Studies in History and Philosophy of Biological and Biomedical Sciences xxx (2010) xxx–xxx

Contents lists available at ScienceDirect

Studies in History and Philosophy of Biological and Biomedical Sciences

journal homepage: www.elsevier.com/locate/shpsc

Discussion

Natural selection and the limitations of environmental resources

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A R T I C L E I N F O

Article history:
Available online xxxx

A B S T R A C T

In this paper, I am clarifying and defending my argument (Nanay 2005) in favor of the claim that cumulative selection can explain adaptation provided that the environmental resources are limited. Further, elaborate on what this limitation of environmental resources means and why it is relevant for the explanatory power of natural selection.

When citing this paper, please use the full journal title *Studies in History and Philosophy of Biological and Biomedical Sciences*

One of the most important recent debates in philosophy of biology focuses on whether natural selection can explain why organisms have the traits they have.

Elliott Sober claims that selection is a negative force: it does not create; it only destroys (Sober, 1995, 1984, Ch. 5). Random mutations create a variety of traits (or genetic plans) and selection eliminates some of these, but the explanation of the traits of one of these individuals is provided by random mutation and inheritance (and some developmental factors), not by the elimination process. Selection can explain why certain individuals were eliminated, but it cannot explain the traits of the ones that were *not* eliminated.

Karen Neander argues against the validity of this argument, which she calls the argument for the ‘Negative View’ of selection, at least as far as cumulative selection is concerned (Neander, 1995). After a couple of rounds of exchanges without any sign of rapprochement, one gets the sense that there is some sort of miscommunication between Neander and Sober. One gets the sense that the opponents and the advocates of this argument may not mean the same by the term ‘selection’.

I argued (in Nanay, 2005) that cumulative selection for trait *A* in a population can (partially) explain why a specific organism, *x*, with trait *A* in this population has this trait, as long as the environmental resources in this population are limited. My argument was the following (significantly simplified).

(i) The probability of *x* having trait *A* depends counterfactually on whether *x*’s mother survived and had trait *A*.
(ii) The probability of the survival of *x*’s mother (like that of all other organisms in the population with trait *A*) depends counterfactually on the death of those organisms in the population who had trait *B* (of *x*’s uncles).
(iii) The probability of the death of those organisms in the population who had trait *B* (*x*’s uncles) depends counterfactually on the selection process for trait *A* (Nanay, 2005, pp. 1105–1106).

Because of transitivity (see Nanay, 2005, pp. 1106–1108 for why these counterfactuals are transitive in spite of the fact that counterfactuals in general are not), it follows that selection for *A* explains why *x* has *A* in populations in which environmental resources are limited. The limitation of environmental resources is crucial as it justifies step (ii). If there is cumulative selection in a population in which environmental resources are not limited, (ii) is false; therefore, selection in this population fails to explain why specific organisms have the traits they have.

Ulrich Stegmann argues that my proposal does not work (Stegmann, 2010, pp. 65–66). He points out, correctly, that an explanation for why organism *x* has trait *A* always needs to be contrastive, that is, it needs to be an explanation for why organism *x* has trait *A* rather than trait B. I fully agree with this point. He aims to point

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1369-8486/$ - see front matter
doi:10.1016/j.shpsc.2010.10.007

Please cite this article in press as: Nanay, B. Natural selection and the limitations of environmental resources. *Studies in History and Philosophy of Biological and Biomedical Sciences* (2010), doi:10.1016/j.shpsc.2010.10.007

out that my explanation does not deliver such contrastive explanation. I disagree.

Stegmann notices—again, correctly—that the probability of *x* having *A* in (i) depends counterfactually on a conjunction: the claim is that the probability of *x* having trait *A* depends counterfactually on whether *x*'s mother survived *and* had trait *A*.[1] He goes on to argue that the real work in this counterfactual is done by the second conjunct only. To show this, he argues that the probability of *x* having trait *A* rather than *B* does not depend counterfactually on whether *x*'s mother survived. I completely agree. But why does this show that the real work in (i) is done by the second conjunct only?

If *P* depends counterfactually on *Q*&*R*, then it famously does not follow that *P* depends counterfactually on *Q* and *P* depends counterfactually on *R* (see Lewis, 1973 for a classic summary). So, the fact that the probability of *x* having trait *A* (rather than trait *B*) does not depend counterfactually on whether *x*'s mother survived does not show that whether *x*'s mother survived is irrelevant for the counterfactual (i).

What I take to be Stegmann's main argument is that (ii) gives us a counterfactual dependence relation between the death of *x*'s uncle and the survival of *x*'s mother, whereas (i) gives us a counterfactual dependence relation between *x*'s mother having *A* and *x* having *A*—as the second conjunct about the survival of *x*'s mother is irrelevant for (i). So there would be a mismatch between (i) and (ii).

Note, however, that (ii) is also about the conjunct of *x*'s mother having *A* and surviving to reproductive age: it says that 'The probability of the survival of *x*'s mother (like that of all other organisms in the population with trait *A*) depends counterfactually on the death of those organisms in the population who had trait *B* (of *x*'s uncles)' (Nanay, 2005, p. 1105): the probability of the survival of *x*'s mother, who is stipulated to have trait *A*, depends counterfactually on the death of *x*'s uncles. Therefore, there is no mismatch. Both (i) and (ii) deal with the conjunction of *x*'s mother surviving and having trait *A*.

To make this clear, we can rephrase (ii) in the following way: the probability of an organism having *both* the property of surviving to reproductive age *and* trait *A* depends counterfactually on the death of those organisms in the population who have trait *B*. If there were fewer organisms with *B* dying, there would be more organisms with *B* consuming the environmental resources. Therefore, among the organisms that have trait *A*, fewer would survive and—conversely—among the organisms that survive, fewer would have trait *A*. In short, among the organisms in the population, fewer would have both the property of surviving to reproductive age and of having trait *A*.

To sum up, step (i) and (ii) of my argument follows the schema:

(i) *P* depends counterfactually on *Q*&*R*.
(ii) *Q*&*R* depend counterfactually on *S*.

P is the proposition that *x* has trait *A* rather than *B* (just as Stegmann suggests). *Q* is the proposition that *x*'s mother survives to reproductive age. *R* is the proposition that *x*'s mother has trait *A*. And *S* is the proposition that organisms with trait *B* are selected against in the population. Given the much-discussed considerations regarding transitivity, nothing should stop us from concluding that *P* depends counterfactually on *S*. But then nothing should stop us from concluding that if the environmental resources are limited, cumulative selection for trait *A* explains why a specific organism, *x*, has *A*.

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[1] Stegmann paraphrases my probabilistic counterfactuals in deterministic terms. I'll go along with his paraphrases.

Please cite this article in press as: Nanay, B. Natural selection and the limitations of environmental resources. *Studies in History and Philosophy of Biological and Biomedical Sciences* (2010), doi:10.1016/j.shpsc.2010.10.007