An Objection to the Laplacean Chalmers
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Chalmers (2012) endorses the following "Laplacean scrutability" thesis:[1]

(LS) 'For all true propositions *p*, a Laplacean intellect who knew all the Laplacean truths

would be in a position to know that *p*.' (xiii)

Laplacean truths include 'truths about the fundamental laws of physics and truths about the

location of all fundamental entities at a time' (ibid.). So the claim is that given such a set S of

fundamental truths, (LS) says that an inferentially ideal agent can know that, for any true *p*, if

members of S are all true, then *p*. This is quick and dirty, but it suffices for our purposes.

Chalmers is aware that quantum indeterminacy will be seen as a problem for (LS): 'the

apparent failure of determinism in quantum mechanics suggests that the [Laplacean] demon

could not predict the future just from facts about physical laws and about the present' (xiv). Yet

he attacks this difficulty wtih a "frontloading" strategy: '[W]e need only give Laplace's demon

more information…To accommodate nondeterminism, we might give the demon full information

about the distribution of fundamental physical entities throughout space and time' (xiv).

The Laplacean demon thus starts with more information in his attempt to know all truths.

The problem, however, is that quantum *indeterminacy* means that to a notable extent, *there is*

simply nothing to frontload. After all, given a measurement of momentum, non-locality means

(on the standard, Copenhagen interpretation) that the electron *has no* definite location. And that

means, apparently, that multiple 'futures could evolve from the present state of the world given

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[1] All references to Chalmers will be to this work.

the right sort of quantum-mechanical evolution' (p. xiv). But if so, it seems the Laplacean demon would not be able to know exactly what is true of the future. So (LS) seems false.

In reply, however, Chalmers might also frontload all truths about the most fundamental *determinate* facts. These would be the lowest-level truths which are "emergent" from whatever gappy reality exists at the quantum-level (the most fundamental chemical facts, perhaps). Call this strategy "lowest macro-level" frontloading or LML frontloading for short. If these less fundamental truths are frontloaded as well, perhaps the Laplacean demon then has enough to infer in full detail the future course of events.

It accords with this that Chalmers switches from talk of "Laplacean truths" to talk of a "compact class" of truths, where the latter is not limited to "fundamental" truths. The compact class is just defined as "a set of truths that involves only a limited class of concepts and that avoids trivializing mechanisms such as coding the entire state of the world into a single number" (xiv). The upshot is that (LS) is superseded by the thesis of "conditional scrutability:"

(CS) 'There is a compact class of truths such that for all true propositions p, a Laplacean

intellect would be in a position to know that if the truths in that class obtain, then p.'

(xv) [2]

Again, the compact class need not be limited to the most fundamental physical truths—so it seems to allow LML frontloading.

Even so, (CS) does not categorically require LML frontloading. Further, there is clear evidence that Chalmers decides against it. (He does not explicitly say why—but naturally, he

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[2] Chalmers ultimately endorses a stronger version of (CS), where the knowledge in question is apriori. But it suffices to consider the weaker (CS).

does not want to trivialize (CS) by frontloading too much.[3]) Instead of frontloading truths from the lowest macro-level, we find Chalmers frontloading principles that facilitate *inferring* such truths from the frontloaded quantum-level truths. Specifically, in order to infer macro-level truths in spite of quantum indeterminacy, he proposes to assume:

> (*) 'an entity is located in a certain region…if a high enough proportion of the (squared) amplitude of its wavefunction is concentrated within that region.' (294)

This, plus a few additions, will supposedly "deliver classical truths at both the microscopic and macroscopic level" (295).[4]

So at the least, Chalmers forgoes LML frontloading.[5] But is (*)-frontloading enough to elude the problem with quantum indeterminacy? Well, consider that if (*) is to be frontloaded in the demon's compact class of truths, then it must be true. However, its truth is dubious. Given an electron, there will indeed be a region r where the probability mass is maximal, as per the antecedent of (*). Even so, it would not *follow* that the electron is located in r.[6]

However, up to this point we have assumed the standard Copenhagen interpretation of QM. Perhaps that is unfair to (*), since there are indications that Chalmers conceives (*) as part

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[3] Sometimes, Chalmers puts scrutability in a trivial-sounding way, e.g.: "The most important argument for A Priori Scrutability proceeds by frontloading *any* empirical evidence E that *might* play a role in conditional scrutability into the antecedent into one's conditional knowledge" (p. 160, italics mine). But elsewhere in the book, Chalmers invests much effort in avoiding trivialization, and I assume here (if only for dicussion's sake) that he succeeds in this.

[4] Soon after, Chalmers also endorses something like the converse of (*): 'the properties and relations that normally bring about the relevant sort of spatial experiences are precisely properties and relations requiring the wavefunctions amplitude to be largely concentrated in a certain area' (296). However, this seems to support inferring the micro from the macro, rather than the other way around. It is thus no help to (CS), and I shall leave it aside.

[5] This also gels with Chalmers' discussion of "narrowing the base" in his chapter 7.

[6] I am indebted here to Dan Linford for discussion.

of the interpretation from Ghirardi, Rimini & Weber (1986). This may well help the demon, since as Chalmers explains, the latter interpretation holds that "the post-collapse wavefunction has most of its [squared] amplitude concentrated in a small region, with infinite low-amplitude tails extending throughout space" (p. 295). If this is assumed, it at least suggests that the electron might be located at a reasonably small region r. And if so, then perhaps the Laplacean demon has enough to infer the macro-level truths.

Nevertheless, to say that an electron could be located in r by collapsing its wavefunction does not reveal where the (pre-collapse) electron actually is. Indeed, Ghirardi et al. never suggest otherwise. What they show instead is how one can start from a quantum-mechanical base, and use principles like (*) to derive an *approximation* of macro-level reality that fits with classical mechanics:

> one can consistently introduce a modification of standard quantum mechanics which leaves things unchanged for microscopic objects, while, for macroscopic objects, transforms quantum mechanics into a stochastic mechanics in phase space exhibiting the classical features. Of course, uncertainty is not eliminated... However the amount of stochasticity is quite small and is compatible with our experience of the behavior of macroscopic bodies. (485)

Thus, Ghirardi et al.'s dynamics may provide enough macro-level truths to capture "our experience of the behavior of macroscopic bodies." However, Chalmers' hope was to make *all* macro-truths Laplacean knowable, and this is not afforded by Ghirardi et al.

We saw that LML-frontloading may allow some kind of Laplacean scrutability, perhaps even of a non-trivial sort. However, Chalmers opts to frontload less, and it does not seem sufficient to vindicate (CS), even if (*) and GRW-mechanics are frontloaded.

Finally, it is worth noting that quantum indeterminacy need not be actual in order for there to be a problem. It is enough if quantum indeterminacy is possible. For Chalmers is clear that if (CS) is true, that is because the demon is able to *infer* all truths from the compact class of truths. And 'infer' apparently means "validly infer:" The demon is not portrayed as making explanatory or inductive conjectures—he is instead portrayed as *deducing* truths from the compact class. But such deduction would require the *impossibility* of the macro-level facts being different, given the compact class of truths. Yet if quantum indeterminacy is at least possible, then it *is* possible for the macro-facts to differ, given Chalmers' compact class of truths. Naturally, if quantum indeterminacy becomes discredited by some future science, then frontloading that would close off those alternate possibilities. But as things currently stand, the mere possibility of quantum indeterminacy suffices to frustrate the demon.[7]

[1176 words]

References

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[7] My thanks to Dave Chalmers, Ram Neta, an anonymous referee, and especially Dan Linford, for discussion and helpful comments on an earlier draft.