Logic and Physicalism

Neil Tennant and Frank Jackson

Neil Tennant

1 Introduction

Frank Jackson sets out, in his paper 'Finding the Mind in the Natural World', to show that "only by doing some conceptual analysis can materialists find a place for the mind in their naturalistic picture of the world." To do this he needs a formulation of materialism as a supervenience thesis. The supervenience thesis Jackson favours is his:

(III) Any world that is a *minimal* physical duplicate of our world is a duplicate *simpliciter* of our world.

Jackson then makes two important entailment claims, backed by argument:

(A) Materialism entails (III).

(B) (III) entails that the physical story about our world entails the psychological story about our world.

By transitivity, then, if materialism were true then the physical story would tell it all. Finally, he argues for what I shall call his *a prioricity thesis*:

(C) The materialist is committed to there being an *a priori* story to tell about how the physical way things are makes true the psychological way things are.

(B) is an arresting claim. It is rejected by many writers on materialism, supervenience and reductionism. The orthodox view is that materialism, explicated as some form of supervenience claim, does *not* entail reductionism. That is, it does not entail any claim to the effect that the mental story can be obtained from the physical story by entailment. (It does not matter whether the entailment is direct, or mediated by appropriate identifications and definitions.)

I disagree with each of (A), (B) and (C). My aim here is to set out criticisms of the arguments that Jackson gives in support of each of these false claims.

In summary, Jackson's aim is to establish the following entailments (A), (B) and (C):

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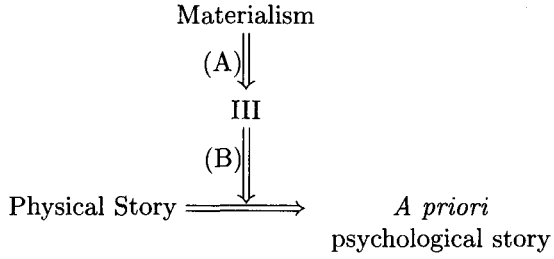


I shall show that (A) fails. Then I shall show that even if (A) holds, (B) fails. Finally, I shall show that even if (B) holds, (C) fails.

2 The Failure of (A)

A minimal physical duplicate of our world would be obtained by putting into it just those physical features of our world, and nothing more. Jackson illustrates this idea by appeal to a recipe for making scones:

> A minimal physical duplicate of our world is what you would get if you used the physical nature of our world (including of course its physical laws) as a recipe... for making a world.

Note, however, that Jackson can't be intending the phrase "for making a world" to cover the world in all its possibly *non*-physical respects as well as its physical respects. For on *that* wide a reading a world that was physically just like ours, but in which all creatures were zombies, would (according to (III)) be a duplicate *simpliciter* of our world. Hence all the creatures in our world would be zombies. But materialism, properly conceived, cannot be committed to *that*. Thus Jackson's elucidation of (physical world)-recipes should read:

> A minimal physical duplicate of our world is what you would get if you used the physical nature of our world (including of course its physical laws) as a recipe... for making a world *in its physical respects.*

We shall consider first an example showing that the converse of (A) fails. Imagine a world, which I shall call World, in which there is just one physical thing, a rock. It has no mental life. World also contains exactly one *non*-physical thing: a disembodied philosophical intelligence, which happens to be pondering the truth, in World, of the thesis of materialism (as it concerns World). If this philosophical intelligence were to take Jackson's line, it would think that materialism about World entails:

(III$_{\text{World}}$) Any world that is a *minimal* physical duplicate of World is a duplicate *simpliciter* of World.

Consider a minimal physical duplicate of World, namely Otherworld. Otherworld contains exactly one rock, just like the one in World. That, after all, is all that the *physical* World-recipe calls for. But the truth of ($\text{III}_{\text{World}}$) requires that Otherworld should be a duplicate *simpliciter* of World. Hence Otherworld also contains a disembodied philosophical intelligence, which is *non*-physical. Provided only that all worlds that were minimal physical duplicates of World were to contain such non-physical disembodied philosophical intelligences, the truth of ($\text{III}_{\text{World}}$) would be sustained. But, in the nature of these cases imagined while yet sustaining ($\text{III}_{\text{World}}$), materialism would be dramatically false. For a materialist, there could be no such thing as a disembodied philosophical intelligence.

We have shown that the *converse* of (A) above is false. ($\text{III}_{\text{World}}$) could be true in such a way as to falsify materialism. But (A) itself, Jackson would say, is still true: materialism about World entails ($\text{III}_{\text{World}}$).

Not, unfortunately, so. To see this, we shall presently vary the thought experiment slightly. But first, let me explain what I mean by the *laws of epiphenomenal emergence* for a given world. These are the laws that tell us what non-physical, epiphenomenal traits arise, within that world, out of the physical bases within it. The emergent traits are epiphenomenal in that they do not "feed back" causally into the *physical* happenings within the world in question.

Here now is the slightly varied thought experiment promised. World is the world with one rock, as before. The rock has no mental life. But that is *all* that there is in World. So World has no non-physical things in it. The minimal physical duplicate Otherworld of World contains the rock, and *nothing else*; but the rock, in Otherworld, *does* have a mental life. Let it be ever so spasmodic: just once, let us say, it runs through Descartes' *cogito ergo sum*. (Do not ask *how we would know this*; one is free, by the rules of this game, to stipulate that this, metaphysically, is how things actually *are* in the world Otherworld). The laws of epiphenomenal emergence in Otherworld are different, then, from those in World. So we have the minimal physical duplicate Otherworld of World *not* being a duplicate *simpliciter* of World, because in World, but not in Otherworld, the rock has no mental life.

World may be dull, but it is no embarrassment to the materialist. Otherworld is a little more exciting, *but still need not be an embarrassment to the materialist*! Why? Well, for the materialist, all that's important is that the physical should determine the non-physical, in the sense that any difference in the non-physical (such as the mental) facts would have to be subtended by some difference in the physical facts. So if, say, the rock in Otherworld were running through the ontological argument rather than the *cogito*, this would be because of some physical difference in the rock: it was made of quartz, say, instead of granite.[1] All that is important for the

[1]Note that it is no difficulty for my argument that this would make Otherworld an inexact physical duplicate of World. I can settle for its being impossible for the rock in World to be running through any philosophical argument but the *cogito*. Its being made

materialist is that, once the physical facts are in, then all the non-physical (i.e. mental) facts are fixed. It's the rock's being made of granite that would make it the case that it would be the *cogito* that it ran through; and it's the rock's being made of quartz that would make it the case that it would be the ontological argument that it ran through. Do not ask me why; that's just how it happens to be. (Remember, I get to make up these worlds; and I'm a materialist in doing so.)

The upshot is: materialism can happily countenance the failure of (III). Therefore materialism does not entail (III), contrary to what Jackson claims. (A) is false.

If the worlds with the rocks are too far-fetched for my philosophical audience, let me make the same case with a pair of worlds nearer to home: one as close as one can get, the other not too many Lewisons away.[2] World is the actual world. Otherworld is a minimal physical duplicate of World. That is, Otherworld contains the same (sorts of) physical things, distributed the same way through space and time, as World contains, and also has the same physical laws as World. Consistently with this requirement of minimal physical duplication, however, I stipulate that Otherworld has different laws of epiphenomenal emergence from World. The laws of epiphenomenal emergence in Otherworld make it the case that the Doppelgänger, in Otherworld, of Jack Smart in World, has telepathic, empathetic insight into what it is like to be a cricket. This insight is into precisely those aspects of cricket-being that manifest themselves anyway in crickets' observable behaviour. Thus Doppelgänger-Jack Smart's physical dealings with crickets are, in Otherworld, just as they are in World.

So we have a minimal physical duplicate Otherworld of the actual world World, but Otherworld is not a duplicate *simpliciter* of World, because in World Jack Smart has no telepathic cricket-empathy. That is, (III) is false. If Jackson were right about materialism entailing (III), then our thought experiment would have refuted materialism.

But this, the materialist would say, cannot be; it is all a little too swift. Swift it is indeed, but only by courtesy of Jackson's claim that materialism entails (III)! Better to hang on to materialism, I would say, and regard as fishy the alleged entailment taking one from materialism to (III).

For the materialist *about World* need not be at all put out by the unusual goings-on (by World's standards) in *Otherworld.* And the materialist about *Otherworld* need not be at all put out by Doppelgänger-Jack Smart's cricket-empathy within Otherworld. It still supervenes on the physical happenings within Otherworld! – or so she could claim. If that empathy were different, it would have to be because of some difference in the physical nature of Otherworld. ("No empathy-change without some physical change" is how the supervenience slogan would specialize to the case at

of granite still fixes that *that* is what it's thinking.

[2]The Lewison: the basic unit for measuring distances between possible worlds.

hand.) If Doppelgänger-Jack Smart empathized with a given cricket some way other than the way he actually does in Otherworld, this could only be because his neurological firings, or those of the cricket, were in some respect different from the way they actually are in Otherworld. I am maintaining materialism-via-supervenience; the difference is just that I don't understand supervenience to be captured by Jackson's (III).

Jackson was right to look to some form of supervenience claim to capture the essence of the thesis of materialism. But (III) is the wrong sort of supervenience claim to plump for. (III) is far too strong as an explication of materialism in possible-worlds terminology. (III) can be counterexemplified without violation to one's materialist convictions, properly conceived. Hence (III) is not entailed by materialism, properly conceived. And we saw earlier that (III) does not entail materialism, properly conceived. (III) and materialism are at logical cross-purposes. (III) is neither necessary nor sufficient for materialism, properly conceived.

3 The failure of (B)

We have seen, then, that Jackson's entailment claim (A) is false. I proceed now to his entailment claim (B). Jackson endorses a "straightforward and familiar argument" which purports to show that (III) entails that "the psychological story about our world is entailed by the physical story about our world". With no misrepresentation of its essential structure, but with a little extra detail supplied, Jackson's argument is as follows:

> Let Δ be the statement which tells the true physical story about our world.
> Let Π be any true statement entirely about the psychological nature of our world.
> Let W be an arbitrary world at which Δ is true.
> Then W is a minimal physical duplicate of our world.
> By (III), W is a duplicate *simpliciter* of our world.
> Hence W is a psychological duplicate of our world.
> Thus Π is true in W.
> But W was arbitrary. Hence any world making Δ true makes Π true also. That is, Δ entails Π.

Unfortunately, this argument can be faulted at two of its steps. One of the faults can be corrected; the other cannot. First, we have no guarantee that there is a unique sentence Δ that tells the full physical story about our world. The full physical story may not be finitely axiomatizable. Suppose, however, that we get round this objection by appealing instead to some (possibly infinite) *theory* Q instead of a single sentence Δ. The corrected argument would then read:

> Let Q be the theory which tells the true physical story about our world.

Let Π be any true statement entirely about the psychological nature of our world.
Let W be an arbitrary world at which Q is true.
Then W is a minimal physical duplicate of our world.
By (III), W is a duplicate *simpliciter* of our world.
Hence W is a psychological duplicate of our world.
Thus Π is true in W.
But W was arbitrary. Hence any world making Q true makes Π true also. That is, Q entails Π.

This argument, however, is still defective. The fallacious step is the move

W is an arbitrary world at which Q is true;
So, W is a minimal physical duplicate of our world.

The reason why this is defective is that the theory Q need not be *categorical*. That is, Q might have distinct non-isomorphic models, even of the same cardinality. Our world may be but one among many distinct, non-isomorphic models of Q. So another of them, chosen as W, need not be a minimal physical duplicate of our world. This objection is fatal to the argument in its present form, and I do not see how to correct it.

Jackson is therefore deprived of his so-called "entry by entailment" thesis (B). It follows that his subsequent efforts are misdirected. These efforts are directed to maintaining (C) in the face of the anticipated objection that necessary but *a posteriori* truths (such as 'Water is H_2O') may be involved as premisses of the entailments in question.

4 The Failure of (C)

By opting for the so-called two-dimensional treatment of the necessary *a posteriori*, Jackson hopes to establish (C), the claim that "materialists are committed to the *a priori* deducibility of the phenomenal from the physical". Even though we have seen already a fatal objection to Jackson's derivation of entry by entailment, let us set that objection aside for the time being in order to look more closely at his proposed defence of his (false) a prioricity thesis (C) against the objection that he anticipates would be based on the necessary *a posteriori*.

In his discussion of the objection he deals exclusively, by way of illustration, with a case involving the necessary *a posteriori* truth 'Water is H_2O'. Consider Jackson's example inference

(1) Over 60% of the Earth is covered by H_2O

(2) H_2O fills the water rôle on Earth

(3) Therefore, over 60% of the Earth is covered by water.

(1) is contingent *a posteriori.* (2) is necessary *a posteriori.* (3) is contingent *a posteriori.* For Jackson, (1) on its own does entail (3), in that truth is necessarily preserved from (1) to (3). But the entailment of (3) by (1) is not *a priori.* The entailment of (3) by (1) *and* (2), however, is *a priori.* And that's the nub of (C). That (2), if true, is necessary, is a matter revealed to us, according to Jackson, by conceptual analysis in the philosophy of language. Jackson describes himself as having argued that materialists must hold that the complete story about the physical nature of our world given by Δ entails everything about our psychology, and that such a position cannot be maintained independently of the results of conceptual analysis.

That is, in the context of his example inference above, (1) entails (3), but this cannot be maintained independently of the results of that conceptual analysis that guarantees necessity for truths such as (2).

Jackson's example, however, was about water and H_2O, and 'water' is hardly a *psychological* term. Nevertheless, his example is suggestive enough to lead one to see how others might be constructed for suitably psychological terms. I would venture the following as an exact analogue of Jackson's inference above, designed to make rather more to the point his description of what he takes himself to have argued for:

(1*) Sticking pins into people causes their C-fibres to fire

(2*) C-fibre-firing fills the pain rôle for human beings on Earth

(3*) Sticking pins into people causes them pain.

(1*) is contingent *a posteriori.* (2*) (if true) is necessary *a posteriori.* (3*) is contingent *a posteriori.* For Jackson, (1*) on its own would entail (3*), in that truth would necessarily be preserved from (1*) to (3*), should (2*) be true (hence necessary). But the entailment of (3*) by (1*) would not be *a priori.* The entailment of (3*) by (1*) *and* (2*), however, would be *a priori* (as (C) contends). That (2*), if true, is necessary, is a matter revealed to us, according to Jackson, by conceptual analysis in the philosophy of language.

I think we have here an analogue that Jackson would admit as adequate for the purpose of making his general point about the rôle for conceptual analysis. But now let us look at his closing description of the general situation he has sketched:

> ... the materialist is committed to there being an *a priori* story to tell about how the physical way things are makes true the psychological way things are. But the story comes in two parts. It may be that [the] one part of the story say[ing] which physical way things are, Δ_1, makes some psychological statement [Y] true, and the other part of the story, the part that tells the context, say[ing] which different physical way things are, Δ_2, makes it the case that it is Δ_1 that makes the psychological statement [Y] true. What will be *a priori* accessible is that Δ_1 and Δ_2 *together* make the psychological statement [Y] true.

This general gloss obviously calls for the correspondences

$$(1)/(1^*) - \Delta_1 \quad (2)/(2^*) - \Delta_2 \quad (3)/(3^*) - \mathrm{Y}$$

with reference to the examples given above. Note that the unstarred ones came from Jackson; while the starred ones were the ones that I supplied by faithful analogy, as more apt for making the point about *psychological* terms.

But now something objectionable emerges upon this clarification. Jackson's gloss on Δ_2, "the other part of the story, the part that tells the context, say[ing] which different physical way things are" is fine when applied to his own sentence

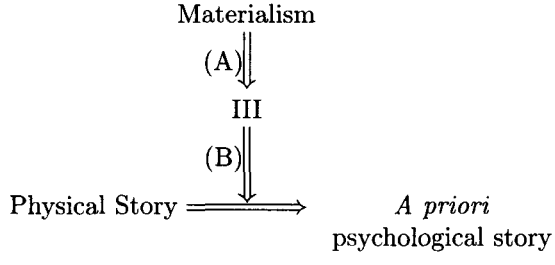
(2) H_2O fills the water rôle on Earth.

But what about the sort of sentence he should have been dealing with in connection with *psychological* terms? The sort of sentence in question would be one like

(2*) C-fibre-firing fills the pain rôle for human beings on Earth.

Does *this* sentence really deserve to be glossed as "say[ing] which different *physical* way things are"? Isn't the whole point that "pain" is a *psychological* term, not a *physical* term? It would appear that Jackson's use of the water-H_2O examples (in his discussion of the rôle of conceptual analysis via the theory of rigid designation) has misled him into thinking that the sentences *really* needed for slot (2) in his generic example would be telling a purely *physical* story. In this he is mistaken. Even if we grant him his "entry by entailment" thesis (B), Jackson has failed to establish his a prioricity thesis (C): "the materialist is committed to there being an *a priori* story to tell about how the physical way things are makes true the psychological way things are."

To repeat my earlier summary: Jackson's aim was to establish the following entailments (A), (B) and (C):



I have shown that (A) fails. But even if (A) holds, (B) fails. Moreover, even if (B) holds, (C) fails.

The root problem underlying these failures, I believe, is that Jackson characterized the concept of supervenience inadequately at the outset. This is not the place to rehearse an alternative explication of supervenience; I shall only mention that there is a model-theoretic explication, due to Hellman and Thompson, which to my mind is much more promising.[3] It gives rise to a technically more demanding problematic: to establish whether, given supervenience, it would follow that one could reduce the theory of the supervening level to the theory of the subvening level. Beth's Theorem was invoked by George Bealer in attempt to show that reductionism would indeed follow from supervenience.[4] Hellman and Thompson tried to block the argument via Beth's Theorem. Their strategy, however, does not work; but it turns out that there are other, better reasons why reductionism is not entailed by supervenience.[5] In my view the orthodox position (supervenience plus anti-reductionism) can be defended. But to rest secure with it, the debate has to move from the relatively crude devices of possible worlds semantics to the more satisfactory intricacies of model-theoretic semantics. The resulting philosophical conviction (as to the correct view) is worth the technical effort; but that is another story.[6]

Frank Jackson

Neil Tennant correctly notes that my discussion can be divided into three parts: in the first I argue that materialists are committed to a certain supervenience thesis (III); in the second I argue that (III) commits them to the entailment of the psychological by the physical; in the third I argue that this entailment in turn commits materialists to the possibility of *a priori* deducing the psychological way things are from the physical way things are. He objects to each part. I think that his objections involve misunderstandings of the (difficult) issues and of the detail of my arguments. I will presuppose familiarity with both my original paper and his reply, but it will be necessary to cover a certain amount of old ground.

1 Does Materialism Entail (III)?

As Tennant notes, I argue that materialism amounts to

(III) Any world that is a minimal physical duplicate of our world is a duplicate *simpliciter* of our world.

[3] G.Hellman and F.Thompson, "Physicalism, Ontology and Reduction", *The Journal of Philosophy* 72 (1975), 551–564.

[4] G.Bealer, "An inconsistency in functionalism", *Synthese* 38 (1978), 333–372.

[5] N.Tennant, "Beth's Theorem and Reductionism", *Pacific Philosophical Quarterly* 66 (1985) 342–54.

[6] I am grateful for the editorial invitation, after the Colloquium discussion of Frank Jackson's provocative paper, to write up my comments on it; and to Frank himself for providing me with a draft so that I could do so.

although the argument in the second two parts only uses the weaker claim that materialism entails (III). Tennant argues that (III) does not entail materialism, and, more to the point for the argument in the second two parts, that materialism does not entail (III).

The arguments he offers, however, involve a misunderstanding of what 'a minimal physical duplicate' means in (III). A minimal physical duplicate of our world (or of any world w) is a world that (a) is exactly like our world (or w) in every physical respect (property for property, particular for particular, law for law,relation for relation), and (b) contains nothing else in the sense of nothing more than it *must* to satisfy (a). Clause (b) is a kind of "no gratuitous additions" clause that I sought to give intuitive expression to with the recipe metaphor. Tennant's misunderstanding of the notion of a minimal physical duplicate runs right through his discussion in section 2, but I will focus on his main argument against my claim that materialism entails (III).

I offered (III) as an expression of what it takes for materialism to be true at our, the actual, world. It is though clear how to generalise it to give an account of what it takes for materialism to be true at a world w, namely

($\mathbf{III}_w$) Any world that is a minimal physical duplicate of w is a duplicate *simpliciter* of w.

(III_w) will be false of many worlds, but those it is true of are the worlds where materialism is true. Tennant in effect gives his objection as one to the view that materialism at w entails (III_w) for a nice simple w. This is fair enough. I agree that a corollary of what I say is that the truth of materialism at w entails (III_w).

He describes two distinct possible worlds, called 'World'and 'Otherworld'. World contains just one physical, inanimate rock; Otherworld is physically exactly like World – its physical nature is exhausted by its containing a rock exactly like the rock in World – but it has in addition some laws of "epiphenomenal emergence" that ensure that this single rock has a little bit of mental life. His objection is that materialism is true at World, but it is not true that every minimal physical duplicate of World is a duplicate *simpliciter* of World, for Otherworld is a minimal physical duplicate of World but is not a duplicate *simpliciter* of World. Tennant is right that materialism istrue at World but wrong that Otherworld is a minimal physical duplicate of World. It contains gratuitous extras, namely, the laws of epiphenomenal emergence and the mental life secured by them. Indeed, it is explicit in his discussion that Otherworld is obtained from World by *addition.*

He makes the same mistake in his follow up argument given in terms of a pair of worlds more like our own (the example involving Jack Smart and cricket). He adds laws of epiphenomenal emergence but thinks that he is still dealing with a minimal physical duplicate of the world he *added* these laws to.

How did Tennant manage to misunderstand the notion of a minimal physical duplicate? As far as I can tell the answer is contained in the first paragraph of his section 2. Here he seems to think that I could not have meant what I did mean by 'minimal physical duplicate' on the ground that this reading would mean that

> ... a world that was physically just like ours, but in which all creatures were zombies, would (according to (III)) be a duplicate *simpliciter* of our world. Hence all the creatures in our world would be zombies. But materialism, properly conceived, cannot be committed to that.

But what (III) commits a materialist to holding is that *any* minimal physical duplicate of our world is a duplicate *simpliciter*, and so that *if* there is a possible world which is a minimal physical duplicate of our world except that all the creatures in it are zombies, then that world is a duplicate *simpliciter* of our world. And sensible materialists – ones who do not think that we are all zombies (all materialists as far as I know, for even eliminativists hold that we are conscious in enough of a sense to count as not being zombies) – hold that the antecedent of this conditional is false; that is, they deny that there is a possible world which is a minimal physical duplicate of our world except that all the creatures in it are zombies. They think that being conscious is a *physical* feature of many creatures in our world and so that any physical duplicate of our world contains consciousness and hence creatures that are not zombies. Of course many *non-materialists* have held that there is a possible world, W, which is a minimal physical duplicate of our world and yet which contains only zombies. They argue: our world has consciousness; W lacks it; our world and W agree in all physical respects and so what our world has that W lacks is non-physical; ergo, our world has some non-physical nature and materialism is false. The materialist reply to this argument is, and must be, to deny that there is such a W.

2 Does (III) Entail That There is a Statement About the Physical Way Things Are That Entails the Psychological Way Things Are?

Tennant does not criticise my argument for the answer yes to this question. He criticises an argument that he wrongly says is mine. My argument is of course available in my original paper but it helps to bring out the crucial difference between the argument I offered and the one he thinks I offered if I start by giving mine in the same style as Tennant sets out the argument he thinks I offered. My argument can be set out as follows:

(1) Let Φ be the statement true at our world and all and only the minimal physical duplicates of our world.

(2) Let Π be any true statement entirely about the psychological nature of our world.

(3) Let w be an arbitrary world at which Φ is true.

(4) Then w is a minimal physical duplicate of our world.

(5) By (III), w is a duplicate *simpliciter* of our world.

(6) Hence, w is a psychological duplicate of our world.

(7) Thus, Π is true at w.

(8) But w was arbitrary, and so any world making Φ true makes Π true; that is, Φ entails Π.

Tennant notes that we have no guarantee that there is a unique sentence that tells the true physical story about our world. But the point is unimportant. We can either develop the argument in terms of an arbitrary sentence ('Let Φ be an arbitrary sentence...'); or use the notion of a *statement*, where statements are individuated by their truth conditions, so that there can only be one statement true at any given set of worlds including, of course, the set consisting of our world and all and only the minimal physical duplicates of our world (this was in fact what I had in mind, and was why I did not use the term 'sentence'). Tennant prefers to use the term 'theory' instead of 'sentence' or 'statement'. I am not sure why. What he says suggests that he does not want to use 'sentence' when we are dealing with something that may be infinite. In any case, one thing we are agreed upon is that the point is a minor one. I will continue to use 'statement' but everything I say in what follows could be expressed using his term 'theory'.

It is worth highlighting the role of the notion of a statement being entirely about the psychological nature of our world. This means, as I explained in the original paper, that if the statement is false at a world, then that world must differ in psychological nature from our world – the statement is not about anything but our world's psychology, so there is no other way for it to be false. It is this notion that secures the step from (6) to (7).

The difference between my argument and Tennant's is that in place of my (1) Tennant has

(1*) Let Φ be the statement which tells the true physical story at our world.

This difference is crucial. Tennant faults the step in the argument from

(3) Let w be an arbitrary world at which at which Φ is true.

to

(4) Then w is a minimal physical duplicate of our world.

He would be right to do so had my argument used (1*) instead of (1). In Tennant's version of the argument Φ is "the statement [or theory] which tells the true physical story at our world" (quoting from (1*)), and there are worlds at which the true physical story about our world is true but which have additional non-physical stuff (extra "angels", say) and so are not minimal physical duplicates of our world. However, my argument actually

used (1), and in it Φ is "the statement true at our world and all and only the minimal physical duplicates of our world" (quoting from (1)), and on this account of Φ the step is clearly valid.

3 Does the Physical *a priori* Entail the Psychological?

Suppose that you are a materialist and (unlike Tennant) accept that I have shown that you are committed to a certain physical story about the world entailing each and every psychological detail about our world. You might very well point out that my argument uses the necessary truth preserving account of entailment, and so, in view of the now widely accepted existence of necessary *a posteriori* truths, that it shows nothing as such about the *a priori* deducibility of the psychological from the physical. The aim of the last part of my paper was to show (sketchily – the issue is complex and space and time were limited) that, nevertheless, you are committed to an *a priori* deducibility claim – or, more precisely, you are if you accept what I (unoriginally) regard as the most appealing account of the necessary *a posteriori*, that provided by two dimensional modal logic. I will not repeat the argument here, but I should point out that there is a serious error in Tennant's account of my argument.

I sought to convey my basic point in terms of the best known example of a necessary *a posteriori* truth, the identity of water with H_2O. I argued that in spite of the fact that this is *a posteriori*, the H_2O way things are *a priori* entails the water way they are. In particular I discussed the argument

(1) Over 60% of the Earth is covered by H_2O

(2) H_2O fills the water role on Earth

(3) Therefore, over 60% of the Earth is covered by water.

Tennant points out, correctly, that I say a) that the step from (1) to (3) is necessarily truth preserving and so an entailment on *that* account of entailment, but the step is not *a priori*, and b) that the step, from (1) and (2) combined, to (3) is both necessarily truth preserving and *a priori*, and so the conjunction of (1) and (2) *a priori* entails (3). The error comes when he says (on his own behalf and mine) that (2) is necessary *a posteriori*, and that I hold that the fact that if (2) is true, it is necessarily true is revealed by conceptual analysis.

(2) is not necessary *a posteriori* because it is not necessary. Something other than H_2O might have filled the water role on Earth. It is not a necessary truth that the clear, potable, etc. liquid on Earth is H_2O anymore than it is a necessary truth that Einstein fills the role of being the most famous scientist of the twentieth century on Earth.

The reason I hold that the step from (1) and (2) combined to (3) is *a priori* as well as necessarily truth preserving is quite different from the reason Tennant attributes to me. It turns on the point that

(4) Water fills the water role on Earth

is, in my view, *a priori* true (provided that the water role is spelt out in the right way so as to include causal connections with certain uses of the word 'water' and all the rest of it) though contingent. But this means that we can see *a priori* that if (1) and (2) are both true, then so is (3). For from (1) and (2) we can infer *a priori* that what fills the water role covers over 60% of the Earth; but then the *a priori* nature of (4) enables us to make the final step to (3) also *a priori*. But we already know that the step from (1), and *a fortiori* from (1) and (2) combined, to (3) is necessarily truth preserving, so we have the desired result that the step from (1) and (2) combined to (3) is necessarily truth preserving and *a priori*. But (1) and (2) are both about the H_20 way things are. Hence, we have shown that the H_2O way things are *a priori* entails thewater way things are; or at least we have for a single case, and as the argument does not depend on the particular details of the case, it is plausible that the point generalises.[7]

[7]I am indebted to comments from David Braddon-Mitchell and Philip Pettit.