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# ONTOLOGICAL REDUCTION: A COMMENT ON LOMBARDI AND LABARCA

ABSTRACT. In a recent article in this journal (*Foundations of Chemistry*, 7 (2005), 125–148) Lombardi and Labarca call into question a thesis of ontological reduction to which several writers on reduction subscribe despite rejecting a thesis of epistemological reduction. Lombardi and Labarca advocate instead a pluralistic ontology inspired by Putnam's internal realism. I suggest that it is not necessary to go so far, and that a more critical view of the ontological reduction espoused by the authors they criticise circumvents the need to resort to their radical alternative.

## INTRODUCTION

In a recent contribution to the discussion of reduction in chemistry, Lombardi and Labarca (2005)[1] take up the issue of ontological reduction, which, following the usage of several contributors to this discussion, they distinguish from epistemological reduction. They argue that the current opposition towards reduction is entirely concerned with the latter, which leaves the question of the former open and raises a problem of the secondary status of chemistry. This they propose to address within a framework allowing "coexistence of different but equally objective theory-dependent ontologies" (p. 146) inspired by Putnam's internal realism. Context and contrasts suggest that the authors view these different ontologies as in some sense at odds with one another so that they cannot simply be amalgamated into one all-embracing ontology. This is a drastic and, many would agree, unpalatable remedy, which I would prefer to avoid with a different diagnosis.

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A question left open is presumably not one which has an obvious answer; it must be decided by additional considerations. But Lombardi and Labarca find, after examining a number of recent contributions to the debate, that "there seems to exist a broad consensus among philosophers of chemistry about the relationship between chemistry and physics: epistemological reduction must be rejected, but ontological reduction *cannot be denied*" (pp. 132–133; my emphasis). If I understand their position correctly, they accept the terms of this argument but question the "broad consensus". I agree that this consensus should be questioned, but I question the terms of the argument and would shift the burden of proof. I would emphasise that such an important conclusion should be based on a good argument, in the absence of which the issue remains open. Ontological reduction cannot reasonably be simply assumed. But it is not even clear how the thesis of ontological reduction should be formulated. I also have some worries about the term "epistemological reduction", which is where I will begin.

## WHAT ARE EPISTEMOLOGICAL AND ONTOLOGICAL REDUCTION?

Standard arguments against reduction dispute the reduction of one theory to another (e.g. thermodynamics to statistical mechanics), usually by questioning derivability, or the reduction of one or more properties to other properties (e.g. temperature to mean kinetic energy), usually by questioning the truth of an equivalence to the effect that all and only objects with the putatively reducible property have the other property. According to Lombardi and Labarca (p. 133), these are epistemological reductions because they deal with laws and concepts rather than regularities and entities. But if reduction of laws doesn't establish the reduction of regularities, what does? If this is part of the work supposedly accomplished by an ontological reduction, it should be shown how, perhaps by examples and a general schema. As matters stand, it is not clear what the distinction is. The choice of the term "concept" rather than "property", on the other hand, seems to beg the question.

The topic of properties raises philosophical bones of contention about universals, but it should be possible to state the points at issue here in a way which is neutral with respect to this general philosophical problem. The term "entity" is often used for what has properties or what predicates are true of, in which case it denotes something of a different ontological category. On this use, the ontological list should read "regularities, entities and properties", eliminating the contrast. If, on the other hand, it is used to cover universals as well as particulars, then it includes what is at issue when debating, say, the reduction of temperature to mean kinetic energy. The epistemological element concerns the support that may be given for believing reductions of these kinds, but the conclusions themselves are not epistemological.

The really important term, however, is "ontological reduction". How is this to be understood? Lombardi and Labarca say

> When ontological reduction of the chemical world is not questioned, the fundamental physical entities become the only "real" entities and all the chemical concepts not derivable from quantum mechanics lose their referring character. In other words, the physical reducing realm has ontological priority; chemical descriptions only refer to appearances or, at most, to secondary entities endowed with a merely derived existence. (p. 127)

Is this idea of second-class existence, in what the authors go on to describe as "an ontologically inferior level of reality", coherent? The authors chide Ramsey (p. 139) for insisting on just one level of reality. But I can't see that they establish the failings of this position.

The position has a long philosophical pedigree. The canonical expression to the idea in the recent tradition of analytic philosophy goes back to Russell's famous article on definite descriptions, where he questions any notion of different kinds of existence. Russell (1905) addressed the problem posed by expressions such as "the present king of France", which don't refer to anything, but nevertheless occur in meaningful sentences which therefore have a truth value. A similar problem arises with negative existential statements such as "Homer

doesn't exist'' (more colloquially, ''Homer was not an actual person'') which are true, but can't be understood to predicate existence of what the subject of the sentence refers to since it has no reference if the sentence is true. Russell derides as incomprehensible the idea that in the meaningful sentences in which these terms are used, they indicate things not enjoying full-blown existence but which merely subsist. It just isn't a solution to the problem to postulate a lesser notion of subsistence adequate to satisfy the referring function of the grammatical subject but not actually counting as existing. Russell proposed an elegant solution involving a contextual definition of the problematic expressions ascribing to the sentences where they occur a logical structure in which the original grammatical subject does not appear. But this is not the place to go into the technical details. Quine referred to this as a ''paradigm of philosophical analysis'', and went on to apply the thesis in his influential notion of ontological commitment. Grover Maxwell (1962) applied the idea in his influential critique of Nagel's attempt to ''dissolve'' the realism/instrumentalism dispute as a purely verbal issue involving different senses of ''real'' and ''exist''. And so the story goes on. Anyone taking on this position must have a very substantial argument.

Another sense of ontological reduction suggested in the last-quoted passage is elimination of existence altogether in favour of ''the only 'real' entities'' which belong to physics. Our authors say that ''chemical descriptions only refer to appearances''. But can reduction do this? Elimination occurs, surely, when a theory is overturned and abandoned in favour of a new one which dispenses with the entities in question. Caloric was eliminated with the development of thermodynamics, for example, when the idea of heat being preserved was overturned (Chang, 2003). But this is not reduction. Reduction preserves what it reduces. There may be some modification, as in the classic case of the reduction of Kepler's laws to Newton's. Here I'm thinking of how Duhem (1954, p. 193) tells the tale rather than Feyerabend (1962). Entities are sometimes said to be reduced to others when they are defined in terms of those other entities. Numbers are said to be reduced to sets, for example,

when number theory is reduced to set theory. A more familiar example may be Hamilton's definitions of complex numbers in terms of real numbers. According to Hamilton's definitions, a complex number $a+ib$ is a pair of real numbers, $\langle a,b\rangle$, for which addition and multiplication are defined by: $\langle a,b\rangle+\langle c,d\rangle=\langle a+c,\ b+d\rangle$ and $\langle a,b\rangle\cdot\langle c,d\rangle=\langle ac-bd,\ ad+bc\rangle$. Putting $i=\langle 0,1\rangle$ yields $\langle 0,1\rangle\cdot\langle 0,1\rangle=\langle -1,0\rangle$, which is less mystical than $i=\sqrt{-1}$. This is often presented as eliminating the mystique of imaginary numbers. But it certainly doesn't eliminate the imaginary numbers themselves. That would require a theory which doesn't allow the existence of solutions to equations such as $x^2+1=0$.

Speaking of mystique, Lombardi and Labarca hint at an argument for ontological reduction:

> although the properties of a chemical system are not deducible *a posteriori* from the properties of its physical components, *a priori* predictability cannot be denied without reintroducing a kind of unacceptable vitalism into science. (p. 132)

Again, in connection with the "broad consensus", the authors say: "to accept ontological emergence amounts to populating the ontology with dubious metaphysical entities whose existence is not guaranteed by science" (p. 133). This is the mystical scare story: any expansion of the physicist's ontology must amount to the addition of mystical, or dubious metaphysical, entities. This line of thought is familiar from the philosophy of biology, where reduction has been questioned along broadly the same general lines as in chemistry, and a threat of ontological extravagance has been thought to call for a notion of supervenience. Kincaid (1990, p. 591) acclaims the introduction of supervenience into the philosophy of biology as "the finishing blow to vitalism" (cf. also Sober 1985, pp. 49–50). But vitalism had been eliminated from biology on general methodological grounds as an inoperative principle long before supervenience came onto the scene, and flogging dead horses is a poor defence of anything. I'm not aware that vitalism has been an issue in modern chemistry, but the onus is certainly on those who would use this kind of argument to demonstrate the

mystical implications of the science from which ontological reduction would save us.

What is needed to make the thesis clear is an acceptable notion of ontological dependence, in terms of which the ontology of the reduced theory can be said to be dependent on that of the reducing theory, but not vice versa. Philosophers might think in terms of counterfactuals, along the lines of "if the reducing ontology didn't exist, then the reduced ontology wouldn't exist". But apart from the notorious problems of determining the truth conditions for such sentences – i.e. determining whether they are true or not – it is not clear that this would provide a sufficient condition anyway. To illustrate, in the classical debate on the nature of space, which is an ontological dispute, the relationist (Leibniz) is cast in the role of reductionist and the substantivalist (Newton) is antireductionist. The relationist clearly maintains the ontological dependence of spatial entities on material entities, and thus that if there were no bodies, there would be no space. The substantivalist is sometimes characterised as maintaining the contrary counterfactual: if there were no material bodies, there would still be space (cf. Lacey, 1970, p. 319). But this might be disputed. Perhaps the substantivalist thinks that although spatial ontology cannot be reduced to relations between material bodies, there would be no reason to think there is space in a universe where there are no bodies. But this would eliminate the contrast. Since Lombardi and Labarca don't make any such proposal, however, I won't pursue these speculations about how the thesis of ontological reductionism can be made clear but leave that to the proponents themselves. My intention was just to indicate the sort of thing that needs to be done.

## CONCLUSIONS

Any notion of ontological reduction implying either the second-rate, inferior existence of the reduced realm, or its total elimination, certainly can be denied. Contrary to what Lombardi and Labarca say (pp. 139–40), it could even be denied if what they call epistemological reduction – i.e. the reduction of laws

and properties – could be established, because according to the available account, it doesn't make good sense. Philosophers of chemistry are said to deny epistemological reduction but affirm ontological reduction, which our authors diagnose as presupposing externalism or metaphysical realism and prescribe internal realism as the only antidote. I've tried to suggest that it is not necessary to go so far; the issue can and should be nipped in the bud. For this reason I've not gone into their notion of internal realism. But if there is a problem of the synchronic analogue of theory change (p. 138), for example in relating micro- and macrorealms, I can't see that separating the realms into two different worlds will provide a solution. Above all, I've argued that the onus of proof lies squarely on the shoulders of the would-be ontological reductionist, who must first give a coherent account of what the thesis is, and secondly, give a convincing argument for it. Until then, there is no need for the non-reductionist to get excited.

## NOTES

1. All page references are to this article unless otherwise stated.

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