

Introduction

In this book I propose to embark on an exploration of one of the most difficult yet fundamental concepts of the natural and social sciences, the concept of “structure.” This will not be an easy voyage – many a tall ship has been wrecked in the course of such an enterprise. Nonetheless, the call of the open sea can be still heard and the time seems to be ripe for another daring undertaking. Let us then accept the challenge and investigate this much used and abused notion which, as Neil Smelser pointed out some time ago (1967), constitutes the chief conceptual focus of sociology and of numerous cognate fields as well.

Since the 1970s, under the stewardship of Robert K. Merton and Peter Blau, several conferences and ensuing publications have resulted in (a) increasing the visibility of the issue of “social structure,” (b) mapping many previously held positions on the matter, and (c) heightening the realization that more progressive work was needed at both the conceptual and empirical levels (Blau 1975a and b; Blau and Merton 1981; Coser 1975). This was certainly facilitated by the dynamic influence of French structuralism, which at the time still reigned supreme. In the 1980s, this progress has been relatively halted, given the later misadventures of formal structuralism and the significant change of course in the social sciences away from the consideration of large social structures and more in the direction of presumed processes of “microstructuration.” Giddens’s attempted mediation became very attractive to many people for a short time; but his work now looks more and more like a diversion from the initial project and, certainly, as strategically exhausted.¹ Similarly, the equally heralded, more collective search for the missing “micro–macro link” (Alexander et al. 1987; Hechter 1983b; Knorr-Cetina and Cicourel 1981; Lindenberg et al. 1986; Wardell and Turner 1986) has been also proved – at least for the time being – to be a dead end, for it has failed to uncover any significant analytical mechanism(s) accounting for the processes of structuration from the micro- to the robust macro-level. So at this point, we seem to be at an impasse. Nonetheless all is not lost. Promising new ways of

¹ Sadly, I consider Giddens’s work on social structure a walk in a blind alley. Its length is not a warrant of true theoretical elaboration and extension; it rather looks like a new language in search of some application, but unable to lead to a robust research program. I agree with Turner (1986a) and Elster (1985, 1989a) that we need to move from “verbosity” to “mechanisms” of structuration.

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handling the issue of social structure do exist; but they are not available within the strict disciplinary confines of sociology. By expanding the search for new ideas to other relevant fields and to the exciting novel conceptions and empirical findings of current physical sciences, one may discover Ariadne's thread leading out of the labyrinth. There are no guarantees, of course – no absolutes or permanent foundations; only pragmatic, relative but robust promises inspiring such an exploration. Naturally, I intend to follow that route!

As the title suggests, my goal is to elucidate the logics of social structure – indeed, of social structures. Why logics? Why structures? This is not a simple matter to be resolved with a few explanatory strokes – this is the subject of this entire book. Nonetheless, some preliminary remarks are in order. To start with the notion of “structures,” we would preemptively point out that the opposition of an abstract notion of structure (structure-type) to the many seemingly empirical structures (structure-tokens) seems erroneous. “Universal” notions of structure have been rightly opposed on both theoretical and empirical grounds. On the other hand, the naive presumption of the existence of “empirical structures” has been thoroughly contested as well: there are no empirical structures but interactional or social systems structured by particular structuring mechanisms. To make better sense of this, we will argue – and elaborate in later chapters – that any proper theory of social structure unavoidably must rest on a suitable metatheoretical notion of “level structure” populated by different “structural” entities (i.e., systems of interaction, systems involving externalities, social systems, and so on) exhibiting particular “structural” forms. This approach then pragmatically demarcates *second-order* questions about structure in general (the “structure of structures” as it were, the level structure, though not an abstract, universal conception of structure) from *first-order* questions about commonsensically presumed concrete structures (that is, structured systems that are taken to be “real” even when, defensively, they are construed as such only pragmatically or from an “internal realist” point of view).² There are many “concrete structures” inscribed in “structured systems” but their relations to each other and to the total “structure” one may have in mind is neither simple nor easily un-

² On the new pragmatic turn in the philosophy of science see Rorty (1979, 1982) and Margolis (1986). Putnam's notion of “internal realism” is explained in his 1981, 1982, 1987, 1988 (compare also Goodman 1978; Laudan 1977). I opt for a form of *intensional* realism (linguistic-conceptual) along lines suggested by Wittgenstein and Lakatos. In general, I believe that the scaffolding of Lakatos's notion of “Research Programmes” is very robust (though I dislike the narrow interpretation offered by Wagner 1984).

derstandable, nor does it exhibit perfect fit to a model of token-type inclusion.

The analytical difficulty of spelling out the relations obtaining among structures (not only among structured social systems) is compounded by the fact that for different concrete structures there exist distinct structuring operations or mechanisms. Thus the need to speak of the *logics* of structures: the various operative mechanisms in a multidimensional actional *and* structural topology that bring about structured systems exhibiting in a relative way an inscribed structural form. These are the treacherous reefs and shoals that have endangered many other efforts; namely, the realization that, if any serious advance is to be made, it is absolutely necessary to discover and elucidate these, as we shall see numerous, special structuring mechanisms producing, underlying, and animating the imputed structural forms of concrete structured systems. These are the logics of structuration from the micro to the intermediary and then to the robust macro levels (see their preliminary inventory in the Appendix), logics to which others until now have just alluded, and which must at this point become the focus of analysis. Consequently, in this book I have committed myself to the task of (a) articulating the progressive strategies fruitfully implemented in the study of social structure; (b) teasing out and elaborating significant forms of “structure” at different levels of size and complexity; and (c) analyzing the particular mechanisms involved in the production/emergence of these concrete structures.

The book is divided into five parts. Part I refers exclusively to the various epistemic strategies currently used in the physical and biological sciences and describes in more detail the new “emergentist” programs of research now flourishing in many scientific domains. This strategy may appear to many to be mistaken. Indeed, with the demise of the logical positivist model of science (see the story in Suppe 1977), the pendulum has moved in the opposite direction, to the point that once more one finds most sociologists arguing on behalf of the radical incommensurability of the respective explanatory models, if not for the outright rejection of the entire scientific enterprise. In the process, not much attention has been paid to the significant changes taking place in many scientific fields, changes which permit for the first time a real rapprochement of physical, biological, and social sciences on equal footing. In this sense, the study of current scientific and philosophical conceptions of “epistemic strategies,” “emergence,” and “structure” is extremely important for social theory. The message one gets from the recent developments in these domains is that the physicalist, Newtonian–Laplacean (dogmatic empiricist, mechanistic, equilibrium-based, atomistic) model of the world is superseded by a more robust, emer-

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gentist one, hospitable to the habitus of social scientists, who will find nothing offending their sensibilities in the current views favoring the ascription of semiautonomy and of a sui generis character to the social structural as well as the mental phenomena – indeed to all emergent phenomena. Since these positions are quite new and not widely known, a survey of the major advances in the physical, biological, and cognitive sciences, bearing on the issues at hand, seems indispensable. It could then be shown that a new convergent model has emerged – a nonreductive, nonequilibrium, multilevel conceptualization of phenomena, which is currently revolutionizing these sciences and which could provide support for a different and more successful recasting of the notion of social structure.

Therefore, we want first to focus on the strategies, proposals, and debates in the philosophy of science and the research practices of the scientists themselves. There are four chapters here addressing these issues: Chapter 1, “Epistemic strategies in contemporary science,” presents five metatheoretical, second-order strategies guiding first-order theoretical research programs and low-level empirical research. These are called the reductionist, constructionist, heterarchical, hierarchical, and transcendent/holist epistemic strategies. Chapter 2, “The dynamics of emergence,” reviews recent developments and debates in the physical, biological, and cognitive sciences, all of which seem to converge on the point that the world provides ample evidence of emergence, that it forms a level structure, and that the proper approach to the world should be based on a robust nonreductive materialist or “integrated pluralist” philosophy of science. As a result of this review of numerous scientific research programs I take it as a well-corroborated posit that the “emergentist epistemic strategies” of constructionism, heterarchy, and hierarchy are superior to the older and more extreme views of reduction and holism. Chapter 3, “The nature of hierarchical and heterarchical organization,” focuses on clarifying the meaning of “hierarchy” and “heterarchy,” the more robust as well as recent forms of emergentism. In this chapter the differences between hierarchical and heterarchical organization of phenomena are illuminated in a number of examples. I end by justifying my preference for the heterarchical approach, which I use to ground a metatheory of social structure in Parts IV and V. Chapter 4, “Some formal theses on hierarchy and heterarchy,” specifies in a more formal way the differences between the two robust emergentist strategies. A number of theses are posited detailing and codifying the characteristics of these two strategies. After concluding this part, the reader ought to form the impression that, of the five candidate strategies, three (constructionism, heterarchy, hierarchy) are admissible as progressive metatheoretical research programs

and, of these three, heterarchy is preferable on grounds of relative comparative merit.

In Part II we focus on the applications of the constructionist epistemic strategies to social phenomena in order to spell out what I call the constructionist or compositionist logics operative in the production of emergence. This strategy marks the first break with reductionism and, as argued in Chapter 2, is the preferred choice of many leading physicists and molecular biologists. In the domain of the social sciences, constructionism is represented by those research programs that begin to theorize the partly continuous, partly discontinuous emergence of social structure out of individual (intentional, rational, or other) actions and ensuing “systems of interaction.” Usually, the emphasis falls on discontinuities and the emergent paradoxical effects. In any case, phenomena are explored that are said to be beyond the intentions, understanding, or control of the participating individual actors; and, of course, the higher the level and the more complex the systems of interactions, the more pronounced are the discontinuities presumed to be and the more complex the structural products. We pursue this strategy in three chapters, initially discussing several forms of the radical reductionist program. Chapter 5, “Methodological individualism,” presents the archetypal versions of reductionism in the social sciences. Here we analytically demarcate four types of predicates (individual-, relational-, conventional/institutional-, and structural-) implicated and intertwined in the texture of human social phenomena. On this basis we critique the foundations and appraise the prospects of six forms of methodological individualism. Chapter 6, “Constructionism/compositionism: elementary notions,” introduces the constructionist views as they apply to the case at hand. Here we briefly discuss the exchange and network models as well as the game theoretical logic, focusing on the work of Raymond Boudon, Thomas Schelling, Mancur Olson, and Jon Elster. Chapter 7, “Complex systems of interaction,” is devoted to the further extension and elaboration of game-theoretical and other models to higher levels of structures. We look at “corporate” and “collective” actors, many-actor systems of interdependence, systems involving complex and compounded externalities, and more complex “entangled systems.”

Part III focuses on the Logics of hierarchy for reasons of symmetry. Here the emergence of structure is seen not as a byproduct of aggregated individual actions but as derived from quasi-local, semiglobal, and global characteristics or macrovariables, such as size, phase-separated aggregate interactions, the coupling of lower-level structures, and new mechanisms of structuration and their ensuing structural effects. Furthermore, individual action is conceived as parameterized by the se-

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miglobal or global characteristics of the structural systems, the latter said to have authoritatively superseded the former and to exert a downward influence over them. Chapter 8, “Hierarchy theory and postfunctional analysis,” is intended as the antipode of Chapter 5: Here we present an analytical summary of the tumultuous career of the various forms of “functionalism,” the backdrop for all “holist” versions of theory, and proceed to evaluate the prospects of holism on the basis of an extended articulation of changes that have taken place in the fields of physical chemistry, molecular biology, and ecosystem modeling. We then posit a “postfunctional” mode of analysis as the only viable form in the research program of former functionalists. Chapter 9, “The hierarchical theory of social structure,” explores a number of previous conceptualizations of social structure along hierarchical lines (Bunge, Hernes) and details the extent to which the “received view of Marxist theory” is an exemplary instance of a hierarchical structural theory.

Part IV deals with Heterarchical logics, which I personally favor. This is the most complex type and is situated midway between the constructionist and the hierarchical logics. Here I build on Hofstadter’s (1979) erudite, pathbreaking, analyses of heterarchical, tangled systems, placing emphasis on the *analytical* characteristics of the heterarchical model of social structure. Chapter 10, “Heterarchical thinking in social thought,” presents various theories of “structuration,” and attempts to go beyond the limits of the constructionist microstructuration programs (by introducing the dialectic between agency and structure). I also offer here my own basic views on the heterarchical organization of social structures as a positive heuristic of an ongoing research program on this subject. The ideas presented here are then further developed and applied in the next part. Chapter 11, “Neural networks as a model of structure,” by far the most speculative section in the book, discusses the very novel conception of “neural networks” as a possible advanced model of social structure. Various parallels between the neuronal/mental and individual/social discontinuous connections are surveyed and appraised.

Part V addresses issues relative to the Phenomenology of social structures in accordance with the basic canons of the “logic of heterarchy.” Here we offer a description of a matrix composed of structural types and structural levels and elaborate the relations obtaining not only between structures at a given level but, more importantly, between structures at adjacent levels; expectedly, these interlevel relations of structures are the more complex and difficult since, under the heterarchical canons, they are presumed to be entangled, not authoritatively subsumed under each other as in a hierarchy. Chapter 12, “Modalities and systems of interaction,” posits various modalities of interactions

implicated in the process of “emergence.” We review several relevant proposals and then discuss the varieties of types of systems of interaction, the micrologics animating them, and the structural effects emerging out of them. Chapter 13, “Heterarchical levels of social structure,” outlines a concrete description of upward heterarchical (entangled interlevel) structuration. We describe three levels of social structures: groupings, fields, and totalities. We then proceed to analyze the first two levels: We describe the distinct social structures populating them, establish the important intralevel as well as interlevel connections, and articulate the mode of their emergence. Chapter 14, “On structural totalities,” posits several detailed examples of structural totalities (such as “class structures” or “the world system”) and investigates the modes of their emergence and functioning, along heterarchical, not hierarchical or holist lines.

In Chapter 15, we reach some important conclusions, which we offer as recommendations to social theorists pursuing agendas relative to the study of social structures. We adduce certain preliminary results as guideposts for further development and we locate several issues in need of further clarification. Finally, we point out possible points of contestation and invite interested scholars to apply analytical scrutiny to these and to the rest of this work.

For reasons of proper closure we offer an Appendix and a Glossary. In the Appendix we inventory and briefly discuss numerous logics of structuration that need further elaboration. They are placed there in order to indicate their tentative nature as parts of an ongoing program of research into the character of such logics and their possible concatenations. I will focus on these logics in forthcoming work. The Glossary brings together brief explanations of philosophical and scientific terms. Readers will find the Glossary especially helpful for Part I. Words included in the Glossary appear in boldface in the text.

The reader should be advised that there are some rough waters in Chapters 2–4, 8, and 11. It may be sufficient, in the beginning, for one to focus on Chapter 1, then read Chapters 5–7, 9, 10, 12–14. Upon completion of these chapters one may then return to the more complicated “scientific” descriptions and arguments in the previously omitted chapters. In the end, I believe, it is important for understanding my argument that one cover the whole terrain.

In addressing this book to my professional colleagues in sociology and cognate disciplines, I do no more than offer my preliminary results as a starting point for appraisal and reevaluation of our thinking. I cherish the hope that it may be found useful to our fields in some meaningful way.

Part I

Metatheoretical considerations

Part I focuses on the recent developments in many scientific fields (physics, biochemistry, population ecology, neuroscience) where there has been a dramatic shift away from the dogmatic **reductionist** epistemic strategy and toward a dynamic and emergentist conceptualization of various kinds of phenomena along new – **constructionist**, heterarchical, and hierarchical – lines of thought. This informal introduction to current scientific issues and debates, prior to any consideration of the already available sociological approaches, will help us, I believe, to see the problem of social structure in a new light.

There are four chapters in this part and they address the following issues: the five basic **epistemic strategies** of reductionism, constructionism, **heterarchy**, **hierarchy**, and transcendence/**holism**, which provide a conceptual map within which subsequent discourses can be located (Chapter 1); the case against reductionism and in favor of emergence (Chapter 2); and the empirical (Chapter 3) and formal (Chapter 4) demarcation between the two higher forms of emergence, heterarchy and hierarchy.

As I stated in the introduction, the going here, especially in Chapter 2, may be unfamiliar for many readers, as it was for me when I started this research program. Because of our professional socialization most of us have built an aversion to “heavy” science, or have grown unaccustomed to its latest vocabularies and models. Yet, I have come to believe that the effort of investigating some of these models is very worthwhile. I would recommend to the wary colleague to first read this part quickly, and then proceed to the better known material of later chapters with a plan to return to this section for a second, more elaborate reading.

1 Epistemic strategies in contemporary science

One of the most puzzling issues among modern scientists and philosophers has been that of whether or not, for virtually all the domains of nature, higher levels of organization are determined – and therefore also explained – by lower levels of organization. Two obvious answers are available to this question informing two antithetical positions on the matter: (1) an epistemic belief in elementarism or microdeterminism holding that lower-level parts determine and explain the composition and behavior of higher-level wholes; or (2) an epistemic belief in holism and/or macrodeterminism, which asserts that higher level wholes are something distinct from the parts they incorporate and are, therefore, independent of them. Elementarism and holism, irreconcilable opponents, have been with us from the outset of philosophical inquiry. We saw them clash most recently when, in the 1930s and 1940s, the advancing armies of **logical positivists** and their allies attempted to enthrone elementarism, that is, behaviorism, **physicalism**, and **methodological individualism**, in the empires of science and philosophy. Today, in the **postpositivist** era, we still find ourselves entangled in and puzzled by the old dilemma – but now, at least, several new alternatives are open to us.

Epistemic strategies

Were one to complete a survey of contemporary science and philosophy of science, including the most recent and exciting work, one would discover five basic **epistemic strategies** that either have been already utilized in previous research or are currently proposed as more appropriate alternatives to previously-utilized strategies. I call these “epistemic strategies” with the understanding that they are, basically, *pragmatic* epistemic designs, rooted in provisional or permanent ontological commitments, and informing and guiding more specific methodological orientations. I believe that in actual scientific practice (but also in most of the less ethereal practices of philosophers) **ontological** and **epistemological** positions are intertwined and difficult to disentangle; the same is true of the relevant epistemological and **methodological** claims. In defense of these strategies, proponents claim that the orientation at hand is purely methodological; while at the same time stronger epistemological claims are allowed to surface for the

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purpose of augmenting the symbolic power of the given research program over its competitors and critics.¹ In many cases, therefore, this epistemic theorizing is a composite of interrelated ontological, epistemological, and methodological preferences and stratagems initializing a research agenda in philosophical discourse as well as in any local scientific practice.

We can call these five epistemic strategies:

- (1) the strategy of reduction (elementarism proper);
- (2) the strategy of construction or compositional emergence;
- (3) the strategy of heterarchy or heterarchical emergence;
- (4) the strategy of hierarchy or hierarchical emergence;
- (5) the strategy of systemic transcendence (holism proper).

We will start with a preliminary definition of these terms, before proceeding to their elucidation and the investigation of the dispositions and mechanisms they imply.

(1) We may define the strategy of reduction (**reductionism**) as adhering to a strict *microdeterminism*; that is, wholes are nothing more than their parts suitably combined to form a certain level of complexity and, thus, that higher levels of organization are determined and explained by their lower levels of organization, down to the most elementary level of quantum physics.

(2) In contrast, the strategy of construction or composition is rooted in a *partial microdeterminism*, but also pays significant attention to relational–interactional and contextual–ecological variables. That is, this strategy considers the higher levels of organization as products not merely of the aggregation or integration of lower level parts, but of the interaction of these parts and with the contextual–ecological “exigencies.” The result is a constructionist, weak emergence of novel forms and properties practically irreducible to their constituent parts.

(3) The strategy of heterarchy (moderate emergence), the newest and, admittedly, least developed, strategy, is defined as *underdetermination* of the macrostructure(s) by the given microparts and as semi-autonomous emergence of higher-level phenomena out of lower level phenomena. Therefore it is a strategy that supports a **nonreductive ma-**

¹ The notion that epistemic strategies compress ontological, epistemological, and methodological commitments into an overarching form of “strategic behavior” derives from Lakatos (1978) and Bourdieu (1977a, 1986b, 1988, 1990). There is a rhetoric of theory and research implicated in any epistemic strategy, because the latter is a form of argumentative discourse. A study of the texts and subtexts, say, of Elster would demonstrate this beyond any reasonable doubt (cf. 1985, 1986a, 1989, and in Roemer 1986). On my view, any research program incorporates many discursive apparatuses – conceptual, logical, pragmatically empirical, rhetorical, technical, inscriptive, and so on.