Review of: "Femmes finales: natural selection, physiology, and the return of the repressed"

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This is an extremely neat paper. I am very sympathetic to much of what the author claims and also I find that the arguments he provides for most of the points being made throughout the manuscript are very compelling. Further, I love the historical exploration of the tropes of femininity regarding the fortune and misfortune of the notion of final causes in different scenarios in 19th and 20th century biology. All in all, as a reconstruction of the role of teleology, final causation and teleonomy within the context of evolutionary biology and the life sciences as well as an ambitious genealogy of the shifting replication of the Baconian meme associating final causes with *vestal virgins* all over the course of development of different biological milieus, the article reads as an insightful, illuminating and extremely interesting piece which opens up new and unexpected avenues for further research and reflection. I am very thankful to the author for this thought provoking piece of work.

Said this, here's a sketchy list of suggestions that the author might well deem interesting to think about in relation to some parts of the manuscript.

First , there is a contention being made all over the paper that physiology was a late incorporation to the modern synthesis of evolutionary biology and more generally a neglected discipline in the context of evolutionary discussions following the publication of the *Origins.* That is a good point I fully agree with. I also agree that history of biology and our understanding of some nuances pertaining to the history of accounts of evolution would benefit from incorporating physiology to the equation more explicitly. To do full justice to the importance of the role of physiology in this respect, perhaps some attention should be given to the extent to which a variety of shreds of evidence and theory coming from present-day physiological research is contributing to our current debates on the limitations of the MS and how to expand it. The name of Denis Noble whom professor Haig quotes in other parts of the article ,comes across as one of the obvious references in highlighting the significance of physiological research for constructing a complete understanding of the evolutionary process.

Second, the author's treatment of Whewell´s perceived gulf (tension as Prof Haig has it drawing from previous work conducted by Michael Ruse) between physics and the organization of the living world with regards to purposiveness constitutes a nice discussion of Whewell´s philosophy of biology. Haig argues that this tension is surely one calling for an explanation. I agree with Haig that Whewell probably felt unease about such divorce between the metaphysics of different areas of scientific concern but on the surface of it I don't see why he should have. The idea that the world is metaphysically homogeneous may have been an seductive one historically, but seems to run counter the widely diverse

ontological implications of different sciences in their present state of development. Maybe purposiveness is simply a feature of the biological world without parallels in other branches of science. If so, this division , puzzling as it may seem to many, would echo with the sort of promiscuous realism that John Dupré for example argues for in *The Disorder of Things.*

Also, much of what Haig glosses over in terms of Whewell´s view of teleology as being a regulatory principle in explaining the organic world is reminiscent of Kant's doctrine of natural purpose in his analytic teleological judgment. Kant would not be usually considered as one of the most noticeable sources of inspiration for Whewell (or Darwin) but yet I think that there is a congenial line of thought linking these two figures together here.

Furthermore, the author interprets Darwin as naturalizing teleology rather than eliminating it altogether. I agree that this is the most plausible interpretation of the significance of the Darwinian theory for final causation. As a point of scholarly contrast however I want to point to R. Richards´ differing interpretation of some key motives of Darwin's thought pertaining to the role of teleology and goal-directedness in evolution. In a number of places Richards argues not solely that German romantic philosophy of life was crucial for the construction of D´s theory (which I think is contestable) but also goes so far as to saying that until pretty late in his scientific career D thought of evolution as an intelligently guided process. Again I think this is not a plausible interpretation of D but perhaps Haig could consider including a reference to this theme in another version of this paper or in some other pieces to come.

Also, I did not know Michael Foster´s words about Owen in his eulogy for Th H Huxley. Ironically, it is worth considering that contrary to what Foster said, Owen´s work is not only valuable due to his detailed empirical descriptions as Forster suggests. As a matter of fact some insights coming from Owen´s (and L. Oken´s) purportedly “fruitless speculation” has been vindicated in hindsight by current work in evo-devo about organic forms in particular in relation to the origination of limbs: Laura Nuño de la Rosa for example, but also Gerd Müller among a number of others have written extensively about the interest of topics very close to Owen´s scope of theoretical interests in the origination of evolutionary developmental biology. On a similar note, there is a link to be drawn between Gould and Lewontin´s defense of structure over function against the blandishments of adaptationism, which Haig refers to later on in his paper, and a very significant historical thread of research and theorizing on physical constraints over evolution (from Pere Albrecht or D´Arcy Thompson to Gerd Müller and contemporary evo-devo).

In a somewhat related vein, another prominent figure who opposed the mechanical view of life and stressed the inherent directiveness of organic activities is E.S. Russell. While I am aware that the purview of the article and the number of materials it considers is already very board the way the paper stands I still think that it would be beneficial to engage his work on teleology

Finally, I doubt it is entirely fair to say that Varela´s work on autopoietic systems is meant to supplant natural selection. Also irrespective of what Varela´s intentions might have been, it does not need to have such an effect. Although it is true that Varela´s (and Maturana´s) views about autopoiesis have been generally dismissed in mainstream Neo Darwinism and that they signal some of the ways in which the MS falls short of offering a complete picture of the functioning of the

living world, yet it would be an overstatement to assert that NS and Autopoiesis are flat out incompatible with each other. I do not see any reason for thinking that the autopoietic view of biological systems and the principle of NS cannot both coexist peacefully and productively in a new and extended evolutionary framework.