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ORIGINAL PAPER

Federalism in science — complementarity *vs* perspectivism: Reply to Harré

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Regarding the question of the unity of science, two stable and one unstable positions have been held. Reductive unitarianism and regionalism are the stable positions. According to the first, defended among others by Poincaré and by some, though not all, members of the Vienna circle, and their American disciples such as Nagel, nature being one, scientific knowledge can in principle achieve, and should aim towards, a state of theoretical unity. According to the second, because nature is heterogeneous (being composed, as Dupré and others believe, of an indefinite number of unrelated patterns, or, as Cournot for example held, of different though somehow connected orders), science can at best, and should only aim to, construct regional representations. The unstable position seeks a middle ground, taking seriously, on the one hand, the strive, constitutive of modern science, to achieve unification, and the notable successes which this strategy has met, and, on the other hand, the no less notable failures of the strategy as well as the fragility of the reasons advanced in favor of the inevitability of its eventual triumph.

Rom Harré's paper is an inspiration to those who, like myself and my co-authors in the work referenced below, seek to secure a tolerable degree of stability for the intermediate position, which, taking after Auyang, I will label 'federalism', a suitably loose denomination.

In this brief comment I shall not seek to do justice to the many challenging ideas and arresting examples presented in the paper, and will merely attempt to bring in sharper contrast the two modes which, as I understand him, Harré sees as possible ways in which federalism is, or can be, achieved. I will also raise an issue regarding the source and destination of the more strongly non-reductionist form of federalism.

The first federalist mode, which I propose to call 'perspectival', appears, under various forms and names, in many accounts of the plurality of scientific disciplines. Some of the most familiar examples come from classical physics, as mentioned in the text: 'No one seriously doubts that gases are really swarms of molecules', and

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'It is possible to show how the molar properties of gases are the result of molecular properties of aggregates of components.' Mayr's positioning of evolutionary biology, seeking 'distal' explanations of biological phenomena, with respect to physiology which (together with other branches of biology continuous with it), aims for 'proximal' explanations, provides another well-known illustration (which does not fall under the micro–macro model, to which the problem of emergence is often unprofitably wedded). I remain neutral on the reduction/emergence issue, and consider examples such as these accordingly. My aim is to contrast this kind of situation with another, where the 'complementarity' mode of federalism seems to operate. Some caution is needed to avoid confusions stemming from terminological choices: Harré and some of his readers might want to consider these examples as falling squarely on the reduction side, and keep the emergence side for cases which I think of as forming complementarity pairs. The distinction I want to emphasize allows for non-reductive cases of perspectivity, although as we shall see it (obviously) disallows reductive cases of complementarity.

To characterize perspectival federalism, it is helpful to return to the root of the metaphor, visual perception. A coin seen from most angles and the same coin seen from the side afford different visual experiences. These experiences are in a sense incompatible: there is no qualitatively similar visual experience which somehow combines the two, because the very same visual experience cannot at the same time be blob-like and stick-like. The coin creates a 'visual field' (it shapes the light field in a certain way), which has a mathematical description independent of any viewpoint (in the sense of a vantage point defined in real space; of course, there is such a thing as the mathematical stance). Seeing (visually perceiving), on the other hand, includes as a 'grammatical' constraint the fact that it can only be done from a definite vantage point. So, regardless of the details of our neurophysiological apparatus, the effect of the (primary, intrinsic) 'visual field' created by the coin positioned in a certain location varies with the vantage point. This is easy to understand (because we 'know' about the perspectival nature of seeing; also congenitally blind children know this: it is presumably a 'hinge proposition' about seeing).

When this scheme is extended to the epistemic realm, it leads to the idea that the various sciences provide views of nature as seen from different vantage points. There is a 'thin' construal of the metaphor, where the particular ways in which the sciences construct their proprietary representations of nature is left unspecified. For this version of the scheme, an alternative, though related, presentation of the idea is Auyang's geometrical model: she proposes to think of the various sciences as providing local coordinate maps (in the sense of differential geometry) for a manifold, in this instance the objective world (Auyang, 1998: 74–75).

By contrast, a cognitive approach to science leads to a 'thick' interpretation, which draws on the similarities between vision and science as natural processes. One of the possible uses of the affordance idea is to help us focus on these similarities, *via* the case of everyday, ecological cognition.

But whether thin or thick, the perspectival scheme for federalism has a crucial feature which makes it the basis of a 'soft' kind of pluralism, one which minimizes the discomfort caused to our unitarian instincts. Given any two vantage points, there is a third one from which the two original ones can clearly be seen to be partial views of one determinate set-up (although what is revealed of the object from these original vantage points may no longer be clearly discernible from the third one). The existence of this third vantage point reveals the compatibility of the two original ones,

and the mind can in effect pretty effortlessly move back and forth between all three vantage points, so that, at least for a trained mind, the situation is very much like visual perception. Insofar as commonsense is comfortable, for whatever reason, with the perspectival phenomenology of vision, it can easily accommodate this perspectival pluralism, as an extension to the conceptual understanding of our 'folk theory', or as some would prefer to call it, of the 'language game' of visual perception. Just as the multiplicity of vantage points entails neither subjectivism nor relativism (the coin viewed from anything but its side is blob-like, and viewed from the side is stick-like, yet this is an entirely objective state of affairs, and it concerns one single, well-defined material entity, *viz* the coin), so with perspectival pluralism. One can thus have all of realism, objectivism, unity and non-reduction.

By contrast, the second mode of federalism offers a starker view, one less friendly to unitarianism, and to the natural ontological attitude. We need a reason to accept it, and the paper under discussion is mostly about those reasons, and how we can come to terms with them. Bohrian complementarity stands to this mode as visual perception stands to the previous one: it is the source of a metaphor. In quantum physics, a choice must be made at the outset, it is a binary choice and it is irreversible: once a certain experimental set-up has been applied, light is particle-like, or it is wave-like, but not both. There is no third vantage point from which both undulatory and corpuscular representations of the phenomenon are accessible, except perhaps in a very indirect sense to which I will come back in a short moment. The same goes for the complementary pairs cited by Harré, and possibly others: cognitive neuroscience and cognitive psychology, for example, may well turn out to be such a pair. There is no easy path joining the members of a complementary pair for the mind to follow: a sort of intellectual Gestalt shift is required, as many examples in Harré's paper illustrate. The main point of the paper, as I understand it, is to convince us that complementarity just is a fact of scientific life, which, once accepted (and to this end the author offers a couple of helpful mindframes: affordances and the task/tool metaphor), relieves the anguish caused by the emergence/reduction debate: *of course,* complex systems can sometimes give rise to emergence, but this is just *one* manifestation among many of a pervasive phenomenon, whose reality is beyond serious doubt. This, by the way, is the third vantage point from which the coexistence of two complementary representations can be intelligibly conceived: it plays on the metatheoretical (or metaphysical) plane the function filled by the same-level third vantage point in the perspectival scheme.

To conclude, I should like to make one remark, and offer some conjectures.

First, it is striking that the source of the analogy, in both federalist schemes, is very removed from the target. Visual perception is in more than one way *unlike* science or scientific inquiry. Bohr's (or de Broglie's) complementarity principle concerns the most refined and formalized branch of empirical science and is in that respect *quite unlike* the disciplines which Harré (or I) can think of as members of candidate pairs for complementarity. In fact, *commonsense* or phenomenological bodies of knowledge can be members of such pairs, while quantum complementarity is precisely the point where the paths of science and commonsense are commonly believed to part. This observation leads one to call for further exploration of the basis of the metaphors, or independent arguments in favor of the two schemes.

When does complementarity (in the metaphorical sense) seem to arise? My first conjecture is that crossing a normativity boundary is a *sufficient* condition for complementarity. Going from biology to psychology leads one from one form of normativity (the functioning organism and organs) to another (meanings); similarly with the move

from medecine to art, as from the *Catalogo* aria in *Don Giovanni* to Mozart's supputed Tourette; or from physics (normless) to physiology (endowed with the norm of metabolism); or from physiology to soccer…

The second conjecture is that complementary pairs give rise to a highly dissymetric relation, as in the standard micro–macro case, but of a much deeper metaphysical kind: one member plays the role of form, the other of matter, so that matter is 'recruited' to realize form. This is how I understand the task/tool metaphor: physics and physiology are the material basis of the game of soccer, which recruits the suitable forces and processes (and could have recruited others).

My final conjecture is that the cases we are interested in, from a scientific (and sometimes practical) point of view, are those in which complementarity comes with a (real or conjectured) connection. Those are the cases which motivate scientific and philosophical inquiry. Being a person and being a patient need to be connected somehow, regardless of how complementary they are. Equally for being conscious and having a certain neurobiological constitution. In fact, this is where push comes to shove. Life would be simpler if complementarity relieved us of the need to play both roles at once. It doesn't, but it does relieve us of the guilt of never being more than very moderately successful at it.

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