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Fossils, Fishnets, Fine-tuning…and Flaws in Sober's Defense of Common Ancestry

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Abstract: *In a recent, widely celebrated article, Elliott Sober has taken up the difficult task of assessing the case for common ancestry despite difficult gaps in the fossil record. Sober urges that he defender of (gradualistic) common ancestry should argue that discoveries of intermediates, when they occur, offer far stronger support to their own view than persisting gaps offer to their opponents. Despite being an advocate of common ancestry, I argue that Sober's arguments are deeply flawed. First, they do not address the most serious challenge that the fossil record presents to common ancestry, particularly to gradualistic versions of that hypothesis which Sober wishes to defend. Second, Sober's general account of how to assess relative degree of evidence offered by discoveries or absence thereof is flawed and seemingly inconsistent.*

I n a recent, widely celebrated article, Elliott Sober has taken up the difficult task of assessing the case for common ancestry despite difficult gaps in the fossil record.[1] If the presence of intermediate forms in the fossil record supports the theory of common ancestry, then apparently the absence of those forms should count against it and rather count in favor of contrary views, specifically, separate ancestry. Otherwise the defender of common ancestry plays a disreputable game of "heads I win, tails you lose." Sober urges that this objectionable maneuver should be avoided and instead the defender of common ancestry should argue that discoveries of intermediates, when they occur, offer far stronger support to their own view than persisting gaps offer to their opponents. Despite being an advocate of common ancestry, I argue that Sober's arguments are deeply flawed. First, they do not address the most serious challenge that the fossil record presents to common ancestry, particularly to *gradualistic* versions of that hypothesis which Sober wishes to defend. Second, Sober's general account of how to assess relative degree of evidence offered by discoveries or absence thereof is flawed and seemingly inconsistent.

Introduction.

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[1] This article is a response to Elliott Sober's "Absence of Evidence and Evidence of Absence -- Evidential Transitivity in Connection with Fossils, Fishing, Fine-Tuning, and Firing Squads." *Philosophical Studies*, 2009, 143: 63-90.

The popular slogan "absence of evidence is not evidence of absence," Sober rightly notes, is at best *sometimes* true. Sometimes such an absence of evidence is devastating, sometimes it is negligible and there are cases in between that will involve matters of degree. Sober suggests the following principle in order to adjudicate uncertain situations involving the significance of evidential absence.

> *The Law of Likelihood:* Evidence E favors hypothesis H_1 over hypothesis H_2 precisely when $Pr(E|H_1) > Pr(E|H_2)$. And the degree to which E favors H_1 over H_2 is measured by the likelihood ratio $Pr(E|H_1) \, / \, Pr(E|H_2)$.[2]

The issue of "degree" involved in this formulation is absent from Sober's other recent work,[3] but he offers a defense of it (which I will not canvass here) and it is essential to our present task of assessing degrees of support for competing hypotheses that appeal to either the presence or the absence of certain bits of evidence, especially when some amount of searching for E has already been conducted.

Section 1. Sober's Assessment of the Evidential Significance of Fossil Record Gaps.

The competing hypotheses under scrutiny are those of common ancestry *CA* and special ancestry *SA*. Importantly, Sober assumes that *CA* involves *gradual* changes between phenotypical traits of organisms; on this view for any two "organisms" or "forms", there *must* have been a chain of phenotypical intermediate forms which gradually trace backwards in time to a common ancestor. Equally as important, Sober assumes that *SA fails to involve* any "stasis" requirement; some organisms trace their ancestry backwards through time without ever converging upon a common ancestor, yet nonetheless there *might* be an organism or organisms in their lineage whose phenotypical traits diverge from the norm to such an extent that they might be mistaken for an "intermediate." Indeed, Sober refers to such possible cases as "intermediates," though it is clear that he means this in this in the sense of "intermediate in terms of appearance" rather than "intermediate in an ancestral chain." Consider the case of the Archaeopteryx. Defenders of *SA* will admit that phenotypically it is intermediate between modern reptiles and modern birds (though

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[2] Sober, 2009, p. 65. Without this extra consideration involving degrees and ratios we are left where Sober ended his discussion of likelihoods in "The Design Argument." "In summary, likelihood arguments have rather modest pretensions. They don't tell you which hypotheses to believe; in fact, they don't even tell you which hypotheses are probably true. Rather, they evaluate how the observations at hand discriminate among the hypotheses under consideration." P. 4 of the updated version online.

[3] See for example this law as it appears in Sober's "The Design Argument," p. 2 of his updated version at http://philosophy.wisc.edu/sober/design%20argument%2011%202004.pdf. Earlier versions of this are found in "The Design Argument," in *God and Design: The Teleological Argument and Modern Science*, ed. Neil Manson (London: Routledge, 2003), 25–54; Sober, "The Design Argument," in *Blackwell Guide to the Philosophy of Religion*, ed. William Mann (Oxford: Blackwell, 2005), 117–47.

far closer to the latter), but they typically deny that there is a common ancestor for these two groups of organisms.

The upshot of adding *gradualism* and *non-stasis* to *CA* and *SA* respectively is profound. The past existence of an intermediate on *CA* is unity and the non-existence of such an intermediate becomes zero. The non-existence of (phenotypical) intermediates on SA, however, cannot be unity, nor consequently can the existence of such intermediates be zero. There is some small value, which Sober labels "*q*," of these intermediates existing on *SA*; the probability that no such intermediate ever existed on *SA* is thus 1-*q*. Whatever the value of 1-*q* the non-existence of an intermediate is devastating to *CA* as (assuming gradualism) it puts the odds of such non-existence at zero. Whatever difficulties there are in dealing with ratios whose denominator is zero, the Law of Likelihoods given above will render the result that the non-existence of such an intermediate is crushing to *CA* and "*infinitely* favors" its competitor.

However, although gradualistic *CA* holds out the promise that there *was* an intermediate, it does not entail that we will *observe* such an intermediate.[4] "The key is not to confuse the *existence* of intermediates with our *observing* such intermediates….That depends on how often they fossilize, on how long those fossils last, and on how much fossil hunting paleobiologists undertake." In sum, the relevant probabilities to which we should turn must somehow take into account how this sort of unavoidable "screening off" of historical evidence will affect our observations.[5] Sober suggests we take this into account with the variable *a*.

(SO) *a* = *Pr*(we have observed and intermediate|*CA* & there exists an intermediate) = *Pr*(we have observed an intermediate |*SA* & there exists an intermediate)

"This proposition", Sober says, "expresses an assumption—that the probability of observing an intermediate, if one existed, is the same regardless of whether *CA* or *SA* is true." Thus, the situation to which we should attend is given in the following figure.

	CA (and gradualism)	*SA* (and non-stasis)
We have observed an intermediate	*a*	*qa*
We have not observed an intermediate	1-*a*	1-*qa*

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[4] Actually, to speak of "observing" intermediates is difficult here. No one has observed a dinosaur, for example. But surely there is some broader sense to the term "observe" which is useful and unobjectionable in the present context. I would not like to digress into alternative issues involving "observing that" as they would be both unhelpful and unnecessary in the present context of debate.

[5] In this sense, some of his earlier formulations of the Law of Likelihoods are preferable to the present one; in those formulations the variable *O*, representing "observations," occurs in the place of *E*.

Now if all of this is correct, then it follows, Sober argues, that the ratio towards which the above formulated Law of Likelihoods directs us when we try to assess the degree of evidence which gaps in the fossil record provide for *SA* is…

$$\underline{Pr(\text{we have not observed an intermediate }|SA)} = \underline{1\text{-}qa}$$
$$Pr(\text{we have not observed an intermediate}|CA) = 1\text{-}a$$

Since both *q* and *a* are greater than zero, the non-observation of an intermediate *favors SA*. But, as seems to be the case, both values for *q* and *a* are quite small, the ratio will not be all that large so the *degree* of evidence for *SA* thus obtained "should not have creationists dancing in the streets." But when we turn to consider the second issue, namely how well the discovery or observation of an intermediate favors *CA* the ratio to which we should direct our attention is…

$$\underline{Pr(\text{we have observed an intermediate }|CA)} = \underline{a}$$
$$Pr(\text{we have observed an intermediate}|SA) = qa$$

Again, since *q* falls between one and zero, the observation of an intermediate *favors CA*. In order to assess the *degree* of confirmation in either case, we must compare these two ratios. That is, we must attend to whether…

a/qa is greater than $(1\text{-}qa)/(1\text{-}a)$

…which can be simplified to whether…

$1/q$ is greater than $(1\text{-}qa)/(1\text{-}a)$

…which in turn simplifies to whether…

$1/1+q$ is greater than *a*

Where *q* is small, and recall that this value refers to the seemingly unlikely presence of intermediates phenotypes on *SA*, the inequality is true for practically all values for *a*. But if *a* is also small, that is to say it is unlikely that we will find the intermediate on either hypothesis due to the historic "screening off" effect, then the inequality will be a very large one. We may justly infer that…

$1/1+q$ is *far* greater than *a*

And thus, confirmation for *CA* from observations of intermediates is of far greater degree than the non-observation of those intermediates offers to *SA*.

Section 2. Clarifying the (Important) Subject of Debate.

The argument is initially a persuasive one. But it turns vitally on the variables *q* and *a* and how they affect the evidential significance of a "gap" versus a "fill" in our imperfect fossil record. But I think both variables are largely irrelevant to that issue, the latter being perhaps *entirely* irrelevant. This section is dedicated to the first issue, the problem with *q*. In order to identify the problem, let's return to the question "what is the debate over common ancestry and the fossil record a debate about?"

Sober's stalking horse is clearly some form of "creationism." Separate ancestry is clearly a vital *part* of this doctrine and it is hard to think of any other camp who would invest much worry in the debate at hand. But is it about the fossil record that these defenders of separate ancestry and their critics dispute? Seemingly, it involves

the evidential significance of fossil "gaps" in the record. Nearly as obvious is the debate over the evidential significance of those intermediates already discovered such as the Archaeopteryx. Sober's *q* seems quite appropriate to track these disputes.

But a brief bit of reflection should reveal that this fails to address the chief problem that the fossil record presents to defenders of common ancestry. It is not merely that some particular intermediate is missing, nor the degree to which its discovery or non-discovery constitutes a problem for *CA*. The problem of "gaps" lies in the fact that (1) vast *numbers* of these intermediates are still missing and (2) the peculiar fact given gradualism representatives within *particular classes* of this missing set seemingly should have been discovered by now.[6] To illustrate: the absence of some specific transitional form lying midway between ancient reptiles and the Archaeopteryx does not concern me deeply. The absence of *any* would. Moreover, even if gaps between the Archaeopteryx and modern birds were filled with enormous numbers of diverse transitional forms, the numbers alone would not alleviate my concern. Whatever the number of forms discovered, I would deeply prefer to see that very number of intermediates "stretched out" so to speak so that it smoothly (even if less gradually) took me from reptile phenotypes to the Archaeopteryx to phenotypes of modern birds. Otherwise, a serious difficulty for the hypothesis of common ancestry would remain.

In sum, if the debate over the gaps in the fossil record were a debate over the relevance of specific, individual, phylogenic transitional forms, their discovery or absence thereof, I'd be content embrace Sober's conclusions, if not his arguments, with respect to that issue. But that's not, I think, the debate for which we seek a more definite resolution. The most persuasive case against common ancestry is a *cumulative case* that hinges vitally upon the numbers of missing transitions and the peculiar relations of groups of those missing links to one another. Sober's variable *q* is formulated so that it addresses a different or at least far more narrow topic. If defenders of common ancestry are ultimately forced to take refuge in probabilities and evidential principles, particularly those formulated in terms of *q,* that would be unfortunate. What we need are bones. Bones of certain types. Preferably a good number of those. But we don't have them.   Until we do, the central problem here remains largely unaddressed and to that extent unresolved.

Section 3. Where Sober's Analysis Goes Wrong.

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[6] In a footnote on p. 71, Sober wrestles with the issue of "numbers" here and has to admit that his conversation will have to admit of simplification of the issue. What he does not address at all, in my opinion, is the peculiar nature of those missing representatives relative to one another; conjoined, they sometime create *enormous* gaps of very peculiar sorts. So long as the case for *SA* is an appeal to this fact and remains a cumulative case, the central worry persists.

So far we have simply raised the question, "*If* Sober's analysis works, what of interest follows?" But has Sober correctly analyzed how a "screening off" process is involved in a correct analysis of the fossil record? I think his analysis is manifestly flawed and I cannot recommend it in defense of common ancestry. His selection of the variable *a* involves an indefensible and inconsistent understanding of how such screening processes effect the evidence we obtain from observing or not observing certain bits of evidence under certain circumstances.

Let's begin by examining and reviewing his approach generally. Where Sober discusses the existence of an intermediate, I will simply refer to it as *x* and take the proposition in question to be "*x* existed." That we have observed or failed to observed such an intermediate will be denoted by *Ox* and *~Ox* respectively. And *SA* and *CA* will be denoted as H_1 and H_2 respectively. I will cash out Sober's *q* and *a* in these more general terms. Thus Sober put forward the following claims.

1.) $q = Pr(x \text{ existed } | H_1)$
2.) $a = Pr(Ox | H_1 \& x \text{ existed})$
3.) $a = Pr(Ox | H_2 \& x \text{ existed})$

It seems to me that if we direct our attention to these three points then the remaining vital points of the argument, including those on the table above, follow…

4.) $Pr(Ox | H_1) = qa$
5.) $Pr(Ox | H_2) = a$
6.) $Pr(\sim Ox | H_1) = 1\text{-}qa$
7.) $Pr(\sim Ox | H_2) = 1\text{-}a$

Lines 6 and 7 are entailed by 4 and 5, and given that the values of *q* and of *a* are somewhere between zero and unity then Sober's point that both *Ox* and *~Ox* are bound to have some evidential significance on the Law of Likelihoods follows immediately. From there he makes an assessment of the *relative degree* each can confer upon our hypotheses. This turned our attention to whether…

$1/1+q$ is greater (or *far greater*) than *a*

And obviously this depends upon the values of *q* and *a*, most obviously the latter value.

But this entire discussion has gotten off on the wrong foot. We ought not have given our attention to these values in the first place. The question before us was "how does one take into account the 'screening off' effect which time, fossilization improbabilities, fossil delicacy, lack of paleobiological research, etc. interfere with our ability to observe the *x* in question?" The answer seems to be obvious. Take this conjunction of difficulties, call it (*CD*) and attach it to each of the hypotheses in question. That will tell us the odds of *Ox* on either hypothesis conjoining each to the difficulty in question, in effect treating these inherent difficulties as background assumptions. Partisans on either side of the dispute should have no objections to this, I think, and typically they dispute the degree to which the enormity of variety and numbers of fossil discoveries or breadth of research has overcome the difficulties

involved in (*CD*). On my analysis then, the relevant question the status of both of the following and their ratios…

$Pr(Ox|\ H_1\ \&\ CD)$ versus $Pr(Ox|\ H_2\ \&\ CD)$

$Pr(\sim Ox|\ H_1\ \&\ CD)$ versus $Pr(\sim Ox|\ H_2\ \&\ CD)$

Granted, this makes matters quite a bit messier. For unlike lines 2 and 3 above the two values in question are sure to be unequal where special versus common ancestry are the hypotheses under consideration. Why will this be the case? (*CD*) does not adjudicate whether or not that intermediate *x* ever existed in the first place. First, whether it was ever likely to be around in order to be later observed will be left to the explanatory resources of the two hypotheses under consideration. And secondly, whether or not this *x* was likely to have existed on *SA* or *CA* depends vitally upon which *x* we are discussing (A rather recent *x*? A large or small *x*? etc.).

Sober takes an entirely different and, I argue, quite objectionable tactic. The "screening off" effect is accounted for by taking the disputed issue of whether *"x existed"* and attaching it to the hypotheses under dispute. *As if the existence of x itself were responsible for the evidential difficulty with which we are trying to investigate.* Indeed, the value *a* discussed by Sober has little apparent connection at all with the phenomena of "screening off" which was supposed to be discussed and consequently the value has no clear connection to his conclusions regarding the observing or failing to observe some intermediate in any given situation. My suggestion of (*CD*) rather than *"x exists,"* I think, aligns well with common sense. Unfortunately for Sober, it does not align well with any of the calculations of ratios and degrees of evidence canvassed above which vitally involve the tidier value of *a*.

Perhaps the difficulty (and even Sober's inconsistency on this issue) will be more apparent if we consider other cases of "screening off" and how Sober has handled them. Consider the case in which our observation is that the constants of the universe allow for our existence and the competing hypotheses of Design versus Chance. This is the so-called "argument from fine-tuning." At first glance, the observation supports Design over Chance. Sober admits as much.[7] But when one considers the fact that we could not have observed a universe of any other sort, a type of "screening off" seemingly has to be accounted for. "We exist (as observers)." This prerequisite for any observation at all, at least any observation by *us*, puts uninhabitable universes out of the realm of potential observation for us. How do we account for this "observation selection effect?" Sober's reply is that we must conjoin the fact that "we exist" to each hypothesis. The relevant likelihoods to consider, then, are the odds of observing that the constants of the universe allow for our existence on

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[7] That Design indeed confers the higher likelihood on this observation is argued in 2009, p. 78, footnote 11. Similar points can be found in his updated version of "The Design Argument," online in footnote 23.

each hypothesis where each hypothesis is conjoined to the fact of our existence. Thus conjoined, both hypotheses can account for the data equally well.

My point is not to criticize Sober's suggestion here.[8] My point is that on his view when we are looking for what it is that negatively effects our evidence due to some sort of screen off, *our existence* is the culprit or cause of this and for that reason it should be conjoined to the competing hypotheses. By contrast, it is very dubious that the *existence of a fossil intermediate* is similarly the culprit in the case of the fossil records imperfections. Rather, it is *CD* that accounts for this and ought, if Sober's assessment of the fine-tuning case is correct, to be used in the analysis of the status of the fossil record.

And consider the source of inspiration for Sober's analysis of the fine-tuning case. His suggestion is that our existence acts for us in the manner in which a set of facts regarding a fish net might affect the results of a survey of fish in a lake. For example, a catch of 50 fish each over ten inches long would seem to confirm the hypothesis that "All the lakes fish are over ten inches long" over a competing hypothesis that "Only half the lakes fish are over ten inches long." Again, Sober admits as much. But suppose we discover that the holes in the net were too large to catch fish less than ten inches long.[9] Obviously something about the lake's fish population was screened off in the process of gathering information about the lake so that the evidential value of our observation of only large fish is negatively affected. How do we account for this? Again, Sober's suggestion is that we take those facts about the fishnet that are responsible for this unfortunate screening and build them into each hypothesis under discussion.

So once more the suggestion is that we find the set of facts responsible for the "screening off" effect and build them into the hypotheses. And again, in the case of the fossil record this set of facts working against observers is my set *CD*, not Sober's suggestion of "intermediate *x* exists."

How has this point, the seemingly *complete irrelevance* of *a* to the issue of taking into account the difficulties in assessing the evidence afforded by gaps or fills in our

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[8] That has already been done several times over. See Weisberg, J. "Firing Squads and Fine-Tuning," (2005). British Journal for the Philosophy of Science, 56, 809-821, Monton, B. "God, Fine-Tuning, and the Problem of Old Evidence." (2006). British Journal for the Philosophy of Science, 57, 405–24. and Nunley, T. "Fishnets, Firing Squads and Fine-Tuning (Again)." (2010). Philosophia Christi, 12 (1), 33-51. None of these criticisms, however, agree in their analysis of what exactly goes wrong with Sober's arguments.

[9] And, Sober adds, let us suppose a host of other facts such as the lake's fish population being 50 or larger, that the net was left in the lake until 50 fish were caught, etc. To my knowledge, it was Weisberg, p. 811, who first pointed out that the facts about the holes in the fishnet would not by themselves entail our observation of 50 large fish. In "Absence of Evidence and Evidence of Absence," he returns to his earlier version given in Manson (2003) and merely footnotes "I'm assuming that the net will fill with fish regardless of whether the 100% or 50% hypothesis is true" (p. 77, footnote 11).

fossil record, been overlooked? (SO), Sober said, "expresses an assumption—that the probability of observing an intermediate, if one existed, is the same regardless of whether *CA* or *SA* is true." True, it does. Moreover, it is also true that the ravages of time, etc. are not affected by *CA* or *SA* any more than weather patterns or temperature of the sun seems to be. But my question remains; what is gained here by inserting "*x* existed" into the background assumptions of each hypothesis when our basic problem is not *x's* existence but difficulties inherent in the task of assessing the "screening off effect" with respect to the fossil record?

Here, I think, is where Sober and many of his readers are making a slip. Rather than taking into account *the cause* of the screening off, they have slipped into thinking about *the thing* which is alleged to have been screened off. This is simply the confusion between *CD* on the one hand and *"x exists"* on the other. Now consider what would occur in the fine-tuning and fishnet cases if a similar confusion were made (and there is more than one way to do this depending upon which allegations regarding the lake's population or the origins of the universe's constants you wish to bias your result in favor of). The results would be implausible, I think. This technique cannot be rightly used in cases of fish or cosmology, nor can it be offered in defense of the doctrine of common descent.

Section 4. Conclusion.

Although I advocate a theory of common descent, for the reasons just given I cannot recommend Sober's defense of it.   The issues which are and ought to be of most grave concern in any debate over the subject seem, at best, to be merely touched upon peripherally by Sober's discussion thanks to his overly narrow focus on specific , missing intermediates. The variable *q* seems to me to plunge him into this unfortunately myopic construal of the difficulty. But worse, the method employed by Sober is manifestly flawed with respect to his selected variable *a*. This value and Sober's conclusions based upon it are elegant, general and bolster the common-sense intuition that what we have found in the fossil record is of far greater evidential importance than that which we have not. But my view is that any worthwhile assessment of the fossil record regarding matters of common descent will inevitably be messy, piecemeal and involve issues of the relevant importance of certain gaps and intermediates relative to others. As it stands, there remains a daunting difficulty for advocates of (gradualistic) common ancestry and my view is that only future fossil discoveries can alleviate it.

On the other hand, advocates of common ancestry such as myself, that is those who could care less whether gradualism is true or how often it was the case that evolutionary history proceeded gradually, don't have to be as concerned over those pesky, rather systematic gaps. It is quite plausible to think that the concern over the evidential status of evolutionary *gradualism* is directly linked to a concern over the evidential status of evolutionary *naturalism*. If my arguments here are correct, those

with an interest in the latter will have to offer a better reply than Sober has offered regarding problems with the former.

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