Committee I
The Evolution of Man

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DISCUSSION PAPER

on

SESSION I

Comment on Wells: Charles Darwin on the Teleology of Evolution

by

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The Argument of the Paper

The two key propositions in Darwin's theory of evolution are natural selection and random genetic variation. Wells points out that, for Darwin, the randomness of selection was not an inherent statistical property of the distribution of genetic changes. The randomness, in Darwin's view, was an apparent consequence of complex forces which are too complex to understand. Darwin's position on this issue was probably itself a source of the controversy over the possible teleological element in his theory. After all, it is impossible to disconfirm the hypothesis that some grand design is embodied in the types of genetic variation actually encountered. And Darwin, moreover, had no alternative hypotheses. Consequently, the arguments about teleology during Darwin's lifetime were focussed on (though by no means restricted to) those aspects of his theory which were concerned with random variation rather than natural selection. As Wells points out, Darwin himself argued that the proposition that all genetic variations were determined by God is inherently implausible.

At the end of his paper, Wells seems to identify teleology with predictive power. He offers the example of Newtonian mechanics which, he asserts, entails design because it generates determinate predictions on the basis of initial conditions and Newton's laws of motion. He suggests that the same is true of quantum mechanics - the stochastic content presumably notwithstanding.

Though Wells is not explicit, his distinction between teleological and anti-teleological theories appears to turn on foreknowledge of possible outcomes. This would imply a positivist/Cartesian view. The positivist aspect derives from the presumption that all predictions, and only predictions, constitute explanations. The Cartesian aspect derives from the implicit ascription of the authorship of the laws of motion to God - the function of the scientist being to understand God's laws. I imagine that the asserted generalization to quantum theory stems from the requirement on stochastic processes that all possible outcomes are known in advance. Otherwise the probabilities do not sum to unity and probability theory is inapplicable. In these cases, a teleological view would be that God has designed the menu of possible outcomes together with the frequency distributions of realizations.

Darwinian theory differs from both deterministic and probabalistic theories in that it specifies neither the menu of possible outcomes nor any means of determining the actual outcome. Consequently, if there is a design, it is not elucidated by the theory.

A Missed Distinction?

I was puzzled by the opening paragraphs of Wells' paper.

He began by arguing that understanding of 'the *cultural* evolution of man' requires some consideration of teleology. He goes on to suggest that this requirement is paradoxical because teleology is incompatible with Darwin's theory of evolution. I do not see why this should be paradoxical unless an evolutionary account of cultural change is nothing other than an application of the theory of biological evolution. I can think of no obvious reason to believe this.

Wells' initial presumption that human activity often (perhaps typically) reflects a sense of purpose and the pursuit of goals is surely what differentiates cultural and intellectual evolution from biological evolution. If so, then Wells' arguments regarding the implausibility of a teleological element in the theory of biological evolution have nothing to do with theories of cultural and intellectual evolution. Indeed, I can find no references in the 19th century literature to any conception of teleology which is not equivalent to the doctrine of final causes of *natural* phenomena.

It is for this reason that Wells fails to address the issue which motivated his paper in the first place. That is, his discussion of Darwin, though interesting, simply has nothing to do with the existence of otherwise an underlying goal or purpose which determines the direction of cultural evolution.

One promising starting point for a consideration of the issues raised by Wells is the growing literature on evolutionary theories of technological change. The theories of relevance to the present discussion were stimulated in the main by the 1982 book *An Evolutionary Theory of Economic Change* by Richard Nelson and Sidney Winter. While technological change itself is perhaps tangential to questions of cultural change in general, the Nelson-Winter analysis does include formal models of an evolutionary mechanism which reinforces the emergence and eventual domination of 'successful' social behaviour based on the discovery of new ideas.

Nelson and Winter argued that technological changes follow a 'natural technological trajectory'. This 'trajectory' is determined by the relative ease with which one advance follows another in new technological areas and then the increasing difficulty of finding improvements as the technology becomes mature. The metaphor is apt if it is indeed the case that new technologies rise quickly - yielding rapid increases in efficiency or other benefits - only to slow and falter as the early improvements are realized. The evolutionary aspect of the Nelson-Winter analysis is bound up with a process of competition among firms. Firms which produce new goods for which there is some demand or which use new techniques to produce existing goods more cheaply will be better able to take custom away from firms producing the same old goods in the same old (high cost) way. Nelson and Winter elaborate their arguments by means of computer-based simulation models in which firms find new technologies by drawing them at random from an unknown set of possible technologies. These drawings simulate the result of expenditures on research and development (R&D). Essentially, the more a firm spends on R&D, the more draws they make from the set of possible technologies and, so, the more likely they are to find new and better technologies. Because the simulated firms have no prior knowledge of the elements of the technological-possibilities set, they effectively find technological variations which are random in Darwin's sense of having no *known*, systematic cause. The analogue of natural selection is a result of the competitive process. Firms which adopt relatively inferior technologies tend not to survive.

This evolutionary theory is open to an element of teleology. This is the effect of the exogenous technological trajectory which, according to those who use this theory, is in some sense 'natural'. It is therefore possible to interpret the set of possible trajectories as conforming to some grand design. However, not all writers in the field accept the analytical value of the trajectory idea. After all, if the trajectory were itself predictable, then R&D would become a statistical exercise like quality control or queueing theory rather than exploration of the unknown.

Perhaps the best way forward is to retain the Darwin's realization that evolutionary processes are inherently design-free. The evolutionary process itself rather than the outcome is the interesting subject of study. Applying this notion to studies of cultural and intellectual change, we can draw on both complexity theory and information theory to analyse and, increasingly, to simulate learning and discovery. For these are activities which take place in environments which are too complex to enable us to list in advance all possible outcomes. In any case, if we could apply deterministic or stochastic procedures to the description of learning we would have to specify in advance what could be learned. If we knew in advance what could be learned, then it is not clear what is left to learn.

In short, embracing Darwin's rejection of teleology might well provide a sound point of departure in our attempts to understand the process of discovery and learning and thereby to be able to describe and analyse the sources and limits of the unity of scientific endeavour. The subject of study thus becomes the meta-level of knowledge - knowledge of the ways in which we control the search for new knowledge and understanding. This is a long way from prediction. But it is surely compatible with the view that the scientific community has common goals and purposes at some fundamental level.

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