Fine-tuning is not causal ramification

Micah Newman

0. Cory Juhl (2006) has recently offered an original and provocative—one might even say *surprising*—perspective on cosmological 'fine-tuning.' He suggests that the central phenomenon involved is "not surprising," and does not warrant "extravagant" conclusions such as Intelligent Designers or multiverses. I think that Juhl has made some interesting insights on the subject, but I will argue that his contention misses the point of what motivates fine-tuning considerations. Juhl's mistake is a rather idiosyncratic one, but in an analysis of where and how the mistake is made, the nature of what is supposed to be involved generally in putative cosmological fine-tuning will be clarified.

1. To begin with, let's attend to how Juhl sets up the matter at issue. In the first sentence, fine tuning is said to be a "surprising *coincidence.*" (Juhl 2006: 269; my emphasis) Specifically, his target is the notion that "the values of the constants in our actual physical laws on the one hand, and the values compatible with life as we know it on the other, and the precise 'match' between them, jointly yield a surprising coincidence." (2006: 269) Is this the substance of the fine-tuning argument? I will argue that it cannot be.

An important, and relevant, feature of our universe is that it exhibits *causally ramified* phenomena. As Juhl puts it, this involves a phenomenon "causally depending, for its existence, on a large and diverse collection of logically independent facts." (2006: 271) However, "the proposition that life as we know it is causally ramified is not what is taken to be surprising, or particularly a priori improbable, in standard fine-tuning

arguments." (2006: 271) Certainly, causal ramification is not in itself surprising, so any aspect of fine tuning, to be considered surprising, presumably does not centrally and essentially involve causal ramification per se.

An important fact about a system S in which causal ramification is manifested is that "most causally ramified phenomena within S will exhibit sensitivity to fundamental parameters that describe the structure of S." (2006: 271) Another relevant, and somewhat more specific, feature of our universe that Juhl points out is that it is *moderately complex.* That is, "it consists of some smallish number (less than 100, say) of basic components, and that the behavior of these components is governed by (alternatively, accurately modelled by) some smallish number of coupled partial differential equations." (2006: 269)

I take causal ramification to be a necessary concomitant to lawlike behavior; at least, I can't see how there could be one without the other: the systemic connections needed for causal *ramification* seem to me to presuppose lawlike behavior. And, of course, lawlike behavior in a system entails causal ramification. It is important to note that it is possible to separate the presence of causal ramification as such from moderate complexity, for if the universe were relatively simple—consisting of at most three kinds of elementary particles, say—it could certainly still support causal ramification to a full extent just as in our universe, which I suppose in that case would entail that all physical behavior could be governed/modeled by at most seven basic equations.[1] In other words, it

[1] Perhaps it is metaphysically impossible for anything to exist except as part of a causally-ramified system. Anything I say in this paper is compatible with that assumption, but does not depend on it. All I need for present purposes is to show that it is

would qualify as a system S as described above in the same sense that our universe does, regardless of the fact that it is relatively simple instead of moderately complex. Already, in the above-quoted definition of Juhl's of moderate complexity (2006: 269), moderate complexity and the lawlike behavior involved in causal ramification have been run together: the second clause states that the basic components are governed/modeled by equations, and this is just to entail the existence of causally ramified phenomena.

Juhl claims that "sensitivity to the precise settings of the constants is just fine-tuning." (2006: 272) This is the central claim that I take issue with. If it is correct to assimilate fine-tuning to *sensitivity* to the precise settings of the constants, how did fine-tuning ever come to be thought surprising? Juhl suggests that "[i]t could turn out that, in some mathematically interesting sense, the degree of sensitivity of global features to variation in constant settings is very surprising." (2006: 273) However, I do not find it at all plausible that any of degree of such sensitivity could turn out to be 'surprising,' and this is because I don't see how any aspect of causal ramification per se could turn out to be surprising. For, if causal ramification requires mathematically-statable physical laws, then sensitivity to precise settings of such equations and constants will be an essential feature of causal ramification itself. And, if this is correct, then for such sensitivity to turn out surprising in any way would be for causal ramification to be surprising, and presumably all parties to the dispute will at least agree that causal ramification is not surprising. It is therefore *prima facie* highly implausible that fine-tuning is essentially a

---

possible to discover the moderate complexity of the universe on a separate basis from one's realization that the universe is an 'S-like' system (and I think it is obvious that in fact we did).

matter of causal ramification, nor should it be considered simply a '*coincidence'* between the kind of universe we live in and the actual settings of the physical equations and constants as we find them. So, what *is* 'fine-tuning'?

2. Robin Collins defines fine-tuning thus: "We say a constant of physics C is fine-tuned for life if the width, W_r, of the range of values of the constant that permit, or are optimal for, the existence of intelligent life is small compared to the width, W_R, of some properly chosen comparison range R: that is, if $W_r/W_R << 1$." (ms) Obviously, the crucial issue then becomes how R is defined. Collins suggests that a natural way of doing this is to have R reflect "the *epistemically illuminated region*—that is, the range of values of C for which we can make a reasonable estimate [of] whether or not that value of C is (intelligent) life-permitting." (ms) This seems to me to accurately capture the matter under 'fine-tuning' discussions. The argument for 'surprisingness' then runs as follows (as given in Collins (ms)):

(1) For some constant C, $W_r/W_R << 1$. (premiss)

(2) According to a *restricted principle of indifference*, "if we have no reason to prefer any value of a parameter over another, we should assign equal probabilities to equal ranges of possible values for the parameter, given that the parameter in question directly corresponds to some physical magnitude." (Collins ms)[2] (premiss)

[2] This principle bears further explication, but it suffices to note here that "acceptance of the restricted principle of indifference does not commit one to the general validity of the principle of indifference." (Collins ms)

(3) $P(L_c/AS\&k) << 1$, where L_c is the fact that a constant falls within the life-permitting range, AS is the "atheistic single-universe hypothesis," and k is some appropriately-selected background knowledge. (conclusion; 1, 2)

'Surprisingness' is often taken to be, or to be an index of, *low epistemic probability*. (3) is a Bayesian formulation of a low (epistemic) probability, and captures the relevant surprisingness. To ease the tension, then, one either posits a designer for the single universe, or an atheistic multiverse scenario.

Juhl, in his paper, does not specifically address narrowness of range for the constants involved, and so neglects premiss (1) of the argument. He says about the fundamental laws and constants that "[w]e simply do not know how improbable it is that they would be exactly as they are," (2006: 274) and that the probability space for such estimates is "made up out of thin air." (2006: 270) Taking this point as it stands, Collins' point about narrowness of range relative to an epistemically illuminated region remains untouched: we do not even need to go into counterfactuals involving occult 'prior physical probabilities' to see that the universe as we find it is fine-tuned for moderate complexity, not to mention life-supporting conditions. The point of the 'restricted principle of indifference' is not to circumscribe a set of such unknowable prior *physical* probabilities, but to lay down a (the?) rational means of assessing (1) in terms of epistemic probability as done in (3).

The epistemic probability that Juhl assesses may be taken as simply $P(L_c/k)$, where k includes the fact that life exists and is causally ramified. Then, when premiss (1) is neglected, $P(L_c/k)$ comes out to be quite high, whether or not we include AS in our background knowledge k. In contrast, the point of the fine-tuning argument is that (1)

plus restricted indifference entails that $P(L_c/AS\&k) << 1$, and thus that fine-tuning is surprising given a naturalistic metaphysics. Both Juhl's treatment and the above argument entail that the fundamental laws and constants will have specific settings. But the above argument takes into account, whereas Juhl does not, that for W_r representing settings for universes in which even any kind of chemistry is possible, $W_r/W_R << 1$.

3. Juhl makes it clear that he is not appealing to an 'observer selection effect,' according to which "if the constants did not have values close to their actual values, there would be no observers around to note this fact."[3] (2006: 273) With respect to an analogy to a case of a kidnap victim who will be killed if an ace of hearts is not randomly drawn from each of ten shuffled decks of cards, Juhl rightly recognizes that upon such an occurrence, the kidnap victim would be "rationally justified in being extremely surprised." (2006: 274) One disanalogy that Juhl posits between such a case and fine-tuning is that it is given in the analogy that the cards are randomly shuffled:

> A more apt analogy would be one in which the kidnapper's device outputs some sequence of cards, and that sequence is 'logically improbable,' but we have no idea what the internal structure of the device is. For all we know the device always outputs precisely those values. (2006: 274)

Well, if "the device always outputs precisely those values," then *that* would certainly be cause for surprise. Of course, any 'independently given' sequence is as 'logically improbable' as any other, but as has already been stated, it is not sheer logical

[3] Peter van Inwagen has called this gambit "one of the most annoyingly obtuse arguments in the history of philosophy," (2002: 151) and one certainly sees his point. Nevertheless, it does get aired now and again.

improbability that is at work in considerations of fine-tuning. This can be seen by examining another of Juhl's proposed disanalogies, which is that in the kidnap victim case

> we are given an 'independently interesting' sequence, ALL ACES OF HEARTS, as a 'target' sequence. The 'specialness' of that sequence does a lot of the intuitive work in the example, arguably. But in typical discussions…it is not claimed that 'life as we know it' could have been described as an interesting pattern independently of simply empirically examining life as it actually exists, with all its baroque and quirky kludging. (2006: 274–75)

Perhaps the claim Juhl refers to is not made because it is usually assumed tacitly: the point of fine-tuning is that it is interesting that a moderately-complex (and life-enabling) universe exists because of the very narrow range of fundamental parameters required for such—outside of which there is a vast range representing utterly inhospitable universes—independently of the presumably contingent fact that life did in fact evolve in it. In other words, the 'specialness' of the parameters of our universe is in fact, *pace* Juhl, analogous to the specialness of the sequence of cards consisting of all aces of hearts. It might be objected that no matter what obtained, one could find some fine-tuning argument of some kind having to do with specific parameters. But this objection is only telling if one construes 'fine-tuning' as just *sensitivity* as Juhl does, or otherwise begs the question that fine-tuning is not surprising. For, if there is fine-tuning in an interesting sense, then in non-fine-tuned universes no one would be around to make fine-tuning arguments! I conclude, then, that Juhl has not demonstrated that the case of cosmological fine-tuning is importantly disanalogous to the hypothetical kidnap-victim/shuffled-cards case.

4. Juhl makes the important claim that given the joint facts of moderate complexity and causal ramification, "fine-tuning per se should have been expected ever since we came to know that life is causally ramified and that the physics of our world is moderately complex." (2006: 273) This is certainly true if fine-tuning is just "sensitivity to the precise settings of the constants," but becomes a further question, if fine-tuning is essentially a matter of W_r/W_R being much less than 1 for one or more physical constants. Does the conjunction of moderate complexity and causal ramification entail (1) in the argument given above? In other words, could (1) have been logically deduced once we knew the basic facts of moderate complexity and causal ramification? Perhaps so; actually, largely because of the considerations Juhl discusses in his paper, I think it is likely true. In any case, I will certainly grant it for the sake of argument. So, how could fine-tuning represent an index of low prior epistemic probability if we already knew that our universe is moderately complex? Well, that our universe is moderately complex—and does not simply consist of collection of identical 'Democritean atoms,' for example—is a fact that we found out a posteriori, with the potential to represent a low epistemic probability. This remains true, it seems to me, even if such fine-tuning is intrinsically correlated to a collection of general facts that we discovered individually without finding them to be particularly surprising: we actually *didn't* know all about such facts if we did not realize just how specific the conditions have to be in order for *anything* like our universe to exist.[4,5]

[4] Worries about 'old evidence' notwithstanding (see Bradley Monton (2006)). Interestingly, though, Juhl (2007) thinks that 'the problem of old evidence' is a red

References

Collins, R. ms. How to rigorously define fine-tuning. Available on the World Wide Web via <http://home.messiah.edu/~rcollins/ft.htm> (accessed July 2007).

Juhl, C. 2006. Fine-tuning is not surprising. *Analysis* 66: 269–75.

Juhl, C. 2007. Fine-tuning and old evidence. *Noûs* 41: 550–558.

Monton, B. 2006. God, fine-tuning, and the problem of old evidence. *British Journal for the Philosophy of Science* 57: 405–24.

van Inwagen, P. 2002. *Metaphysics.* Boulder: Westview Press.

---

herring (and I'm inclined to agree with him)! However, given that Juhl's central gist in his (2006) is that fine-tuning should be thought unsurprising *given what we already knew*, it is puzzling to me that he should be suspicious of 'old evidence' worries.

[5] Many thanks to Cory Juhl, Robin Collins, Trent Dougherty, and Ted Poston for helpful comments.