REFLECTIONS ON NELSON GOODMAN'S *THE STRUCTURE OF APPEARANCE*

PROFESSOR Goodman's recent work,[1] deals with a group of problems usually assigned to the province of epistemology; but it is neither based on, nor does it purport to establish, any sweeping epistemological theory in the traditional manner; rather, it aims at constructing, in a painstakingly careful procedure, a conceptual framework which will make it possible to state and to examine with lucidity and rigor certain basic issues in the theory of knowledge. By virtue of its methods and its results, it constitutes a distinguished contribution to analytic philosophy. Unlike the contemporary analytic school in Britain, however, which appears to be predominantly interested in clarifying philosophic perplexities with the help of analytic tools provided by ordinary language, without insisting on (or even expecting much benefit from) the use of logical techniques other than those implicit in a judicious and sensitive use of conversational English, Goodman, who shares the view that philosophy has the function of clearing away perplexity and confusion, tackles this task in a manner much more akin to the methods used for similar purposes by Carnap, and sometimes by Russell and by Whitehead. He sees the most adequate way of dealing with philosophical problems in the establishment of a "constructional system" within which the issues at hand can be expressed and discussed with clarity and precision. This method of analysis by logical reconstruction requires rigorous and efficient logical techniques; and Goodman, therefore, makes systematic, though judiciously limited, use of the conceptual and symbolic apparatus of contemporary formal logic.

The specific task Goodman sets himself is to construct the beginnings of a theoretical system which will permit an economic description of the structure of our phenomenal experience in the various sense realms. His explicit discussion is limited almost entirely to the visual realm, but his methods are formulated so as to be capable of transfer to other phenomenal domains. For the visual realm, Goodman's objective requires the specification of a list of basic terms which is simple (in a systematic sense, whose exact meaning receives careful clarifi-

[1] Nelson Goodman, *The Structure of Appearance* (Cambridge, Mass., Harvard University Press, 1951).

cation), and which will permit the definition of a fuller vocabulary adequate for the description of the spatial and temporal characters of visual phenomena, the structure of the visual field, the similarities of different shades of color and their corresponding three-dimensional order, and so forth. Since this might appear to be a rather limited program for a comprehensive study, it ought to be emphasized immediately that large sections of the book are devoted to the development of important and often quite novel general ideas, which will be mentioned below, and whose significance for logic and epistemology reaches far beyond the application they find in the author's system construction.

The rigorous construction of a system of the desired kind requires in particular (1) the selection of a set of suitable primitives, i.e., of terms which are not defined within the system, and by means of which all other terms of the system can be defined, and (2) the specification of a system of logic, whose rules determine, among other things, what logical devices are to be permitted for the purposes of definition, inference, and proof. In regard to both of these points, Goodman's work has certain distinctive characteristics, which will now be briefly considered in turn.

The logical apparatus adopted by most constructionalist philosophers includes the formation of classes, classes of classes, and so forth, of whatever entities function as individuals; and it is in terms of such classes that the various nonprimitive terms are defined. Typical examples of this procedure are the definition of natural numbers, signed integers, rational numbers, real numbers, and so forth, as classes of ever-increasing complexity built up from individuals in the manner of Frege and of *Principia Mathematica,* and the construction, in Carnap's *Der logische Aufbau der Welt,* of the phenomenal world and then the world of physics, psychology, and the social sciences, by the formation of classes of increasingly high order from concrete phenomenal individuals, each of which is a full momentary cross section of experience. By way of preparation for his own approach and in order to acquaint the reader with a different type of constructional system, Goodman gives an excellent detailed summary of Carnap's important pioneering work in this field, and he supplements his survey by a judicious and enlightening critical commentary.

In his own constructions, Goodman eschews the use of the class concept as "platonistic" and adheres instead to that contemporary version of nominalism whose development is due largely to the efforts of Goodman and of Quine. Nominalism in this sense rejects the use

of any language containing names or variables for classes; it countenances merely the truth-functional connectives, names and variables for individuals, quantifiers to bind the latter, and one-place and many-place predicates of the first order, which serve to express properties and relations among individuals of the system. The grounds offered in defense of this severe form of logical asceticism are mainly the elusiveness of the notion of class, and more specifically, the incomprehensibility of the idea that it should be possible to construct, out of a given set of individuals, a large variety of classes (such as the class of those individuals, the class of their unit classes, and so forth) which are all different from each other and yet have the same "content" (namely, the given individuals).

The insistence, however, that two entities cannot be different if they have the same content does not appear to me to be convincing so long as the notion of content is used in this general and unspecific manner. Thus, e.g., the idea of different sequential arrangements of a given finite number of individuals — or, as a special case, the formation of two different ordered couples from two individuals — would seem to be quite clear, and yet we have here apparently several different entities with the same content. Incidentally, Goodman insists that nominalism neither asserts nor denies the existence of classes but simply does not wish to commit itself on this question; but it would seem that a noncommittal attitude on this issue can be significantly taken only if the notion of class is at least intelligible. It might be preferable, therefore, to treat nominalism simply as a particular mode of logical procedure which denies itself the use of some of the standard concepts and methods of logic, and which might best be justified by pointing to the systematic economy it frequently achieves, and to its avoidance of logical techniques whose extravagant use is known to give rise to various logico-mathematical paradoxes. It should be emphasized, however, that while Goodman favors the nominalistic mode of procedure, he does not set out to "prove" nominalism and "refute" Platonism (the temper of his entire work is averse to the advocacy of any sweeping isms), and that his ingenious and parsimonious methods of construction can be profitably applied, to a large extent, also by those who are willing to make use of the concept of class.

Some of the functions of the calculus of classes are taken over in Goodman's constructions by the calculus of individuals, a branch of logical theory which was developed, some twenty years ago, by Lesniewski and, independently, by Leonard and Goodman. The central concepts of this theory are certain relations among individuals, such as

overlapping, discreteness, and being a part of; and certain functions such as the sum and the product of individuals. All these concepts have analogues in the theory of classes and exhibit many formal similarities with them; but there exists a fundamental difference: Whereas a class of classes of individuals is always distinct from the class of all individuals involved, the sum of any sums of individuals is always identical with the sum of all the individuals involved. In this manner, the calculus of individuals vouchsafes the identity of any two entities with the same "content"; and, precisely for this reason, it precludes the possibility of forming, from some finite initial set of individuals, an endless array of distinct abstract entities.

As atomic individuals, i.e., as the elementary building blocks to which the constructional devices of the calculus of individuals are to be applied, Goodman chooses, not concrete phenomenal things or events, but rather what, in the terminology of C. I. Lewis, he calls qualia. A quale is a qualitative characteristic of phenomenal experience such as, say, a certain shade of purple occurring in the presentation of a certain piece of cloth in a particular light. Qualia are distinct, of course, from properties as characters of physical objects. The qualia Goodman chooses as atoms include colors, times, visual-field places, and various nonvisual qualia which he does not specify in detail. Thus, moments of phenomenal time as well as phenomenal places are conceived here as repeatable universals. A place can be at, or "together with," several times, several colors, and so forth, and a time can be with different places, colors, and so forth. The totality of individuals of his system consists simply of all the sums that can be formed by means of any of the atomic individuals, or qualia. Goodman conceives the total stream of experience to which his system is to be applied as containing only a finite number of qualia; consequently, the number of all individuals countenanced in his system is finite as well. This striking finitistic aspect of his theory is clearly connected with its nominalistic character: admission of the logic of classes would have permitted the construction of an infinite hierarchy of entities even from a finite set of individuals.

As Goodman points out in developing a useful set of distinctions, his choice of qualia as atomic individuals makes his system phenomenalistic rather than physicalistic and realistic rather than particularistic. In a physicalistic system, the individuals are concrete physical objects or properties of such; in a particularistic system, the individuals are concrete entities rather than abstract characters. (The system of Carnap's *Aufbau* clearly is phenomenalistic and particularistic.) In view

of the realistic character of his system, Goodman's first main problem is that of concretion, i.e., that of constructing unrepeatable concrete individuals from qualities. In the visual realm, a concretum is a color-spot-moment, which may be construed as the sum of a color, a visual-field place, and a time which stand in a peculiar relation of togetherness. Goodman adopts this relation — slightly generalized for technical reasons — as a primitive and then shows how, by means of it, it is possible to define the concept of concrete individual as well as the various relations of qualification in which qualia and certain sums of qualia stand to fully or partially concrete individuals that exhibit them.

The author then turns to the second of his two major constructional objectives, namely, the ordering of the qualia in the different categories. Roughly, the problem is to construct, for each of the categories (color, time, place, and so forth) a map which assigns a unique position to each quale in the category, and which represents the relative likeness of qualia by nearness in position. The solution of the problem requires in each case the specification of a set of terms by means of which the order at hand can be described, and then the selection of primitives suitable to define them. Goodman indicates appropriate procedures partly in detail, partly in outline; he also shows how, subsequently, predicates referring to size and shape of phenomenal concreta may be introduced, and he suggests briefly some approaches to the definition of the different categories of qualia by reference to their distinctive structural characteristics. The treatment of these topics is an exemplar of keen analysis and of constructive ingenuity, and the solutions it reaches as well as the problems it propounds should be of considerable interest to psychologists of perception as well as to logicians. The discussion of the order of qualia ends with a chapter, entitled "On Time and Eternity," which deals in a suggestive and enlightening manner with the ordinal aspects of phenomenal time, with linguistic devices to express temporal relations, and with some connections between phenomenal and physical time.

By what criteria can the soundness of a constructional system be appraised? Goodman offers important and largely novel observations on two aspects of this question: the accuracy of the definitions and the simplicity of the definitional basis.

First of all, the definitions have to be accurate; they must explicate the concepts which give rise to the problems under analysis. Just what does accuracy in this sense amount to? Goodman argues that the definiens of an accurate definition need have neither the same intension nor even the same extension as the definiendum; thus, e.g., in a con-

structional system, points in space may be defined equally well as certain classes of straight lines or as certain infinite "convergent" sets of concentric spheres; but these alternative definientia are neither cointensive (synonymous) nor coextensive with each other; hence, their accuracy notwithstanding, they cannot both be synonymous or coextensive with the definiendum. Accuracy of constructional definitions, Goodman argues, amounts to no more than a certain (nonsymmetrical) kind of isomorphism of the definiens with the definiendum; roughly, this means that the concepts of the constructional system must provide a structural model for the explicanda in the sense that for every connection between entities that is describable in terms of the explicanda, there must obtain a matching connection, stateable in terms of the respective definientia, among the counterparts which the entities in question have within the system.

This criterion must seem puzzling, however, for it evidently presupposes that the extensions of the explicanda are precisely specified —a condition which is rarely satisfied in situations requiring philosophical analysis. In general, the terms around which philosophical perplexities center are beset with obscurity, vagueness, and ambiguity, and the classes of instances to which they apply are therefore anything but precisely determined. Consider, for example, the concept of probability. In preanalytic usage, probabilities are ascribed variously to individual events, to classes of events, and to hypotheses and theories; sometimes, the ascription is made unconditionally, sometimes relatively to some reference class or reference body of evidence. Evidently, no matter what constructional definition of probability may be propounded, the criterion of an exact isomorphism of the definiens with the explicandum cannot be significantly applied at all because the explicandum has no well-determined extension and hence no precisely fixed structure. It seems to me important to note, therefore, that the stage of rigorous construction in philosophy, with which Goodman's book is concerned, presupposes a preconstructional clarification of the explicanda under investigation. This stage of analysis, on which Goodman touches only quite briefly, might be viewed as having three major tasks: (1) to disentangle the various modes of usage of the explicanda; (2) to explore the rationale of each of the various patterns of use and to appraise its value for descriptive and theoretical purposes; and then (3) to assign precise meanings to the explicanda in such a way that they permit a clear description and a fruitful theoretical treatment of the issues under analysis. The methods of the British analysts can be extremely valuable, it seems to me, in dealing with these pre-

constructional problems; for those methods aim at obviating perplexity and confusion by exhibiting and distinguishing different ways of using a given term. But in the pursuit of its objective, analysis cannot be content with a purely descriptive account of linguistic behavior patterns: it has to point out the pitfalls inherent in the various modes of usage, the possibilities they offer for category mistakes and other sources of confusion. And from here on, it is only a short step (called for by an interest in developing a framework for a general and systematic treatment of philosophical issues) to the third of the tasks just mentioned: that of explicitly proposing certain modifications of existing usage which will enhance clarity and which promise to be theoretically fruitful. Once this last step has been taken, the stage is set for the development of a constructional system for the readjusted explicanda; and in this context, Goodman's isomorphism criterion of accuracy becomes applicable and is eminently significant.

Now, for a given set of thus clarified explicanda, there usually exist various alternative ways of constructing definitions which are accurate in Goodman's sense. Among these competing alternatives, those with the formally simplest, or most economic, set of primitive predicates are to be preferred, since the aim is to obtain a systematically powerful system. For, as Goodman points out, to economize and to systematize are the same thing in a constructional procedure: greater formal simplicity of basis means stronger connections among the terms of the system and thus greater theoretical power of the system itself. Before this simplicity of predicate sets — which must be distinguished from the simplicity of theories, or hypothesis sets — can serve as a criterion in appraising the adequacy of a constructional system, it needs a precise explication, of course; and an important chapter in Goodman's book is devoted to the heretofore unexplored problem of devising an explicit definition for the degree of formal simplicity of any set of predicates with one or more arguments. This problem is of obvious interest for logic and axiomatics, and Goodman deals with it in great generality. After first developing his definition for predicates of the nominalistically sanctioned first order — i.e., those representing properties and relations of individuals — he generalizes it so as to render it applicable also to higher-order predicates. The formal simplicity of a predicate set as defined by Goodman is not, of course, just a function of the number of predicates; it depends on the total number of argument places involved and, in an intricate manner, on various structural aspects, such as symmetry, of the relations expressed by the predicates.

This chapter on simplicity constitutes an important contribution to logical theory, and it will undoubtedly stimulate further research.

As was mentioned earlier, Goodman provides a reconstruction only for the "lower" levels of the phenomenal world. The question thus arises whether his methods lend themselves to an expansion of the system. Goodman suggests — and I believe, rightly — that his methods can be used to construct the lower levels of sense realms other than that of vision, but that constructional advance toward the "upper" levels, and especially beyond the phenomenal realm into that of intersubjective scientific concepts, is impeded by a group of serious logical problems. These arise especially in connection with the attempt to introduce disposition terms, such as they occur on the physical and no doubt already on the phenomenal level of analysis. The introduction of these terms seems to require either the use of incomplete definitions in the form of Carnap's reduction sentences — which conflicts with the objective of attaining a system of full constructional definitions — or reliance on modal or counterfactual expressions — which fail to meet Goodman's standards of intelligibility, so that he declines to make use of them, pending further analysis. An additional obstacle on the road to the construction of the intersubjective concepts of science arises for Goodman from his self-imposed restriction to a nominalistic logic and to a finite set of individuals. It is hard to imagine how, on this basis, it would be possible to construct the quantitative concepts of science with their infinite sets of numerical values. However, Goodman cautions against the hasty conclusion that a construction of the physical world on a phenomenalistic basis is definitely impossible and argues that a decision on this issue requires a more precise statement of the problem in question and of the means to be permitted in its solution.

Would the adoption of a physicalistic basis facilitate the task of a comprehensive "logical construction of the world"? Even if, in addition, we permit ourselves the use of a "platonistic" logic, the problems besetting the introduction of disposition terms still remain with us, as is so clearly shown in Carnap's *Testability and Meaning;* and the task of introducing the "theoretical constructs" of the more advanced branches of empirical science seems to give rise to further problems, no matter what kind of basis is chosen. If nevertheless I am inclined to prefer a physicalistic system of the particularistic variety, i.e., one in which the individuals are concrete physical objects or events, and the primitives express characters of those objects, it is because the qualia and the concreta in Goodman's system seem such highly elusive entities, and because descriptive statements about them present great

difficulties for a dependable test; whereas in a physicalistic system of the kind mentioned, the statements about the individuals and their properties and relations are rather readily accessible to intersubjective check; thus, as Popper has argued in *Logik der Forschung,* a system of this kind is especially well suited for a rational reconstruction of intersubjective scientific knowledge.

Goodman's book is not opposed to such alternatives, and, indeed, it provides valuable tools for their development. His careful analyses certainly show that any sweeping claim about the ultimate basis of all empirical knowledge has to be viewed with diffidence; no precise formulation, let alone substantiation, for such general assertions is available today. But while Goodman's book does reflect an attitude of critical caution, it by no means encourages a sterile skepticism. Rather, it propounds a careful piecemeal method of philosophic inquiry, with the help of the most rigorous and dependable tools of logic; and by a highly ingenious use of this procedure, it makes an outstanding contribution to analytic philosophy.

Goodman presents his ideas with great care and lucidity, and he exhibits an enviable gift for succinct and pithy statement. In organizing the contents of this book — to which an excellent index provides detailed reference — Goodman has evidently been guided by strictly systematic rather than by didactic considerations, and thus, he begins with a fairly technical chapter on the criteria of accuracy for constructional definitions. A reader who is not yet acquainted with the objectives and principal techniques of the constructional method might feel needlessly discouraged by the experience of being faced, without many preliminaries, with this rather complex topic; and I should like to suggest, therefore, that those who wish to obtain first a general impression of the book might find it profitable to begin with the less technical chapters, II, IV, and VI, which provide an excellent survey of the central themes in this important work.

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