

**Chapter 1** 1  
**Naturalism and the Scientific Status** 2  
**of the Social Sciences** 3

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AQ1 The purpose of this paper is to characterize a dichotomous view of the current 5  
 situation in the sciences of man and show it to be fallacious. On the view to be 6  
 rejected, the sciences of man are undergoing the first serious attempt in history to 7  
 thoroughly naturalize their subject matter and thus to put an end to their separate 8  
 status. Progress has (on this view) been quite considerable in the disciplines in charge 9  
 of the individual, while in the social sciences the outcome of the process is moot: 10  
 the naturalistic social sciences are still in their infancy, and whether they will even- 11  
 tually engulf or at least profoundly transform the field of social science is unclear. 12  
 The dichotomous conception pits two camps against one another. On the one hand, 13  
 the advocates of the naturalistic social sciences maintain that they hold the key to 14  
 the long-awaited realization of the unity of science program and are set to put the 15  
 social sciences on equal footing with the natural sciences as we know them today. 16  
 On the other, the mainstream in social science is strongly opposed to the very idea 17  
 of naturalizing the field. The impartial observer is then asked to wait and see: ei- 18  
 ther the current attempts at naturalization succeed, and the goals of unified science 19  
 are attained; or they fail, in which case the prospect of developing a social science 20  
 which is truly scientific recedes in the distant future. 21

**1.1 Unity of Science, Yesterday and Today** 22

Unity of science, a program propounded by the Vienna Circle, under a label coined 23  
 by Otto Neurath, has had a curious posterity. On the one hand, it has been all but 24  
 rejected by the 'post-positivist' philosophers of science. Unity of science is seen as 25  
 part of the 'Legend',<sup>1</sup> a philosophers' rational reconstruction of science, a misplaced 26  
 attempt to force upon actual science a normative stance based on presuppositions, 27

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<sup>1</sup> As P. Kitcher puts it in [Kitcher \(1993\)](#).

both ontological and epistemic, which are no longer even remotely plausible. On the other hand, unity of science is conspicuously used as an overall justification for a number of research programs in a number of disciplines. It serves them as warrant and as value: because we have every reason to believe, according to proponents of such a program, that science will eventually reach unification, the success of our particular program has some *prima facie* plausibility as the only, or the winning, game in town; and because science *should* aim for unification, it is our duty to pursue this program, as long at least as it looks promising. This eschatological form of unitarianism is encountered not only in the sciences of man, but also in particle physics, in dynamical systems theory, in complexity theory, in logical modeling, in game theory. Of course, the unity to be achieved is not the same across the various programs. But the combination of putative support and recommendation provided by the idea of unification works in every case. There is in every case the implicit, or explicit reference to the positivists' ideal of unity of science, of which the present efforts are seen as a straightforward implementation.

I shall limit myself from now on to unification programs in the sciences of man. In order to bring to light the spurious character of their claim of perfect continuity with the Unity of Science program, it will help to introduce some terminology. Rather than 'monism', which can cause some misunderstanding, I will use '*unitarianism*' as a label for the doctrine, principle or thesis of the unity of science, and rather than 'bifurcationism', which is too limited, I will use '*regionalism*' to name the opposing view.

Unitarianism can be reductive, i.e. propose the in-principle reduction of all particular sciences to one single science; physics being the only plausible candidate, reductive unitarianism is often called physicalism. Note that physicalism is often defined as an ontological thesis, while unitarianism is at first an epistemic thesis. However, the reductive version of unitarianism seems to imply either agnosticism about the ontology, or adherence to ontological monism. There is another kind of unitarianism, which does not to my knowledge possess a canonical label, and which I will take the liberty therefore of calling *organic unitarianism*, according to which the various sciences can maintain their autonomy, while fated to eventually develop intelligible interconnections, rather than leaving forever some slack between them, so that science as a whole aims at the heterogeneous unity of a complex organism. Whether organic unitarianism is a stable position, which need not eventually collapse into reductive unitarianism is a genuine question which I will leave untouched.

Regionalism also comes in two flavors. According to *weak regionalism*, the sciences as we know them are *as a matter of fact* disjointed: there simply is no systematic interconnections between them, nor a method which can be relied on to eventually provide such links. *Strong regionalism* claims an in-principle separation of the sciences, whether based on some specific purported disconnections (as in the familiar arguments in favor of the separateness of the *Geistes-* and the *Naturwissenschaften*), on some burden-of-proof argument taking as premise the chaotic state of the scientific landscape, or on an inference from the disunity of nature.

## 1 Naturalism and the Scientific Status of the Social Sciences

One might wonder whether there is a real difference between weak regionalism and organic unitarianism. A definite answer would require a more precise characterization of the two positions. The weak unitarian might contemplate as a distant possibility some form of organic unification; on the other hand she might find such speculation on such poorly grasped ideas quite otiose. Suffice it here to point to two historical examples: Poincaré clearly defends an organic unitarianism, while Comte seems to go for weak regionalism (he quite explicitly rejects reductive unitarianism, in terms which seem to rule out the intermediate position which Poincaré would defend half a century later).<sup>2</sup>

Be that as it may, we are now in a position to contrast two very different dialectical situations. In the heyday of (neo) positivism, *reductive* unitarianism was pitted against regionalism, both weak and strong. In our postpositivist age, it is *organic* unitarianism which takes on *strong* regionalism. Moreover, both parties to the first debate appear to have granted an assumption which is rejected by many today.

When the Unity of science movement was launched, the issue was bifurcationism, the doctrine of an absolute separation between the so-called moral (*Geistes*) and natural sciences. What Neurath and his friends wanted to tear down is what they saw as a protective wall which the sciences of man had built around themselves to prevent the natural sciences (and more broadly the associated stringent form of critical rationality) from interfering:

We cannot make a division between 'natural science' and 'mental science'; even less can we make a division between 'natural philosophy' and a 'philosophy of mental science'.<sup>3</sup>

The physical sciences seemed to have achieved, against all odds (as they would have been assessed up to the late eighteenth century), what seemed at the time as a very high degree of unification. Further, the life sciences were not then in a position to suggest the possibility of, and the need for a weaker form of unitarianism. It was thus perfectly obvious to the Vienna Circle that the proper way of countering bifurcationism was to extend to the entire repertory of the sciences the demand which had seemed to yield such a positive outcome for the physical sciences.

The assumption which was common ground then was the unity of the natural sciences, a unity construed as reductive: although the reduction to physics had clearly not been completed, it was I think the majority view (or perhaps the default view, one which few cared to challenge) that it would eventually be shown to be achievable in principle. Symmetrically, the moral sciences were supposed to share a common crucial feature which functioned as a principle of unity. If necessary, exceptions could be dealt with by dividing a field (such as geography or anthropology) into a natural-scientific component and a social-scientific, historical, cultural or hermeneutic component.

<sup>2</sup> Compare e.g. (Comte 1848) and (Poincaré 1902).

<sup>3</sup> Neurath, *Sociology and physicalism*, 1931, repr. as chap. 6 in (Neurath 1983), p. 69.

The assumption of the unity of the natural sciences is now clearly rejected, or at least strongly questioned, by nearly everyone today.<sup>4</sup> If the natural sciences themselves display some form of disunity, the situation is no longer necessarily one in which two solid blocks of disciplines are to either be kept completely apart, or completely joined together. The loosening of the ties previously thought to tightly bond together the various natural sciences provides some slack which can allow some natural sciences to come closer to some sciences of man, without forcing the fusion of the entire two blocks. Thus a new direction opens up, which strict neo-naturalism (variously also called scientific naturalism or philosophical naturalism<sup>5</sup>) as well as dissenting, liberalized forms of contemporary naturalism,<sup>6</sup> are exploring: organic unitarianism, bordering, in the liberalized forms, on weak regionalism, with no other opponent than strong regionalism.

## 1.2 Neo-naturalist Unification

The professed goal of neo-naturalism is to bring the sciences of man at a distance of the natural sciences as a whole no greater than that which separates some of the natural sciences amongst themselves. In other words, the neo-naturalist aims at no more than to show that the topics of psychology, linguistics, sociology, anthropology and so forth stand to disciplines such as biology, logic, statistical physics, in a relation comparable to that between say biology, chemistry, geology and physics. This can be achieved by brute force, i.e. through a complete reconstruction of the sciences of man in a naturalistic framework; or in a more subtle way, by mooring them to the natural sciences by way of a dense network of empirical and conceptual links. A hybrid strategy might combine the two approaches: partial reconstruction, completed by specially fashioned new links between the old and the new corpus. Eventually, the natural (or naturalistic) social sciences would either directly absorb the social sciences as we know them, or force them into a partial reconceptualization making such an absorption possible.

How do the neo-naturalists propose to carry out such a program? They rely, first, on an attitude, a stance, and second, on certain recent research traditions. The naturalistic stance is, in its simplest and most stable form, a passion for looking, looking at ways things in the world *really* are, how they *really* work. In a more contemporary vocabulary, naturalists want scientific knowledge to be thoroughly evidence-based, rather than resting on conceptualizations and beliefs originating in commonsense, philosophical tradition, or armchair speculation. Neo-naturalists believe that the social sciences have remained, by and large, stuck in the prescientific stage characterized by over-reliance on commonsense or speculation, and want to

<sup>4</sup> See, e.g., Galison and Stump (1996), Kitcher (1993), Dupré (1993). E.O. Wilson (Wilson 1998) and friends of the 'consilience' view he defends are exceptions.

<sup>5</sup> See, e.g. Papineau (1993).

<sup>6</sup> See De Caro and Macarthur (2004).

## 1 Naturalism and the Scientific Status of the Social Sciences

deploy instead some research programs which have emerged over the last 50–70 145  
 years. These are the various cognitive sciences, evolutionary biology, suitably up- 146  
 dated and extended, and philosophy itself, transformed as a result of the naturalistic 147  
 turn ushered by Quine<sup>7</sup> and other ‘postpositivist’ thinkers. These three strands com- 148  
 bine into something like a cognitive-evolutionary ‘paradigm’, which has already 149  
 very much refashioned the field of study centered on the individual agent.<sup>8</sup> The 150  
 issue now is whether and to what extent it will reach into the social sciences proper. 151

Anthropology, economics, sociology, social psychology all now have a ‘cogni- 152  
 tive’ (or, in the case of economics, ‘behavioral’) wing, but these wings are at best 153  
 small shacks leaned against their respective mansions. The common thread running 154  
 through the research programs in the various cognitive/behavioral social sciences 155  
 is a simple idea: the individual human being is a complex entity whose behavior is 156  
 to be studied naturalistically, rather than modeled from first principles. No strong 157  
 methodological individualism need be presupposed: the mere fact that mainstream 158  
 theorizing in the social sciences is based on some assumptions, however minimal 159  
 and often implicit (such as the blank-slate ‘theory’ of the mind<sup>9</sup>), regarding the be- 160  
 havior of individuals, is enough to justify the naturalist’s demand. It may turn out 161  
 that some collective phenomena are insensitive to the details, or even to large-scale 162  
 features of individual behavior, but the burden of proof rests on the social scien- 163  
 tist. She cannot take as her starting point a blanket invariance hypothesis based on 164  
 nothing more than a holistic dogma. 165

But how is one supposed to form a correct representation of the individual? This 166  
 is where cognitive science and evolutionary biology are recruited, as well as philos- 167  
 ophy which, in true naturalistic fashion, is understood as working in tandem with 168  
 the relevant sciences, especially when new frontiers are being explored, which is 169  
 very much the case for cognition. However, in actual practice, most so-called cog- 170  
 nitive models of social phenomena make shallow use of concepts from cognitive 171  
 science, and invoke evolutionary theory in highly speculative form. There are as yet 172  
 not many research programs which combine deep results from cognitive science and 173  
 evolutionary biology to produce novel insights.<sup>10</sup> 174

Thus the ‘naturalistic social sciences’ are at present barely rising from limbo. 175  
 Optimists see these attempts as a highly significant beginning. But this view is far 176  
 from universally shared. In fact, there is widespread doubt, within the social sci- 177  
 ences, that the naturalistic approaches (even of the weak kind) can go much beyond 178  
 the restricted area in which they have some relevance. Moreover, many oppose the 179  
 prospect for reasons which are basically those advanced in favor of bifurcationism: 180  
 normativity, intentionality, interpretation, historicity or again free will, are the 181

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<sup>7</sup> Quine (1969).

<sup>8</sup> I do not mean to imply that naturalism has won the day in the sciences of the individual human being. What seems to me uncontroversial is that it has become a major force in those fields. The emphasis here is on the prospects for a similar naturalistic turn in the social sciences.

<sup>9</sup> See, e.g. Pinker (2002).

<sup>10</sup> Dan Sperber (1997) labels the first (most common) kind of work ‘weakly cognitive’ and the second ‘strongly cognitive’. See also his 2006.

familiar challenges which any naturalistic theory must meet, and they claim that the new cognitive-evolutionary paradigm is in no better position to do this than previous forms of naturalism. Of course, this is exactly what neo-naturalists deny, and a large majority of the efforts of naturalistic philosophers of mind is devoted to outlining possible solutions. Finally, it is often stressed by skeptics that cognitive science itself is threatened by deep conceptual problems, whose resolution even sympathetic philosophers of mind increasingly view as doubtful.

This is the context in which the question arises. Will the social sciences finally yield to the neo-naturalist approach and thus at long last earn their place in the realm of genuine scientific thought, or will they resist and thus remain unscientific? That, according to the neo-naturalist, is the issue. Her opponent sees it differently: the social sciences need not and should not heed the call of the cognitive sirens; they have already earned their scientific accreditation; to become natural science, they would need to lose their soul, to cease to be genuine social science.

This, I claim, is a false dichotomy. It will probably not be news to the informed philosopher of science; but I believe that within the social sciences and the cognitive sciences, many people, some philosophers included, are convinced that the issue as I have presented it is correctly posed. As Neil Levy puts it succinctly, "For many of its adherents, evolutionary psychology holds out the promise of bringing the study of humanity within the ambit of science."<sup>11</sup> The same can be said more broadly of many adherents of cognitive science, more particularly philosophers of mind.

### 1.3 The Forgotten Party: QFSS 203

To present the neo-naturalistic approaches in social science (briefly, NSS) as the first, one and only properly or strictly scientific player in the field is a mistake. From their nineteenth century beginnings, the social sciences have harbored a set of research programs which I propose to group together under the heading of *quantitative and formal social science* (QFSS). It includes a large part of economics, as well as the partly overlapping fields of decision theory, game theory, rational choice theory, political science and sociology. Formal models of emergence and interaction in populations of more or less sophisticated agents, as developed in artificial intelligence and artificial life, lay the foundations of a form of general theoretical sociology. And of course the social sciences have always heavily relied on quantitative methods. Social systems are now viewed as 'complex systems', which implies a commitment to an open-ended collection of methods which are all at least in part mathematical in nature.

The existence, and persistence, of QFSS completely changes the picture.

First, QFSS can reasonably claim to be far more important, in terms of results, manpower and resources, than NSS. It constitutes a considerably larger (strictly)

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<sup>11</sup> Levy (2004).

## 1 Naturalism and the Scientific Status of the Social Sciences

scientific enclave in the social sciences than NSS. The first and foremost mode of naturalization is by way of methods. 220 221

Second, QFSS is the 'official' representative, within social science, of natural science. The serious methodological controversies within SS pit the interpretative, constructivist and historicist currents against QFSS, not NSS, and the resulting dialectic sets the agenda for SS. 222 223 224 225

Third, and perhaps most importantly, QFSS is truly about the social realm, which is more than can be said, without further evidence, of NSS. Broadening the perspective, for a moment, to the sciences of man at large (the human and social sciences, or HSS), this is a point worth elaborating, for it is precisely this difference which explains the greater resistance of the mainstream to neo-naturalistic HSS. It is one thing to discover formal-mathematical structure in human affairs; quite another is to treat the sciences of man as a mere province of biology (to put it dramatically). Formalism may be limited in scope, or outright sterile (as the critics insist), at least it doesn't altogether pull the rug from under HSS's feet. For uncovering the ontology of the human order remains a daunting task which only HSS are competent to achieve. Quantitative social science, even buttressed by complexity theory, may perhaps predict how things will turn out, in favorable cases; they have nothing to say about *what it is* whose outcome is of interest. Compare: mathematicians may help meteorologists set up forecasting models; but only meteorologists can tell us what scientific ontology the study of weather and climate calls upon. The basic categories of HSS will never come out of complexity's hat: they have to be put there in the first place. 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242

The distinction is especially clear when the denizens of the task domain misbehave – in other words, when they fail to conform to their assigned role in the model. So if winds, currents, tides, clouds, etc. don't quite conform to their specifications in the model, only a meteorologist can fix the problem. This is of little import in the case of meteorology: mathematics is so deeply embedded in the natural sciences that nothing much hangs on the precise distribution of labor. When it comes to HSS however, it's a different matter. Humans tend to resist in all sorts of ways to externally imposed categories, and only the finest skills and the long experience of the social scientist can be of any help in preventing the modeling enterprise from going hopelessly off track. So while meteorology and say sociology or demography play the lead role in such junctures, with mathematics (or complex systems theory) retrograded to their traditional function of obedient toolbox, the kind of adjustment which the leading discipline needs to make is, in the case of meteorology, naturalistic by definition, in the case of sociology or demography, it is deemed to be of a deeply different nature: bifurcation all over again. 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257

Thus it appears that formal-quantitative, complexity-theory based approaches in HSS preserve, after all, the latter's specificities. By contrast, bio (neuro-cognitive-evolutionary) naturalism may seem to want to impose the one true scientific ontology to HSS. In other words, while formalism does not imply reductionism, let alone eliminativism, bio-naturalism may carry reductive and even eliminative implications. For should bio-naturalistic research programs eventually show (or be allowed 258 259 260 261 262 263

to falsely convince us) that we humans are ordinary biological creatures subject to both distal (evolutionary) and proximal (physiological and mechanical) causation which leave no room for any other type of fundamental determination, then indeed, or so the critics argue, the age-old images of man on which HSS are based would be discredited, and mainstream HSS would soon be displaced by biology, suitably extended.

Fourth, QFSS is unproblematically scientific in the strict sense, inasmuch as its strictly scientific character is based solely on its mathematical methodology. By contrast, NSS's (strict) scientific status is predicated on its naturalism, which in turn is incomplete or flawed, due to the uncertain status of the intentional or semantic (or more broadly normative) concepts which it constantly deploys. QFSS has its own criteria of validation and success, regarding both scientific status and relevance to social science, and these criteria do not rest on dubious claims regarding the proper extension of 'nature' or 'naturalistic methodology'.

These arguments in favor of QFSS are themselves not above dispute of course. But they are not without force either and they rather deeply refashion the problem situation. In a sense, the rivalry between QFSS and NSS is the latest episode in the longstanding dispute between the Platonists and the Mechanists, between those who view mathematics as the universal, unifying matrix and those who view mechanistic causal explanations as the connecting factor, as the 'glue' holding together the scientific worldview. It can also be viewed as a replica of the quake which shook analytic philosophy in the 1960s and the 1970s as its Young Turks rebelled against the established anti-psychologistic, anti-naturalistic stance recommended by Husserl, Frege and the logical positivists.<sup>12</sup>

But is it right to think of the relation between the two approaches as an instance of rivalry? This, I think, is the central question. It is viewed differently by the two parties. Within QFSS, it is fair to say that a majority is indifferent or hostile to NSS, siding quite naturally with mainstream social science within which it enjoys the status of a mostly welcome minority. But there is also a minority within this established minority which is well disposed towards NSS, for both strategic and conceptual reasons. The strategic reasons are a felt need to forge an alliance in order to resist what the 'minority-squared' senses as the rise of an intolerant version of interpretativist, constructivist and historicist social science, which rise in turn may be a reaction to the pretensions of NSS. The conceptual warrant for the alliance rests on two premises. One is the basic dual-aspect assumption of cognitive functionalism which allows, at the level of the individual mind, for both a formal and a mechanistic account, with mechanisms 'realizing' or 'implementing' functions which are fully characterized by their formal properties. The other is that collective phenomena can be accounted for by applying formal, quantitative or more broadly complex-theoretical methods to populations of individuals under the descriptions provided by cognitive science, with the possible help of evolutionary considerations.

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<sup>12</sup> See Kitcher (1992) for a detailed account of the 'return' of naturalism in philosophy, and Kusch (1995) for a historical account of the rise and triumph of anti-psychologism at the turn of the twentieth century.



## 1 Naturalism and the Scientific Status of the Social Sciences

Combining these approaches is by no means trivial, and judging from the ongoing 305  
 attempts it requires additional assumptions or schemata such as social cognition, 306  
 mind-reading, massive modularity, gene-culture co-evolution, niche construction, 307  
 AQ3 generative entrenchment, epidemiology etc.<sup>13</sup> 308

Within NSS, the situation is the reverse. In the cognitive-scientific community, 309  
 the mainstream view, which is still a majority, albeit an embattled one, is favorable 310  
 to QFSS, for the same conceptual reasons for which the minority within QFSS has 311  
 embraced NSS. What some regard as 'orthodoxy' in cognitive science, and which 312  
 certainly can claim historical precedence, holds that mechanisms implement com- 313  
 putations, which in turn constitute the appropriate level of description for cognitive 314  
 processes. Thus it is not only conceivable, but actually obligatory, to have or aim 315  
 for both formal characterizations and mechanical accounts of cognition. The ascent 316  
 to social phenomena requires a naturalistic basis in the form of the appropriate con- 317  
 ceptual equipment in the individual, supplemented, as we just saw, by the extra level 318  
 of complexity of collective phenomena. But an increasingly vocal minority within 319  
 NSS rejects the 'formalistic' approaches of historical cognitive science associated to 320  
 figures such as Turing, Simon, Chomsky, Marr, or Fodor, and tend to be suspicious 321  
 of QFSS. In this discussion, it should be said, the 'Q' and the 'F' components tend 322  
 to come apart: while formal accounts are in dispute, the quantitative dimension is 323  
 welcomed by both sides within NSS, as an indisputable reinforcement of the strictly 324  
 scientific methodology of the field. 325

The precise way in which NSS and FQSS would, in the fullness of time, and 326  
 provided they meet with continued success, complement one another is very much 327  
 of an open question. There is a continuum of hypotheses, ranging from complete 328  
 integration, as sketched above, to a theoretically much less ambitious, loose form 329  
 of complementarity, with NSS and FQSS each providing certain constraints and 330  
 heuristics to social science, without claiming to exhaust the field but helping it, 331  
 through gradual reconceptualizations, on the path to a never-completed unification. 332  
 Most current proposals belong to the latter type: they start from a formal account, 333  
 and submit some of its assumptions to empirical testing on individuals or groups 334  
 of agents, in the hope of making the initial model more realistic, or again in order to 335  
 arbitrate between rival accounts. This movement within the social sciences parallels, 336  
 and is buttressed on the new wave of experimental philosophy, which challenges 337  
 the exclusive reliance of traditional analytic philosophy on conceptual analysis, and 338  
 claims that we need to confront our assumptions about how people reason, what 339  
 they mean by the words they use, what their moral or epistemic standards really are, 340  
 etc., to the 'tribunal of experience'.<sup>14</sup> 341

<sup>13</sup> See Tooby and Cosmides (1992), Hirschfeld and Gelman (1994), Sperber (1996), Carruthers (2006), Richerson and Boyd (2005), Durham (1991), Aunger (2000), Wimsatt (2007), Sterelny (2003), Nichols and Stich (2003), Goldman (2008).

<sup>14</sup> See Knobe and Nichols (2008), Jackson (1998).

#### 1.4 A Return to Neurath? 342

To conclude, it may be worth returning briefly to the source. As we reminded ourselves at the beginning, Neurath is the one, within the Vienna Circle, who coined the phrase 'Unity of Science'. As has now been rediscovered<sup>15</sup> (nor was it an arduous task: it was enough to read some of his papers, which are quite explicit about it), the unity he was proposing as a reasonable demand had little to do with reductive unitarianism, nor even with organic unitarianism. His was a realistic vision of science as it actually proceeds (Neurath 'invented' descriptive philosophy of science several decades before post-positivists philosophers of science decided to renounce or tone down the normative attitude prevalent among the founders of the field).

One of Neurath's conclusions was that all the sciences except possibly fundamental physics make ineliminable use of 'hybrid concepts' (*Ballungen*) which have a component belonging to the formal apparel of the science under consideration, and other components foreign to it, belonging as they do to common parlance or to other, possibly higher-level disciplines:

Complex (messy) statements – '*Ballungen*' – are the basic material of the sciences.<sup>16</sup>

The impurity of concepts leads to an impurity of methods, making all speculations about eventual reduction otiose. This skeptical view was complemented by a rejection of the notion of science as an enterprise on its way to completion:

Pseudorationalism will time and again try to reach, in roundabout ways, the 'one real world' ('the one mass of statements distinguished by certain characteristics'), for example, by putting forward the doctrine of a perfection, perhaps 'infinitely far away' to which science gets closer and closer.<sup>17</sup>

Science as Neurath sees it is more like a series of lighting bolts in the dark, throwing a temporary light and moving on to another location, with few stable connections established between the partial views obtained at successive moments of scientific development.

But these views, which in retrospect seem to go against contemporary trends such as neo-naturalism, were also effectively deployed, as we reminded ourselves earlier, against bifurcationism, the Circle's avowed target. Neurath was after a knock-down argument against any justification of an 'apartheid' view of the 'society' of research programs. What he wanted to promote instead was a state which was neither apartheid nor unification under the banner of physics, but rather 'orchestration'<sup>18</sup>: research programs were somewhat like musicians who contributed to a harmonious, dynamic flux of understanding, explaining, forecasting and reforming.

<sup>15</sup> See Cartwright et al. (1996).

<sup>16</sup> Neurath (1935), repr. as chap 10 in Neurath (1983), p. 128.

<sup>17</sup> Neurath (1936), repr. as chap 11 in Neurath (1983), p. 137.

<sup>18</sup> Cf. the title of a 1946 paper: The orchestration of the sciences by the encyclopedism of logical empiricism, repr. as chap. 22 in Neurath (1983).

## 1 Naturalism and the Scientific Status of the Social Sciences

Perhaps 'orchestration' can still serve as an inspiring metaphor for the social sciences and more broadly the sciences of man, in an age where neo-naturalism brings to light solid empirical data and novel conceptual tools to a collection of research programs which are already partly governed by strictly scientific methodologies, yet retain elements which seem resistant to naturalization.

This cannot be the last word, for Neurath was elaborating his views in a world which has undergone immense changes. The history of ideas moves not in cycles, but in helices. This paper ends by merely stating the real challenge: Where in the helix do we stand at present?

AQ4 **References** 386

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- AQ1. Please check if this para can be set as abstract to this chapter.
- AQ2. Please provide email ID for corresponding author.
- AQ3. Hirschfeld and Gallistel (1994) in the footnote has been changed to Hirschfeld and Gelman (1994) as per the reference list. Please check.
- AQ4. Please provide text citation for the following references: Auyang (1998), Chomsky (2000), Dretske (1995), Fodor (1983), Kim (1998), Margolis and Lawrence (2003), Searle (1995), Sperber (2000), and Turing (1950).
- AQ5. Please update in press details and also provide text citation.
- AQ6. Please check the publisher location provided.
- AQ7. Please update the Ref. of Poincaré (1902).

Uncorrected Proof