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## *Reply to Lewis: metaphysics versus epistemology*

DAVID PAPINEAU AND VÍCTOR DURÀ-VILÀ

Peter J. Lewis (2007) has argued that the Everettian interpretation of quantum mechanics implies the unpopular halfer position in the Sleeping Beauty debate. We retorted that it is perfectly coherent to be an Everettian and an ordinary thirder (Papineau and Durà-Vilà 2009). In a recent reply to our paper Lewis (2009) further clarifies the basis for his thinking. We think this brings out nicely where he goes wrong: he underestimates the importance of metaphysical considerations in determining rational credences.

Lewis's original argument hinged on the epistemic parallels between (a) an Everettian scenario where the  $x$ -spin of an electron in an eigenstate of  $z$ -spin is measured, with the result hidden from an observer and (b) a simplified Sleeping Beauty scenario where Sleeping Beauty is told that she will be woken on Monday and on Tuesday, with memory erasure in between. Lewis (2007: 60) pointed out that in both cases the agent's subjective experience has the same branching structure, with the agent becoming uncertain about her location therein. He concluded that the agent should adopt the same credences in both cases. Given that Everettians are committed in the spin case to assigning pre-measurement credences of  $1/2$  to 'up' and 'down', Lewis infers that the Everettian interpretation implies that Sleeping Beauty should similarly assign pre-sleeping credences of  $1/2$  to waking on Monday and waking on Tuesday. But this would of course be very bad for the Everettian interpretation, since Sleeping Beauty's credences here should clearly be 1.

In essence our retort was that the epistemic parallels between the two cases are trumped by their metaphysical differences. Everettians think that reality itself branches when quantum events take place. But there is no such metaphysical branching in the Sleeping Beauty case. We argued that this warrants a differential assignment of credences of  $1/2$  in the spin case but 1 in the simplified Sleeping Beauty case.

Lewis's first response is to query the extent of the metaphysical differences:

If 'reality' is that which is described by the underlying physics, then there is no branching of reality even in the Everettian case; branching

(for the contemporary Everettian) is a phenomenon that emerges at the macroscopic level via decoherence. That is, in the Everettian case as in the (simplified) Sleeping Beauty case, there is a single world in which the agent is uncertain of her location. (2009: 87)

We are happy to grant that in one sense there is no branching for Everettians. There is no branching at the level of the underlying physics. But in another sense the Everettian interpretation clearly does postulate branching. Everettians hold that after the measurement decoherence generates a part of reality that behaves like a quasi-classical world and contains a post-fission agent who sees spin-up, and another part of reality that behaves analogously and contains a post-fission agent who sees spin-down. From this perspective it is misleading to talk of a ‘single world’ in both the Everettian and simplified Sleeping Beauty cases. Where the single world containing Sleeping Beauty is metaphysically familiar, the Everettian world is a multiverse containing many separate branches of reality resulting from decoherence.

Still, we needn’t fight about the terminology of ‘branching’. For Lewis quickly moves onto another tack. He says that he is happy to allow that there are genuine metaphysical differences between the two cases. But he then argues that these *metaphysical* differences can’t really matter, given that the two cases are carefully constructed to be *epistemically* parallel.

This is where we think Lewis goes wrong: he is here assuming that the rational assignments of credences can be settled *independently* of metaphysics. But we see no reason for this assumption. After all, on the conventional interpretation of quantum mechanics, nobody thinks that the assignment of credences to quantum results is independent of metaphysical matters. On the contrary, it is universally agreed that the rational strategy is to match your credences to the *objective* quantum probabilities, in line with David Lewis’s (1986: 87) Principal Principle.

Everettians will agree that subjects should match their degrees of belief to the objective quantum probabilities. The issue is then where such probabilities are to be found. Everettians say that they arise specifically when decoherence yields quasi-classical branches of reality, and moreover that they are equal to the squared moduli of the amplitudes of those branches.

Against this background, it is irrelevant that there are certain experiential parallels between simplified Sleeping Beauty and Everettian spin measurements. Everettians will simply respond that the Sleeping Beauty scenario does not involve the kind of metaphysical structure that gives rise to non-unitary quantum probabilities, for lack of any decoherent branching.

Since there is no decoherent branching in the Sleeping Beauty case, the objective probabilities of waking on Monday and Tuesday are both 1.

In the spin-measurement case, by contrast, there is branching, with the squared moduli of the amplitudes of each branch equal to  $1/2$ . The rational degrees of belief follow suit, in line with the Principal Principle. The point is that rational subjective probabilities here track objective ones, and the objective probabilities depend on the metaphysical structure. Far from being irrelevant, the metaphysical structure is crucial to the determination of rational degrees of belief.<sup>1</sup>

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## *Moderate Monism: reply to Noonan and Mackie*

JIM STONE

Moderate Monism (MM) is the position that permanent, but not temporary, coincidence entails identity. Harold Noonan writes:

According to the moderate monist if God creates *ex nihilo* (at  $t_1$ ) a bronze statue and later (at  $t_{10}$ ) annihilates it, destroying both the statue and the bronze of which it is composed (Scenario I), the statue and the bronze are identical. If, however, God simply radically reshapes