Dummett on the Time-Continuum

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In a recent paper, Michael Dummett has argued that the classical model of time as a continuum of instants has to be rejected: 'it allows as possibilities what reason rules out, and leaves it to the contingent laws of physics to rule out what a good model of physical reality would not even be able to describe.'[1] My aim here is to argue otherwise.[2]

Some philosophers might reject the classical model because it is what Dummett calls *super-realist*: it postulates states of affairs that are in principle beyond our ken, such as whether a given instant has a rational or irrational coordinate. There is little doubt that Dummett himself finds super-realism unpalatable, but that is not how he argues in this paper. As he makes clear elsewhere, he also shares the intuitionists' misgivings about the continuum itself, but that is again an issue that he wants to put aside. He wants to show, 'on grounds acceptable to the classical mathematician, that the classical continuum is an inadequate model of physical time.'[3] The contention is that the classical model of time fails on its own terms, and that it has consequences that even its advocates would have to recognize as untenable.

Dummett presents three alleged problem cases for the classical model. Since they raise different issues, I will discuss them separately. But they all have one important feature in common: they present examples of physical quantities that change their magnitude discontinuously. Such discontinuous changes might well be ruled out by the laws of nature, but Dummett argues that they have to be

[1] 'Is Time a Continuum of Instants?' *Philosophy* **7**5 (2000), 505. All otherwise unspecified page numbers refer to this article.

[2] Dummett's article has also come under attack by Rupert Read ('Is "What is Time?" a Good Question to Ask?', *Philosophy* **77** (2002), 193–209), who claims that it is a sign of philosophical confusion even to inquire about the nature of time. I am not convinced by this criticism, and I largely agree with Dummett's own response to Read ('How should we conceive of Time?', *Philosophy* **78** (2003), 387–96). The *raison d'être* for the current paper is that I believe that the main problem with Dummett's argument has not been touched upon by Read.

[3] 'How should we conceive of Time?', 388.

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admitted as conceptual possibilities. To make this point, he appeals to Hume's doctrine that each instantaneous state of the world is logically independent of every other one. Since any continuity constraint would contradict Hume's independence claim, Dummett concludes that it cannot be part of our conception of *physical quantities* that their magnitude must change continuously over time (p. 501). With these issues clarified, he then proceeds to present his three examples:

Case 1: Jump Discontinuities

Suppose that the classical model of time is correct, and that we have succeeded in assigning each time point a real number as a coordinate. Now consider a lamp that is abruptly switched off at time $t=1$. There is a period of light followed immediately by a period of darkness, but without any intermediate time at which the illumination has an intermediate value: the status of the lamp exhibits a 'jump discontinuity' at time $t=1$. Dummett does not (and cannot) object to the discontinuity itself, for he has just argued, by appeal to Hume's doctrine, that such cases are conceptually possible. The problem, he claims, is rather that the classical model provides two ways of describing this case. Either $t=1$ is the last time at which the lamp is on, or it is the first at which it is off. Yet these two distinct descriptions 'cannot possibly correspond to any distinction in physical reality' (p. 503).

I don't see why not. It is part of the classical model that these two cases *are* two distinct physical possibilities. We might be in no position to find out which of them is actual, but that is just the kind of super-realist claim that any proponent of the classical model has to accept at the outset, and Dummett has expressly waived all objections to the super-realism of the classical model. Nor is the case we are presented with here a particularly egregious instance. For *any* event—and that includes all continuous as well as discontinuous processes—can we ask whether the region of time during which it occurs is closed (contains its endpoints) or open (doesn't contain its endpoints). In none of these cases would we be in a position to find out which of the two it is.

The point is that only someone who *already* rejects the classical model will accept Dummett's claim that there is only one way to switch off the lamp. Advocates of the classical model will count two distinct—albeit observationally indistinguishable—ways of doing so, just as they will admit multiple ways of doing pretty much everything. Foes of super-realism might not like this, but that *is* the classical view. By complaining that the classical model overcounts possibilities, Dummett thus appears to be begging the question against his opponent.

Still, Dummett might be right that there is something puzzling about this case. Our example is an instant of the well-known fact that no interval of the real line can be divided into two symmetric halves, because only one of the segments can contain the dividing point. Some authors find this counterintuitive and instead advocates 'pointless' geometries that do not have this feature.[4] It might well be that one of these rival accounts offers, on balance, a more attractive picture of time than the classical model, but that's not Dummett's point: he promised us a *reductio* of the classical model, and his first example does not provide one.

Case 2: Removable Discontinuities

Dummett's second example concerns 'removable' discontinuities. These are discontinuities that could be eliminated by changing the value of the physical quantity in question at a single instant. Take again our lamp, but now suppose that it is always on except for the one instant t=1, at which it is off. According to Dummett, 'our conception of physical quantities is plainly such that this supposition makes no sense' (p. 503). Such a state of affairs is impossible, he claims, and it is to be held against the classical model of time that it permits it.

This is a curious argument. Dummett first argues—by appeal to Hume's doctrine—that discontinuous cases like this one are possible because our conception of physical quantities doesn't rule them out. He then turns around and now claims that these cases constitute a problem for the classical model *because they conflict with our conception of physical quantities*. Surely, he can't have it both ways. If our conception of physical quantities permits such cases then we don't have a problem. But if it doesn't then the scenario described is conceptually impossible, and there is no reason why the advocate of the classical model should claim otherwise; we don't have a counterexample unless we have an example. Either way, there is nothing for the classical model to worry about.

Later in his paper, Dummett presents a different argument.

[4] C. Carathéodory, *Maß und Integral und ihre Algebraisierung* (Basel: Birkhäuser, 1956). See also B. Skyrms, 'Logical atoms and combinatorial possibility', *Journal of Philosophy* **90** (1993), 219–32, and A. Grzegorczyk, 'Axiomatizability of geometry without points', *Synthese* **12** (1960), 228–35.

There he suggests that the problem isn't so much that the classical model has to admit such cases, but that it would give the wrong account of why they are impossible. A satisfactory model of time, he writes, 'should render conceptually abhorrent discontinuous changes impossible to describe' (p. 505). However, he himself has argued that the above example conflicts with our conception of *physical quantities*, not that it runs afoul of our conception of *time*. Hence he cannot plausibly claim that the classical model would be wrong in attributing the impossibility to the former. There seems to be no reason (and Dummett does not attempt to provide one) why it should be the job of our model of time to rule out again what our conception of physical quantities already counts as impossible. The cases couldn't get more impossible than they already are.

Case 3: The Thomson Lamp

The third alleged counter-example is a version of the Thomson Lamp.[5] Dummett does not give credit to Thomson, and he uses the example of a pendulum, rather than that of a lamp. But the essential structure of the two cases is the same. Suppose now that the lamp is on until time 1/2, then off until 1/2+1/4, then on again until 1/2+1/4+1/8, off again until 1/2+1/4+1/8+1/16, and so on. At all times later than and including $t=1$, the lamp is off.

Because the sequence of on/off switches does not converge as we approach $t=1$ from below, the function that assigns the lamp's status to each time is not continuous at that point. Dummett complains that the state of the lamp for $t<1$ would not tell us anything about its state at instant $t=1$, and that 'we do not suppose that events are as loose and separate as this' (p. 504). He again wants to blame the classical model of time for admitting this case.

But how tightly events are connected, and to what degree an earlier event explains a later one, is surely up to the laws of nature to decide, and isn't a question that our model of time needs to settle. If we are Humeans (as Dummett wants us to be) then we have to admit that the laws of nature are not conceptually necessary: they could have been different from what they actually are. But if they were different in the right way, a case like the Thomson Lamp could easily arise. Consider a possible world populated by flickering lamps that switch on and off in a perfectly random fashion (that's how the laws are in that world). A lamp's state at one instant of time would impose no constraint whatsoever on its state at any other time. It

[5] J. Thomson, 'Tasks and supertasks', *Analysis* **15** (1954), 1–13.

could then happen, by pure chance, that one lamp turns on and off just as stipulated in our example. So if Hume's doctrine is right then the Thomson Lamp and 'supertasks' like it *are* conceptually possible. If they are ruled out, then they would have to be prohibited by the laws of nature.[6]

Dummett's discussion of these three examples suggests that he is in fact far less comfortable with Hume's doctrine than he professes to be. What he objects to are not the individual states of the lamp (either on or off), but the way his three examples combine them to form a sequence of events. But to deny that it is conceptually possible for individual states of the world to combine in any way whatsoever is to deny Hume's claim that these states are logically independent of one another.

Let E_1, E_2, and E_3 be the scenarios described in Dummett's alleged counter-examples to the classical model. Then Hume's doctrine (HD) entails that the E_i are conceptually possible:

(1) HD $\models \Diamond E_i$ for i=1, 2, 3

Dummett accepts this, but he also claims that all three scenarios conflict with our conception of physical quantity (CPQ):

(2) CPQ $\models \neg\Diamond E_i$ for i=1, 2, 3

But if that were right, CPQ would entail that HD is *false*. For (2) to be true, our conception of physical quantity needs to have some sort of continuity requirement 'built in', and any such constraint would contradict Hume's doctrine.

Dummett thus faces the following dilemma. If he accepts (2) then he has to reject HD. But he can't do that without sabotaging his own argument, for HD is what was supposed to underwrite the conceptual possibility of the E_i in the first place. If Dummett gets to appeal to (2) then there's no reason why the advocate of the classical model shouldn't do the same, and reject the alleged problem cases because they are conceptually impossible. If Dummett instead rejected (2), then he could continue to uphold the possibility of the E_i by appeal to HD. But he could no longer claim that these cases conflict with our conception of physical quantities, and there would be no reason why the friend of the classical model should be bothered by them. Dummett's opponent could now give

[6] That our best physics rules out cases like the Thomson Lamp is argued in A. Grünbaum, 'Modern Science and Refutation of the Paradoxes of Zeno', *Zeno's Paradoxes*, W. Salmon (ed.) (Indianapolis: Bobbs-Merrill, 1970), 164–250.

an argument, based on HD, that shows that these cases *are* possible. So whether Dummett accepts (2) or not, we don't get a problem for the classical model.

In the second half of his paper, Dummett presents his own account of time, which is a variant of the pointless geometry mentioned earlier. Its most notable feature is that it does not even permit us to describe discontinuous cases like his three alleged counterexamples to the classical model. This is an interesting technical result, but it hasn't been shown to have any philosophical employment. If Dummett's examples are compatible with our conception of physical quantities then there is no problem to be solved. But if they are not, then our conception of physical quantities already rules them out and there's nothing left to be done by our account of time. Either way, there is no problem that Dummett's account solves, and the classical model doesn't.

This does not show that the classical model of time has to be accepted, for there are still two alternative strategies that Dummett could employ (even though he does not do so). One obvious possibility would be to give a philosophical argument against the super-realism of the classical model of time, or to rehearse the intuitionists' objection to the underlying account of the continuum itself. In his paper, Dummett explicitly sets these issues aside, but with hindsight this might appear to be a mistake.

A second option would be to argue that our best physics rules out the classical model of time. Some authors have recently argued that quantum mechanics is best understood in terms of a pointless geometry of space and time.[7] If this case could be made, it would provide empirical reasons for favouring something like Dummett's account of time. But that would mean abandoning the classical model because of the greater theoretical virtues of a rival account, not because it is incoherent. There seems little hope of defeating the classical model on its own terms, and Dummett hasn't shown otherwise.

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[7] For discussion, see Frank Arntzenius, 'Is Quantum Mechanics Pointless?', *Philosophy of Science* **70** (2003), 1447–57.