THE ENTANGLEMENT OF TRUTH-MAKERS

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The truth-maker thesis is usually taken to be an atomistic account of reality. As such it is vulnerable to arguments for more holistic accounts. To avoid unnecessary discussion of what we mean by holism I shall not, however, call this the Holism Problem, but rather the Entanglement Problem, after quantum entanglement. The basic idea is that we start with a truth which initially seems to have a fairly simple truth-maker, but on further examination we find that this putative truth-maker is entangled with others so that the true truth-maker threatens to become the whole of actuality, which is not quite what truth-maker theorists have in mind. Throughout this paper I shall concentrate on the purely physical because that is where the problem arises in an acute form.[1] In addition I shall, for simplicity, ignore any special truth-makers required for modal truths, including physically necessary truths as well as metaphysically necessary truths, counterfactuals and so on.

I begin by stating what I call the truth-grounding theory, which is a little weaker than a truth-making theory, and I argue that a truth-grounding theory must be, in a certain rather weak sense, be atomistic. Then I state a further metaphysical thesis, the Primacy of Individuals. After that I present the Entanglement Problem. We may ignore this problem if we rely upon Armstrong's theory of states of affairs and interpret it as endorsing the Primacy of Individuals. Otherwise whether or not a truth-grounding theory is tenable depends very much on other theories and their interpretation. I then argue that the Primacy of Individuals is open to a combination of a priori and a posteriori objections. I conclude with a truth-grounding theory which provides a way of living with a considerable amount of entanglement.

1. *Truth-grounding*

The truth-grounding thesis explicates Bigelow's dictum that truth supervenes on being. It describes a natural kind of entity K which *ground* all truths.

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[1] Perhaps God is an entity which is a constituent of all truth-makers. But that does not entangle those truth-makers with each other.

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There are, I submit, two individually necessary and jointly sufficient conditions for the Ks to ground all truths:

   (1) Necessarily if there are different truths then there are different Ks.[2]
       Or, equivalently: the existence of the Ks there are together with the non-existence of any other Ks entails all truths.
   (2) The contingent truths are directly explained by the Ks. More precisely: the existence of the Ks there are at together with the non-existence of any other Ks is explanatorily prior to the contingent truths, and directly so.[3]

The concept of explanatory priority may be explicated by saying that the truths are correctly explained only by explaining the existence of just what Ks there are, not vice versa. To illustrate the need for this condition of explanatory priority, consider the trivial theory of facts, according to which for any proposition p to say there is a fact that p is just another way of saying that p is true. In that case the existence of the fact that p is not explanatorily prior to the truth of p. And for that reason we should not call this trivial theory of facts either a truth-making or a truth-grounding theory.

The directness requirement is stipulated to exclude the case, and only the case, in which for some other natural kind, the Js, the existence of the Ks explains the existence of the Js which in turn explains the truths. Perhaps either a divine decree or, if that is not the same thing, the one fundamental law of nature entails all truths about physical events. Even so neither a divine decree not a law of nature could ground those truths, because the explanation proceeds via the existence of the entities which the divine decree or law of nature bring about. The directness requirement does not, however, exclude the case in which the Ks ground some truths which in turn explain others. For instance, less vague truths might explain more vague ones.

I shall stipulate that Xs will be said to *supervene* on Ys just in case the Ys there actually are, together with these being all the Ys there actually are, both entails *and* is directly explanatorily prior to those Xs which are not Ys.

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[2] My preference here is for semantic necessity. That requires that the entities be described in some canonical way. For example the description "Barry Smith's s favourite example of a truth-maker" is not canonical, but "the event of John kissing Mary" might well be. Notice also in this connection that although true identity statements such as "Hesperus is Phosphorus" are not semantically necessary they supervene of semantic necessity on the existence of things of the kind in question.

[3] Among the contingent truths are those asserting that various Ks exist and these are not explained by the existence of the Ks. In that case the truth and its grounds are too close for an explanation. So we have to allow these as an exception to (2). But if the class of Ks is too large than this exception trivialises the truth-grounding theory.

With this stipulation the two necessary conditions may be summarised thus: there is some natural kind K such that all truths supervene on the Ks.

For a truth-maker thesis we would require not just supervenience, but that for any truth p there is some entity of kind K whose existence entails p. This leads to well-known difficulties concerning truth-makers for universal generalisations and for negative truths, and to the discussion of the celebrated Porky the Pig Fact ("That's all, folks!"). In this paper I shall, however, be considering the weaker truth-grounding thesis.

A truth-grounding theory must be atomistic in the weak sense that the entities of kind K, on which all truths supervene, must have enough structure to explain these truths. Thus I reject the monist truth-grounding theory according to which there is just the one unstructured ultimately real entity, and all truths supervene on Its existence. I reject it because to explain all truths It must have some structure. The grounds for truth need not, however, be atomistic in the stronger sense of being many mutually independent entities.

In Armstrong's theory, states of affairs are the entities which ground truths. They are of the form $[Fa]$, $[Gab]$, or more generally $[Hab...]$ where F is monadic, G dyadic and H a polyadic universal, a, b etc are particulars, and the square brackets are a reminder that we are considering states of affairs composed of particulars and universals, not propositions composed of names and predicates. A more ambitious theory might be to propose only states of affairs of the form $@F$ or more generally $@H$ where $@H$ is the actuality of the universal H, and it is argued that $@H$ makes it true that H has an instance. So if $F*$ is a predicate corresponding to the universal F then $@F$ would be the unique truth-maker of $(\,x)F*x$, which, according to Armstrong would instead have any number of truth-makers $[Fa]$, $[Fb]$ etc.

Some structure, therefore, is required for the entities which ground truths, but the structure must not be in perfect correspondence with the truths being grounded. For instance suppose that all truths supervene upon subject/predicate truths stateable in a language-fragment L with various predicates $F*$, $G*$, $H*$ etc. If the truth-makers are of the form: the state of affairs that $F * a$, the state of affairs that $G * ab$ etc there is then no explanatory power in the proposed truth-makers for they mirror too closely the propositions they are said to make true. This is a standard objection to the Correspondence Theory, and I am taking it to be a serious one. This is not, however a problem for the Armstrongian states of affairs, $[Fa]$, $[Gab]$ etc as truth-makers or truth-grounds, where there is no requirement that there is a privileged language-fragment L with predicates in exact correspondence with universals.

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2. *Individuals*

The following definition is intended as an explication but as far as the argument goes it could be taken as a stipulation. Particulars of a given kind, as it might be rocks, or goats, are said to be *individuals* if:

(1) It is possible that there are several particulars of the kind with distinguishing characteristics; and

(2) Given any two of them with distinguishing characteristics A and B respectively then there are two distinct possibilities, one of which is actual, namely: (a) x's being A and y's being B; and (b) x's being B and y's being A; where x and y are the two things in question.

Here I stipulate that not merely monadic non-relational predicates count as general terms but so do monadic relational predicates if they are built up out of primitive monadic and polyadic predicates using logical constants such as "not", "and", "or", "there is", and "for all". Thus "loving some person" is a general term, but "loving Mary" is not.[4]

If (1) holds there is a truth of the form: $(\ x)(\ y)(Ax\&By)$. If (2) holds there is truth of the form $(Aa)\&(Bb)$ which entails $(\ x)(\ y)(Ax\&By)$, and such that it is contingently false that $(Ab)\&(Ba)$. That this is contingently false exclude "a" and "b" being descriptions which entail that a is A and b is B.

If (1) holds but not (2) then there is just the one possible way in which one member of the kind is an A and another is a B. I shall call particulars of that kind *pseudo-individuals*. Waves are good examples of pseudo-individuals. Human beings are widely taken to be individuals.

By the Primacy of Individuals I mean the thesis that if there are any pseudo-individuals truths about them supervene on truths about individuals. Thus the existence of water waves is compatible with an ontology of individuals because although water waves are pseudo-individuals truths about them supervene on truths about water molecules, which might be taken to be individuals.

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[4] In Loux's terminology I excluding "impure" predicates. See Michael Loux, "Kinds and the Dilemma of Individuation", *The Review of Metaphysics*, 27 (1974). See also D.M. Armstrong, *A Theory of Universals: Universals and Scientific Realism, Volume II*, Cambridge University Press: Cambridge, 1978:15.

Armstrongian states of affairs are of the form $[Fa]$, $[Gab]$ etc. Here a, b etc are particulars but it is not clear whether they are individuals or pseudo-individuals. On the one hand, that Armstrong holds it necessary to posit this-nesses suggests that he takes them to be individuals. On the other, his proposal that thisnesses may be identified with spatio-temporal locations suggests that particulars are pseudo-individuals.[5] For as Swinburne — himself no enemy of thisness — points out, there is something most peculiar about distinguishing two possible situations which differ only in the swapping of the locations, for instance it would seem that not even God could swap next Tuesday with next Friday (as opposed to merely swapping over the types of event occurring on the two days)[6]. And likewise with swapping two regions of space.

In any case we may offer two interpretations of Armstrong's account, on one of which the Primacy of Individuals holds and the a, b occurring in states of affairs are always individuals, and on the other in which they are sometimes pseudo-individuals not supervenient upon individuals.

3. *The Entanglement Problem*

To illustrate the Entanglement Problem we may consider Armstrongian states of affairs and suppose that these ground all truths. Let us suppose that universal F has at least two instances a and b, which are particulars of the same kind, and that they are distinguished only relationally. A hypothetical example might be a world of "eternal recurrence" in which the universe has a beginning but will always go through exactly similar cycles from Big Bang to Final Crunch. In that case many a universal has an infinity of instances distinguished only by the ordering of the cycles, as first, second third etc. Now consider $[Fa]$, $[Fb]$ etc where a, b etc are qualitatively identical particulars, say nuclear reactions, in the first and second cycles. If a and b are genuine individuals then these are distinct states of affairs. If, however, a and b are pseudo-individuals then a is necessarily in the first cycle and b is necessarily in the second. But being in the first cycle is something with a moderately

[5] Thus he writes: "...the concepts of particularity [ie thisness] and total position cannot be identical. But ... particularity may *in fact* be identical with total position", *A Theory of Universals: Universals and Scientific Realism, Volume II*:4.

[6] Richard Swinburne, "Thisness", *Australasian Journal of Philosophy*, 73 (1995): 389–400.

complicated analysis, involving Big Bangs and Final Crunches. This illustrates how if pseudo-individuals are distinguished relationally then truth-makers concerning them involve other particulars, perhaps even of quite different kinds. There is no problem, however, if the particulars are individuals, for then it was possible for a to have been in the 56th cycle, say, so $[Fa]$ is nothing to do with the first cycle.

Entanglement occurs even more obviously if we adopt the more ambitious account of truth-grounds as being of the form $@F$. For then instead of $[Fa]$ we have $@(F\&A)$ where A is a conjunction of universals such that a is the unique instance of A. And this conjunction will include the rather complicated universal *being in the first cycle*.

So far we have been considering examples which violate only the strongest and least plausible version of the Identity of Indiscernibles, that in which it is claimed that necessarily there are no two individuals sharing the very same non-relational properties. If we allow individuals sharing the same relational characteristics then we could consider an "eternal recurrence" without beginning or end. Or we could consider a universe with perfect symmetry. In that case if a, b etc are pseudo-individuals there can be no distinct states of affairs $[Fa]$, $[Fb]$ etc. To provide enough states of affairs to explain all truths we are then forced to introduce one of the form $@F_n$, where F_n is the complex *universal having at least n instances of F*. This is itself an entanglement.

If the Primacy of Individuals holds then we may assume that all states of affairs are of the form $[Fa]$, $[Gab]$ etc where the particulars a, b etc are individuals. If, however, the Primacy of Individuals fails then, as the above examples show, there is a *threat* of entanglement. This threat will not eventuate if, for instance, basic (ie non-supervenient) pseudo-individuals are distinguishable using non-relational properties. Suppose, however that the best scientific theory can reasonably be interpreted as one in which the basic physical particulars are all points in spacetime and these are pseudo-individuals. Now we should not distinguish the points by means of what is happening at them, for we may envisage a possible situation in which the events happen at different points. So we should distinguish points by their relations with other points. We could restrict the points used to characterise a given point to its near neighbours. But even in that case in order to distinguish the neighbours we have to consider neighbours of neighbours etc. So, it appears, there is no plausible end to entanglement short of the whole of spacetime. Hence if we are to avoid ad hoc restrictions we will be forced to assert that all truths supervene on the one actual physical item, say the instantiation of a complicated structural property by the whole of actual spacetime. At least that is the *threat*. And the threat leads, in turn, to a dilemma. On the one hand, if that vast state of affairs has too complicated a structure, then we have not explained truths by appealing to it, for it is as complicated as those

truths. On the other hand if we insist that it is just an unstructured blob then, likewise we have no explanation.

There are three responses to the Threat of Entanglement, and the associated dilemma: adhering to the Primacy of Individuals; arguing that the correct physical theory does not result in (much) entanglement; or living with entanglement but showing that the resulting vast entities which ground truths are neither lacking in structure nor too complicated. These three responses will be the topics of the remaining three sections of this paper.

4. *Rejecting the Primacy of Individuals*

The Primacy of Individuals is intuitively appealing, and its rejection is therefore a sceptical thesis. But it is a scepticism which is, I say, warranted. First we may argue in an a priori way by asking how we could come to know the Primacy of Individuals? One answer might be that we just do have much knowledge of necessary truths and this is merely one example. Other examples would include mathematical and moral knowledge. That would be perfectly acceptable except that there is a much better explanation of our tendency to believe in the Primacy of Individuals. It is based upon common sense concerning the people and objects around us. Let us grant that neither the manifest relations nor the manifest properties serve to distinguish the manifest particulars. At this common sense level any essential manifest properties are essential to all members of a kind and so are not distinguishing, and the accidental ones do not distinguish either because the particulars could lose them. Now it is characteristic of Aristotelian, Scholastic and Neo-scholastic metaphysics to extrapolate from the manifest and make knowledge-claims accordingly. Hence, I say, the best explanation of many of our metaphysical intuitions is not that we have a special faculty for a priori knowledge, but that we are implicit scholastics. And such Scholasticism is itself based upon a natural but, I hold, mistaken Aristotelian epistemology, according to which once you have seen some examples of a natural kind you are then in a position to know universal truths about that kind. Assuming we do not accept extrapolations from the manifest as reliable it follows that many of our metaphysical intuitions are undermined, including the Primacy of Individuals.

There is, in addition, a well-known argument from quantum statistics[7]. Putting some technical details to one side, it is as if we found that in the tosses of two coins the three possibilities (both heads, both tails, one head

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[7] See Chapter Two of Paul Teller, *An Interpretive Introduction to Quantum Field Theory*, Princeton University Press: Princeton, 1995.

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one tail) were equally likely instead of, as expected, having chances 25%, 25% and 50% respectively. The best explanation for this is that there are indeed only the three possibilities not four as we would expect, where the four would have been: both heads, both tails, a heads and b tails, and b heads and a tails. Hence the "coins", that is the particles, are pseudo-individuals. This argument is not intended as conclusive. It is just that an assignment of equal probabilities is more plausible than an unequal assignment.

The argument from quantum statistics does not depend on how we interpret quantum mechanics provided we grant that particles exist in some form or other. But it is worth noting that the argument might be extended to show that particles of a given kind are not merely pseudo-individuals but totally indistinguishable. As was argued above this also leads to entanglement. But in fact the extension of the argument is not persuasive. For it might be that we would only have totally indistinguishable particles in a highly idealised situation and that in actuality particles can be distinguished relationally or even by very slight variations in their quantitative properties, such as mass. In that case the quantum statistics are explained by arguing that the actual statistics will *approximate* those which would hold in the idealised situation. Hence we have some empirical evidence not that the particles are indistinguishable, so much as that they approximate an ideal state in which they are indistinguishable pseudo-individuals. But we would not even have an approximation to this ideal case if the particles were actually individuals.

That the particles are pseudo-individuals does not automatically force us to reject the Primacy of Individuals, for water waves are pseudo-individuals too. Yet the argument used does provide a case against the Primacy of Individuals. For although water waves are pseudo-individuals they do not exhibit weird quantum statistical effects. That is not surprising. For the plausibility of assigning equal probabilities applies at the micro level. Suppose a certain macroscopic state can occur in n ways and another can occur in m ways then we would be surprised to discover them to be equally frequent but not surprised to discover them to occur in ratio roughly n to m. Hence the quantum statistics are best explained by assuming not merely that the particles are pseudo-individuals but that any more fundamental entities are as well. Hence it stills provide a case against the Primacy of Individuals even if we grant that current nuclear physics is not the final theory.

5. *Can particulars be distinguished non-relationally?*

The definition of an individual given above was somewhat narrow. For many might call particulars individuals if they are distinguished by non-relational predicates even if on the above definition they would be pseudo-individuals. In any case, an ontology of pseudo-individuals distinguished

non-relationally will serve as well as an ontology of individuals if we want to resist entanglement. Although current theories insist that electrons all have precisely the same mass and charge it could perhaps turn out that they vary slightly in mass and that there are only finitely many of them. In that case we could hypothesise that no two are exactly similar. Although this shows how entanglement might be avoided even given an ontology of pseudo-individuals, it illustrates one of the difficulties with an ontology of pseudo-individuals distinguished non-relationally. For such an ontology requires a speculative physics which has no empirical support and is contrary to the best current theories.

6. *Holistic truth-makers*

I have described the Entanglement Problem as a threat to the truth-grounding thesis rather than an objection, because even if we reject the Primacy of Individuals it will be a matter of science and its interpretation whether or not the problem turns out to be a serious objection. But suppose we have to grant the entanglement of states of affairs or of whatever else grounds the truth. Should we then abandon a truth-grounding theory? Not necessarily. At each point of spacetime what is *past* is contained in the backward light cone. And no matter how entangled truth-grounds get we may assume that that which is true of a spacetime point or region x requires for its truth nothing more than the portion of reality in the backward light cone from x. So we may hypothesise that the truth-grounds are the backward-light-cone-shaped portions of universe. Call them the *occupied cones* for short.

Are the occupied cones adequate as the truth-grounds? Any truth about what happens at one, many or even all finite regions will supervene on the occupied cones. For some cone would have to be different if that truth were to be different. And the occupied cones being as they are directly explains these truths just as well as the finite regions (large or small) and their occupants would. To be sure physically and metaphysically necessary truths might require special truth grounds, but we are ignoring them.

Against this it could be urged that positing the occupied cones as the truth-grounds is no better than positing the whole of space-time and *its* occupants as the one and only truth-ground (for physically contingent truths). Now it is not easy to say what is wrong with positing the whole of space-time and *its* occupants as the one and only truth-ground, but in any case I reply that, no, the occupied cones are as good grounds for truth as would a larger class of occupied regions be, one which included arbitrarily small regions. For given any small finite region R we may enclose it in the region contained in one cone U and disjoint from a four cones V, W, X and Y. So we can explain

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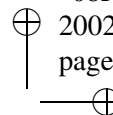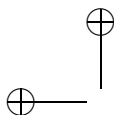
what is going on in R by saying what is going on in U but not going on in V, W, X, and Y.[8]

Perhaps, however, the thought is that more recognition of structure is required in the account of the grounds of truth. I have two ways of handling this objection. The first, which is highly conjectural, is that the ultimate physics might well be one in which the only structure required is the part/whole relation between cones, corresponding as it does to the before/after relation between the vertices.[9] This would be a version of (discrete) geometrodynamics in which there are no occupants. The cones are all there the physical things there are.

Supposing ultimate physics is not quite so simple, then it might well be a field theory. In that case we could consider the grounds for truth to be not the cones in abstraction from their properties but (intrinsically) propertied cones, just as "This cat weighs two kilo's" could be thought of as made true by the cat, with of course its intrinsic properties. Whether such an account could be developed would depend on whether a field theory is true and what sort of field theory it is. But there is at least the epistemic possibility that the cones could be taken as the grounds for all physically contingent truths.[10]

Conclusion

A threat is not an objection. Nonetheless the Entanglement Problem should be put on the truth-making curriculum. If ultimate physics goes one way the threat might evaporate. Or we might be able to live with it taking cones as truth-grounds. Or it might undermine the whole truth-maker project.

[8] Take a sphere and inscribe in it a regular tetrahedron. Next consider the four circles in which the four faces of the tetrahedron are inscribed. Then these four circles are great circles of four spheres which jointly contain the original sphere but are of smaller diameter. Now consider the cones in space-time which intersect a hyperplane in these five spheres. Because the diameters of the four spheres are smaller so are the distances from their vertices to the hyperplane. So there is a region of space-time of finite size included in the cone defined by the original sphere and excluding the four others. By expanding or contracting as required we can make this region smaller or larger.

[9] To fix the structure of space-time we require not merely the before/after relation but also volumes of regions. If space-time is discrete volumes can be taken as the cardinality of thye points in a region.

[10] The properties of the cones would have to correspond to the integrals of the field-strengths at points. Hawking's account in which the universe has only existed for a finite time and began with a 4D space smoothly joined to the subsequent 4D space-time would be one in which integrals of fields over cones would be finite.