understood from point (i), and furthermore, it does not deny the possibility that universals and abstract entities are taken as individuals, which can be seen from point (ii). Indeed, as will be shown below, the system of *SA* takes abstract objects as individuals.[4] Goodman's nominalism is thus merely a position about what formal tools should be allowed in constructing a system.

Moreover, this kind of nominalism is derived from more than the spirit of Ockham's razor, namely, that no suspicious entities should be allowed. He proposes a methodology for accurately measuring the *simplicity* of systems, and the result of a simplicity measurement based on this methodology shows that individual calculus is simpler than class calculus (*SA*, Chap. 3; cf. Cohnitz and Rossberg 2006, Chap. 4). His choice of individual calculus is dependent on this kind of simplicity. His choice is, therefore, dependent not merely on ontological consideration, but also on an objective standard for the superiority of a system to another. Thus, Goodman's nominalism is primarily a characteristic *of a system*, ascribed on the basis of the formal tools used in the system, rather than the position ascribed to each philosopher on the basis of his/her ontological doctrine (Cohnitz and Rossberg 2006, 87).[5]

"Platonism" in Goodman's meaning is in opposition to this kind of nominalism. That is, "Platonism" is the position that allows classes besides individuals and uses class calculus in constructing a system (*SA*, 25). According to this usage, the system of *Aufbau* is Platonist.

Goodman's choice of nominalism is thus based on its simplicity, but it is only half of the story. According to him, individual calculus has a further advantage, particularly in constructing a system *of appearance*, compared with the class calculus used in *Aufbau*. This will be shown in the next section.

SA's formal tools are thus clearly different from those of *Aufbau*. The latter utilizes classes as its "ascension forms (*die Stufenformen*)," which reflect a hierarchy of "self-standing (*selbständig*)" objects such as psychological, physical, and cultural objects in a system (*Aufbau*, §40). In contrast, such a hierarchy is never found in *SA*. *SA* does not intend to reflect various kinds of objects in a formal hierarchy.

4 It is not deniable that Goodman is skeptical about universals. However, he does not take such skepticism as an example of "nominalism."

5 This can be understood from Goodman's own choice in *A Study of Qualities*, which utilizes both individual and class calculi.

2.3 Particularism vs "Realism"

Point (3), extralogical primitives, is dealt with in *Aufbau* as the problem of the basis of constitutional systems (*Aufbau*, Part III, C). Carnap divides this problem into that of the basic elements and that of the basic relation between those elements. As a conclusion, *Aufbau* chooses "elementary experience (*Elementarerlebnis*)" as the basic elements and the "recollection of similarity (*Ähnlichkeitserinnerung*)" between them as the basic relation. On the basis of the latter, the components of the former, such as quality and sensation, are constructed. In contrast, Goodman goes the other way around: he collects qualia of various categories such as color, position, and time, and then constructs individual concrete experiences from these. Because qualia is an abstract object and experience is a concrete object, Goodman calls the problem of constructing qualia from experience "the problem of abstraction" and the problem of constructing experience from qualia "the problem of concretion" (*SA*, 106f.). *SA* deals with the latter, whereas *Aufbau* deals with the former.

This means that Goodman takes abstract objects as the basis of the system although his position is nominalism. In contrast, *Aufbau* chooses concrete objects as the basis of the system. Goodman calls the former "a realistic system" and the latter "a particularistic system" (*SA*, 104). According to this dichotomy, Goodman chooses a nominalist *and* realistic (!) system.[6]

He chooses this because it has advantages over Platonist and particularistic systems like *Aufbau*'s. In particular, Goodman points out two problems from which *Aufbau*'s system suffers but *SA*'s system does not: the problems of companionship and imperfect community (*SA*, 116ff.). The former is the problem that the components that should be decomposed are not decomposed in an analysis such as *Aufbau*'s. For example, in constructing colors from things, this problem would occur when blue things are coincidently always in company with red things. On the other hand, the problem of imperfect community is that components that should not be decomposed are decomposed. For example, this can occur if every two out of three things share a color and only these three share a color with each of the three, but the three things in total do not share one color. According to the criterion of constructing a quality based on the formal method of a similarity circle (see Section 3.1) in *Aufbau*, these three things would be determined to share one color in this case.

The problem of imperfect community can be solved in both "realistic" and particularistic systems, provided individual calculus is used. On the other hand, the companionship problem cannot be solved unless the system is nominalist and "realistic." Therefore, the choice of a

6 However, I do not follow this usage of "realism" because it is quite misleading in the context related to the realism–antirealism debate. When using the word in this peculiar meaning, I will enclose it in quotation marks.

"realistic" system vis-à-vis a particularistic system is justified particularly by the solvability of this problem (*SA*, 151f.).

2.4 Coextensiveness vs Isomorphism

Now, let us consider the final difference, which concerns point (4), accuracy of definition. This is the question regarding when a definiens can be said to accurately define a definiendum. On this problem, Carnap in *Aufbau* supports "the extensional method," which requires only coextensiveness, not synonymy, between the definiendum and definiens (*Aufbau*, §45). Against this, Goodman claims that coextensiveness is still *too strong* to be required in definitions. The reason for this is that some of the existing legitimate and necessary definitions are incompatible with the extensional method. For example, consider Whitehead's definition of geometrical points by certain classes of volumes. A point, in its usual sense, is not extensionally identical to a certain class of volumes, which consists of infinite members. Thus, according to Goodman, *isomorphism*, a relation weaker than coextensiveness, is sufficient for a definiendum and definiens (*SA*, Chap. 1).[7]

Goodman uses the simple sample universe in Fig. 1 to explain his requirement for definitions. Suppose we would like to define points K, L, M, and N. Let some function pick up the following pairs of intersecting lines:

(I) {{a,1},
{a,2},
{b,1},
{b,2}}.

If this function is taken as the definiens of "points," then the class of points

(II) {K,
L,
M,
N}

7 Note, however, that what Goodman thinks is "isomorphism" is not exactly the isomorphism in the sense of modern model theory, but is a slightly different asymmetry relation, what Hellman calls "*SA*-isomorphism" (see Hellman 1977, XXVIIIf.).

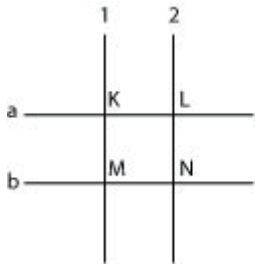

Fig. 1. A sample universe.

would be defined as the class of pairs (I).

Because definiens (I) is isomorphic to definiendum (II), this can be, according to Goodman's criterion, an accurate definition. On the other hand, with only isomorphism being covered by this definition, it still leaves open what member from class (I) corresponds to that from class (II). A particular correspondence is still underdetermined. Even if the usual correspondence is desired, it is not possible to determine it without other definitions. On the other hand, this indicates that other definitions can provide an *unusual* correspondence that holds between extensionally *different* members of classes (I) and (II).

Then, what should be taken as such other definitions? Consider the relation "next-counterclockwise-to" between the points in the figure. That is, a definition that gives the class of relations

(III) {⟨K,L⟩,
⟨L,N⟩,
⟨N,M⟩,
⟨M,K⟩}

is wanted. To define this, use the function whose extension is the following class:

(IV) {⟨{a,1},{a,2}⟩,
⟨{a,2},{b,2}⟩,
⟨{b,2},{b,1}⟩,
⟨{b,1},{a,1}⟩}.

This can be a legitimate definition because it satisfies isomorphism. Using this and the above definition of points, the relevant correspondences will be pinned down to four: the

correspondence of each row of (I) from the top to each row of (II) from the top; that of each row of (I) from the top to the fourth, first, second, and third rows of (II); and the other two similar correspondences.

To narrow these down to one correspondence, the relation "directly above" is sufficient:

(V) $\{\langle K,M\rangle,$
$\langle L,N\rangle\}$

To define this relation, use the primitive whose extension is

(VI) $\{\langle\{a,1\},\{b,1\}\rangle,$
$\langle\{a,2\},\{b,2\}\rangle\}.$

Then, the only correspondence that satisfies the three definitions is the correspondence of each row of (I) from the top to each row of (II) from the top, namely, the usual correspondence. Replacement is now uniquely determined. Call the system given by the primitives satisfying this replacement System A.

System A is the most "natural" system. There can, however, be other systems that satisfy isomorphism. For example, the relation "next-counterclockwise-to" could be defined not as (IV) but as the following class:

(VII) $\{\langle\{a,1\},\{b,2\}\rangle,$
$\langle\{b,2\},\{a,2\}\rangle,$
$\langle\{a,2\},\{b,1\}\rangle,$
$\langle\{b,1\},\{a,1\}\rangle\}.$

Furthermore, if "directly above" were defined as

(VIII) $\{\langle\{a,1\},\{b,1\}\rangle,$
$\langle\{b,2\},\{a,2\}\rangle\},$

then the correspondence of each of (III) from the top to each of (VII) from the top would be the only correspondence that satisfies the definitions. Call the system using this correspondence System B. Both Systems A and B satisfy isomorphism, but have different extensions, and thus are not coextensive.

3. Realism vs Antirealism

Of these four kinds of differences between *Aufbau* and *SA*, I will focus on the last (4) in the following because it is crucial for understanding their ontological differences. The other three will also be treated only to the extent related to the last difference.

3.1 Definition and Object Specification

According to Goodman, the thesis of extension in *Aufbau* is too strong for the criterion of accuracy of definition. The criterion in *Aufbau* is, therefore, inadequate if Goodman's argument is correctly presented.

However, although Carnap in *Aufbau* took the thesis of extension, he used, in his definitions, a peculiar kind of description, a "purely structural definite description" (PSDD), which uses only structural descriptions and depends on no individual or predicate constants (*Aufbau*, §13). This way of definition is similar to Goodman's in that it requires definitions to preserve structures. Indeed, in the above sample universe, the four points can be defined by PSDDs, given some primitives. Use the primitives "I(x,y)," "C(x,y)," and "A(x,y)" intended to pick up (I), (IV), and (VI), respectively, where "x" and "y" are the variables for lines. Then, the following definitions can be given by PSDDs:

(D1) $\mathrm{K} =_{\mathrm{df}} \{s,t \mid \mathrm{I}(s,t) \wedge \exists u \exists v\, (\mathrm{I}(u,v) \wedge \forall x \forall y\, ((x = \{s,t\} \wedge y = \{u,v\}) \rightarrow (\mathrm{C}(y,x) \wedge \mathrm{A}(x,y))))\}$
(D2) $\mathrm{L} =_{\mathrm{df}} \{s,t \mid \mathrm{I}(s,t) \wedge \exists u \exists v\, (\mathrm{I}(u,v) \wedge \forall x \forall y\, ((x = \{s,t\} \wedge y = \{u,v\}) \rightarrow (\mathrm{C}(x,y) \wedge \mathrm{A}(x,y))))\}$
(D3) $\mathrm{M} =_{\mathrm{df}} \{s,t \mid \mathrm{I}(s,t) \wedge \exists u \exists v\, (\mathrm{I}(u,v) \wedge \forall x \forall y\, ((x = \{s,t\} \wedge y = \{u,v\}) \rightarrow (\mathrm{C}(x,y) \wedge \mathrm{A}(y,x))))\}$
(D4) $\mathrm{N} =_{\mathrm{df}} \{s,t \mid \mathrm{I}(s,t) \wedge \exists u \exists v\, (\mathrm{I}(u,v) \wedge \forall x \forall y\, ((x = \{s,t\} \wedge y = \{u,v\}) \rightarrow (\mathrm{C}(y,x) \wedge \mathrm{A}(y,x))))\}$.

In these definitions, the points are structurally determined. That is, the four points can be determined independently of any individual or predicate constants. First, no individual constants appear in the definiens. Second, even if meanings of predicates I, C, and A are not known, the four points can be determined in accordance with the difference in the logical form of the definiens.

This means that the object embodying each logical form can be thought of as the defined point. However, it would then be a problem whether these definitions are really "definite descriptions." That is, can they uniquely determine the intended classes? If we take the three relations "naturally" as intended, we have K = {a,1}, L = {a,2}, M = {b,1}, and N = {b,2}, and therefore, System A. However, given an "unnatural" interpretation of "I(x,y)" and "A(x,y),"

then K = {a,1}, L = {b,2}, M = {b,1}, and N = {a,2}, namely, System B, could be obtained. Therefore, the classes are *not* uniquely determined, and so the PSDDs are unsuccessful.

This is not a failure of PSDDs in the usual sense. When the objects are not uniquely determined, a typical reason for failure is the *shortage of relations*. Even if restricted to "natural" interpretations, when, say, "A(*x*,*y*)" is not in hand, each point could not be determined. The above failure, in contrast, is not of this kind, but of such a kind that, after enough relations for unique determination appear to be collected, an "eccentric" interpretation is given and induces underdetermination.

For Carnap, the above four definitions should have been made to pick up System A rather than System B. PSDDs are used, in general, to clearly specify objects that are usually specified in ordinary language without clear logical forms. This is a replacement of object specification in realist language (*realistische Sprache*) by that in the symbolic language of logic (*Aufbau*, §95). In such a replacement, it is presupposed that the objects specified in the former should be the same as those in the latter. Carnap thinks, in this sense, that coextensiveness is the criterion of accuracy of definitions. The requirement of PSDD is imposed assuming coextensiveness.

Then, Goodman's example seems to show that Carnap's definition is unsuccessful. On the other hand, Goodman does not present the plurality of systems as a "problem" or "obstacle." Rather, he considers that isomorphism is sufficient for accuracy of definition, and the requirement of only isomorphism is so useful that even this kind of example can be dealt with. What, then, are the reasons for such a difference between Carnap and Goodman?

For Carnap, definition is the way of *object specification* (*Gegenstandbestimmung*). The goal of the *Aufbau* project is to achieve *objective* specification of all the objects dealt with in sciences through constitutional definitions. People, even scientists, usually specify objects in partly or entirely subjective ways. This is done using ordinary languages, which do not clearly show the structures of objects. *Aufbau*, in contrast, utilizes the symbolic language of logic, which allows PSDDs, to objectively specify objects.

On the other hand, the reason Goodman uses structures or isomorphism is *not* to objectively specify objects. Object specification is merely a problem of *interpretation*. Symbols of each system are supposed to be given a determinate interpretation (*SA*, 3). Without such interpretations, Systems A and B cannot be distinguished. Supposing determinate interpretations, Goodman takes isomorphism as the criterion of translation between the presystem and system or between systems to be counted as an accurate definition. Therefore, for him, object specification is one thing and definition is another.

This kind of difference between Carnap and Goodman is connected to the difference in conceiving the meaning a system construction using symbolic languages should have. Carnap

in *Aufbau* sought to achieve a logical construction of empirical objects in the spirit of the logicism of Frege and Russell. The construction of the constitutional system in *Aufbau* is an attempt to reduce empirical objects similar to that of mathematical concepts to logical ones executed by Frege and Russell. By the method of "quasianalysis (*Quasianalyse*)" inspired by Russell's Principle of Abstraction, Carnap attempted to construct empirical objects on the basis of logical relationships between objects (*Aufbau*, §§69–73). "Quasianalysis" is what we should do when the existence of components of objects cannot be assumed, which is exactly the case for *Aufbau*'s basic elements, elementary experiences. In such a case, "quasicomponents (*Quasibestandteil*)" will be determined using "similarity circles (*Ähnlichkeitskreise*)" of objects, which are akin to abstraction classes in the Principle of Abstraction.

However, this kind of construction/reduction undertakes, at the same time, the role of accomplishing Neo-Kantian tasks. Systematic definitions of objects based on their logical relationships are seen, in this aspect, not only as the construction of objects, but also as the process of acquiring objective knowledge. This is because the formality of logical relationships is considered to provide objectivity. Giving definitions is thus nothing but the objective specification of objects.

For Goodman, on the other hand, objects are determined previously by interpretations. It is not the case that a reference to objects is not clearly determined previously and becomes objectively determined only after system construction. Of course, system construction includes the procedures of giving interpretations. However, they are procedures of providing the definiendum, to which an old interpretation is previously given, with a new interpretation by the definiens in a system. They are not procedures of more surely specifying the same objects. This kind of thought by Goodman was developed to a pluralist ontology (Goodman 1978, 109–116): each system is a version of a world and system construction is a way of worldmaking. He denies such a conception that there is *the* world, which is determined independently of any system, with various systems describing it differently.

The difference in the tools used in system construction between *Aufbau* and *SA* is also related to their difference in conceiving what a system construction should be. For Goodman, what is to be chosen as the tools is determined considering the simplicity or economy of the system. As a consequence, he chose individual calculus. On the other hand, for Carnap in *Aufbau*, the use of class theory vis-à-vis individual calculus was almost predetermined because he followed the tradition of Frege and Russell. Furthermore, Carnap thought the hierarchy of classes corresponds to the hierarchy of self-standing objects. The formal tool of class was thus needed as a suitable way of maintaining this hierarchy.

3.2 Different Responses to Technical Problems of *Aufbau*

The above differences between Carnap's and Goodman's ideas make clear the reason for a further disagreement between them. As above, according to Goodman, the difference in extralogical primitives between *Aufbau* and *SA* results in a difference in ability to solve the two problems Goodman claimed against *Aufbau*. Carnap was indeed not unaware of these problems. He found, at least, the companionship problem at the beginning of the project (Carnap 1923) and thought it to be important.[8] Although he only let these problematic cases be excluded from the suitable ones at that time, he discussed this problem in slightly more detail later in *Aufbau*:

> If there are no systematic connections between the distributions of the different colors, then this unfavorable case, namely, that the second property [the largest class all of whose members are color-akin] is missing in a color class, becomes the less likely the smaller the average number of colors of the thing and the larger the total number of the things. (*Aufbau*, §70[9])

Here, the fact that the "second property" is missing in a class that should be a color class means that, because the class is a subclass of another color class, it cannot be the largest class all of whose members are color-akin, and therefore, by the criterion of the similarity circle, cannot be a color class. This is exactly an example of the companionship problem. This situation is, according to Carnap, "unfavorable." However, unless a systematic connection between the distribution of colors underlies such a situation, this situation should be thought to rarely occur, given actual conditions such that the average number of colors of a thing is small and the total number of things is large. That is, the companionship problem would not occur in real cases and thus need not be taken seriously.

Goodman criticizes this way of thinking (*SA*, 117). He protests that such an extrasystematic supposition should not be imported. What can and cannot be constructed should be determined by an intrasystematic criterion. Moreover, even if extrasystematic suppositions were to be

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8 This point was mentioned in Decock and Douven 2011, 70 (I appreciate the anonymous reviewer who suggested this paper). However, contrary to Decock and Douven, who say that Carnap "had discovered the companionship difficulty and the difficulty of imperfect community long before Goodman" (*op. cit.*), I found no evidence in Carnap 1923 that he was also aware of the problem of imperfect community. Indeed, 40 years later, Carnap said "Goodman found inadequacies which I had not recognized" (Carnap 1963, 946) after he mentioned the "defects" he did discuss in *Aufbau*, and these defects were essentially the companionship problem.

9 This quotation is from the translation of *Aufbau* by Rolf A. George.

allowed, Carnap's supposition would itself be suspicious. First, if we think of elementary experiences, which are the objects to be analyzed in *Aufbau*, instead of things in the above example, the average number of qualities in each experience would not decrease. Second, the condition "If there are no systematic connections between the distributions of the different colors" is circular. If these "connections" mean only the constant cooccurrence of two qualities, the exclusion of such systematic connections means only the supposition that unfavorable situations do not seem to occur. On the other hand, if the situations in which very similar colors are systematically connected were to be excluded, this would mean the arbitrary exclusion of the cases in which unfavorable situations most likely occur.

Carnap scholars have recently responded to Goodman's criticism. Richardson emphasizes the difference between quasianalysis and usual analysis (Richardson 1998, 61–64). In usual analysis, because the components of an object are already known, one should restore these components. One should, therefore, analyze things in such a way as to solve Goodman's two problems. Quasianalysis, on the other hand, should start from the situations in which the objective components of the objects are unknown. Then, using the structure of the relations of the objects as the only clue, one should identify their components or, more accurately, their quasicomponents. In this case, even if "unfavorable" situations occur so that usually expected qualities are not obtained and qualities different from those intended are instead obtained, it merely means that the objectively specifiable qualities are found to be such qualities. Ultimately, there is no external perspective for checking the correctness of construction. That "unfavorable" situations would not occur is just a working hypothesis given by empirical sciences.[10]

This kind of response suggests that there is some fundamental difference behind the difference between Carnap's and Goodman's attitudes toward the technical problems. However, it is not fully conceived in these responses that this difference is the difference between their positions concerning the system construction mentioned above. For Goodman, the objective of system construction is to provide definitions based on presystematic interpretation. Therefore, what obtains in the definiendum should be more or less determined, and the relations that hold in the definiendum must be reserved in the definiens at least isomorphically. The two problems

10 Similar points are presented by Proust 1989 and Mormann 2003, who follows Proust. According to Proust, "Goodman's objections […] unwittingly reestablish the fiction of an omniscient God capable of testing through originary intuition, that is without construction, what constitution derives from its extensional given" (Proust 1989, 192f.). Mormann sees the method of synthetic geometry as the prototype of the constitution theory of *Aufbau*, and diagnoses that Goodman's failure pointed out by Proust is a consequence of his neglect of such a geometrical background (Mormann 2003, 58).

suggest that this condition would not be fulfilled in *Aufbau*, and thus, according to Goodman, they should be solved. On the other hand, Carnap thinks that empirical objects are not objectively determined previously, and thus, he requires they be specified objectively by system construction. What cannot be objectively specified should be abandoned.

The above response by Carnap scholars, however, does strike Goodman's weak point. For Goodman's position that supposes interpretation be previously determined, presystematic interpretation is problematic. How can we interpret symbol usage that is not arranged in a system and preserve isomorphism based on that? Aside from examples like Fig. 1, the interpretation of which can be clearly determined, this question should be answered when dealing with fields in which the presystematic order is not obvious at all. Dealing with a phenomenological system is of course such a case.

Nevertheless, there are problems on Carnap's side. First, because Goodman proposes ways to solve the two problems, they can be solved in system construction. The attitude that distinguishes what are originally thought to be distinguished is better in system construction than an attitude such as "if they cannot be distinguished, leave them undistinguished." Even if what are originally thought to be distinguished is a part of working hypotheses, it would be better that we can have them maintained than abandoned.[11]

Second, criteria for prescribing what should be given priority and what should be abandoned seem necessary. Goodman requires isomorphism between a definiendum and definiens. On the other hand, Carnap requires coextensiveness between them. This condition is stronger than Goodman's. However, what exactly are the objects between which coextensiveness must hold? In other words, what objects should be defined and what need not be defined? The only criterion suggested by Carnap regarding these questions is whether they can or cannot be structurally described. This induces arbitrariness because what can be structurally described depends on other decisions on what relations are selected as basic relations, how many basic relations are selected, and what kinds of formal tool are selected in system construction.

Indeed, Carnap sees the construction of a constitutional system as the task of giving conventions (*Aufbau*, §179). Of course, what holds in experiences, e.g., how colors of things are distributed in objects, is determined empirically, rather than conventionally. However, which of these facts should be given priority, what should be selected as a basis, and what

11 Afterwards, Carnap suggested a way to distinguish what is to be distinguished: "use a greater number of primitives" (Carnap 1963, 946). This way of solution has been developed in formal detail by Mormann 2009 and Leitgeb 2011. However, Goodman would not be satisfied with this way of solution because the simplicity of the system discussed in Section 2.2 would be reduced by it.

objects should be distinguished or not are under the control of the system constructor. System construction is conventional in this meaning.

Goodman's idea also invites conventionality, though in a different sense from Carnap's. For Goodman, at least what are originally distinguished should be distinguished. It is wrong to argue that this requirement is given from "God's viewpoint."[12] The requirement that presystematically interpreted terms be distinguished is not, for Goodman, given by "the one and only real world" seen from God's viewpoint, for it prescribes only to distinguish what we already distinguish in *a world we made*. Every version, whether before or after system construction, is nothing but a result of our worldmaking. Carnap, in contrast, presupposes the real world and limits its objects to those specifiable for humans. It is from this vision that conventionality arises on what we distinguish.

Goodman's conventionality is not of this kind. For example, in the above definition of geometrical points, underdetermination holds concerning which system, namely, System A or B, should be selected. Conventionality is thus on which system to select. What is conventional in this sense of conventionality is, given the objects to be distinguished, *as what objects should they be distinguished*, rather than what objects should be distinguished. This means the plurality of worlds.

Besides these two problems, there is a third problem against Carnap. Carnap's vision on system construction invites the problems mentioned in the previous section. The example of the definition of geometrical points shows that a PSDD may fail to pick up a unique object owing to an alternative interpretation of primitives, even when such a description seems successful. A solution for this problem available to Carnap is to give structural descriptions even to primitives and block alternative interpretations. Indeed, Carnap attempts to provide such descriptions in *Aufbau* (*Aufbau*, §§154f.)! This way of solution is considered problematic, however.[13]

In summary, Carnap is more realist than Goodman when comparing their views on system construction. For Goodman, there are distinct versions of the world for each system. There can be plural versions with isomorphism maintained between them. This way of thinking makes it impossible to take full realism toward one version, and therefore is a kind of antirealism. The world varies depending on our system construction. For Carnap, on the other hand, the plurality

12 This is indeed what Proust 1989 argues. See footnote 10.

13 This way of solution is criticized by Friedman 1987. Why it is unsuccessful and how it is related to the substitution argument against "the metaphysical realism" by Putnam are discussed in Osada 2014, Chap. 5.

of systems means just the multiple specifiability of objects. The world is unique and exists before specifications. Specification utilizes structural features of the world.

This conclusion may seem opposed to the, now standard, Neo-Kantian reading of *Aufbau*, according to which Carnap is antirealist. This impression is correct in one sense but wrong in another. Of course, *Aufbau* has been a strongly Neo-Kantian project from the beginning. The idea of the objective object specification via PSDDs in the replacement of the subjective specification in ordinary language is particularly in the Neo-Kantian spirit in that the goal is set towards the clarification of the process of obtaining objective cognition. Object specification via PSDDs is the general strategy for system construction, namely, what is shown in the constitution theory (*Konstitutionstheorie*) in *Aufbau*. However, the Neo-Kantian goal of the clarification of objective cognition is also achieved in a particular system (*Konstitutionssystem*) given in *Aufbau*, namely, the system constituting the intersubjective world, including other persons' minds and physical and cultural objects, from the subjective experience. *Aufbau* thus has two Neo-Kantian faces: one appears in the theory for constructing any system, whether epistemological or materialist, and the other appears in the construction of a particular system, namely, *Aufbau*'s epistemological system.[14] The former is about object specification: the dichotomy of objective/subjective is applied to the way of cognition, not to the object itself. On the other hand, the latter is about object types such as psychological/physical/cultural objects: the dichotomy is applied to the object itself. According to the latter, *Aufbau* is antirealist because the only posited relation is the recollection of similarity between elementary experiences, and the other objects are nothing but constituted from this relation. In contrast, according to the former, *only the way of specification* is changed from subjective language to objective PSDDs, whereas *the objects specified in each specification are posited to have their extensional identity*.[15] In this respect, Carnap is more realist than Goodman.[16]

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14 This distinction is similar to that by Richardson. He distinguished "the project of objectivity as pure logical structure [...] through his notion of a 'purely structural definite description'" and "a notion of objectivity within the system of scientific concepts itself via the construction of the intersubjective world of science" (Richardson 1998, 29).

15 This aspect can be consistent with *Aufbau*'s alleged "neutralism" among "subjective idealism" ("phenomenalism" in today's sense), "transcendental idealism" (Neo-Kantianism), "phenomenalism" (Kant's position), "solipsism," and "realism" (*Aufbau*, §175). In constructing a system, the objects must be specified via PSDDs, maintaining their extensional identity. Once specified, the ontological status of these objects can be clarified from a "neutral" viewpoint in accordance with how the objects were specified in this system. For example, all the propositions about objects can be transformed into propositions about the structural connections between subjective experience; at this point, the constitutional theory is consistent with "subjective idealism." On the other hand, the constitutional theory is also consistent with "realism" in many aspects, e.g., in that empirically real objects are accepted only if they are intersubjectivizable or that

Such a diagnosis, if correct, would enable the comparison of Carnap's ontological position in *Aufbau* or Goodman's in *SA* with Carnap's later well-known metametaphysics in "Empiricism, Semantics, and Ontology." I think that his later position is more similar to Goodman's than to his own earlier one in *Aufbau*, which means, supposing the diagnosis in this paper, that his later position is more antirealist than his earlier one. A painstaking work would be needed to show these points, but this kind of argument is likely to provide some important insights to the contemporary metametaphysical discussion.

4. Conclusions

A comparison of Carnap's *Aufbau* and Goodman's *SA* showed their differences concerning the following four formal aspects: (1) the scope of the system, (2) formal tools allowed in constructing the system, (3) extralogical primitives of the system, and (4) the criterion of accuracy of definition given in the system. The difference concerning (4) is based on the difference concerning system construction: Carnap constructs a system to objectively specify objects, whereas Goodman does it to make a world. This difference indicates their ontological difference, namely, the more realist Carnap vs the more antirealist Goodman.

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they are independent of me in the sense that their behaviors are not varied by my desire (*Aufbau*, §§177f.).

16 This sense of "realism" of *Aufbau* is discussed in detail in Osada 2014, Chap. 3.

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