Philosophy of Science // Fall 2016

Handout 15

Creationism and evolution: Paley, Dawkins, Sober

Paley's argument. Suppose I find a stone on a plain (Figure 1). It is uninteresting and absurd to ask why the stone happened to be there. Suppose, on the other we find a watch in these otherwise uninhabited surroundings (Figure 2). Suppose we are able to examine it. The complexity of its parts must convince us in its creation, convince us of a plan with which the watch was produced. Every part plays a small role in making the watch fulfil its overall purpose, which is, well, to show the time. Every part is so delicately arranged, in a non-obvious way, so as to convince us in the existence of a designer.

Figure 1: Unknown stone

Figure 2: Paley's(?) watch

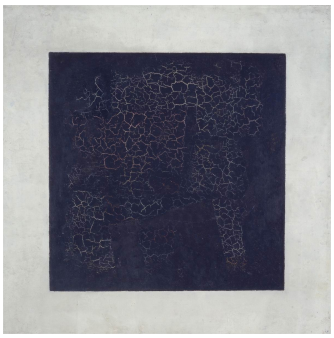

Figure 3: Malevich's Square

Paley then answers a few immediate objections. Several bear considerable interest. In II he says that imperfections of the watch do not prove that there was no designer. So at this stage at least the argument only purports to establish the existence of *a* designer, not any perfect designer. The inference to the existence of the divine designer is established in later chapters. In I and III he says that ignorance of the watch production or of the purposes of various parts should not preclude the design conclusion. The remark I is, I think, the more problematic one. It is true that we infer the existence of an artist from observing works of art. But that is in part because we are familiar with analogous works of art. If, for instance, an ancient Greek were to come to a modern gallery and find there Malevich's Black Square (Figure 3), he would not necessarily infer the existence of a designer. Perhaps he would recognise design in the frame, but not clear whether the square itself would be perceived as a designed object.

It is not clear what to make of VI. Why, that is, all that we infer could not be the best explanation provided by our minds, not reflecting the real existence of any designer?

The claim VII is similarly unclear. Why cannot the laws operate without any agent, any conscious intervention? Presumably we can repeat the question and ask whether there is a designer of laws. That is fair, but that is a different question. Paley makes a stronger claim, that the notion of a law absent a designer is meaningless.

Design clarified. Distinguish first between individual intervention and single intervention. You may think that each observable event is a direct result of God's intervention. Or you may think that God decrees laws that 'produce' individual processes.

Similarly, you have a distinction between the theories of intelligent design and theistic evolutionism. According to Intelligent Design, each complex adaptation is a direct result of God's intervention. According to theistic evolutionism, God decrees sets in motion evolutionary processes that are responsible for complex adaptations. Theistic evolutionism is a thesis about the origin of the universe, and is consistent with the atheist evolutionary theory.

The best formulation of the design argument is *probabilistic*. We can never get a logical inference that would show a contradiction in the chance hypothesis. Rather, we should say that, if a mindless system appears teleological, it probably was made by an intelligent designer.

We should also watch out for *different* hypotheses involving chance.

Example 1 (Sex ratio). Empirical evidence suggests that there are more boys than girls born every year. Say that according to the chance hypothesis, the probability that either a boy or a girl is born is $1/2$. Then:

$$P(B > G|\text{Chance}) = P(G > B|\text{Chance}) \gg P(B = G|\text{Chance}).$$

But $P(B = G|\text{Chance})$ is very small. So $P(B > G|\text{Chance}) \approx 1/2$ in every given year. So $P(B > G|\text{Chance}) < (1/2)^n$ in n years. There is another piece of evidence, that boys die earlier than girls. So, in order to offset this inequality, the good Providence instituted the uneven sex ratio at birth: it is by design that $B > G$. (Therefore, also, polygamy is wrong.)

But there is an alternative explanation based on natural selection. Here is a simplified sketch (due to Carl Düsing and in part to Darwin). The key idea is to consider three generations: the parental generation, offspring, and grandoffspring. Suppose there are m males and f females in the offspring generation. They produce N individuals in the grandoffspring generation. Then each male and female offspring will respectively produce N/m and N/f individuals in the grandoffspring generation. So the minority sex in the offspring generation will have a higher reproductive success! Thus a parent wishing to maximize his success in the *grandoffspring* generation will overproduce offspring of the minority sex. Clearly an equilibrium should be reached: this happens when there is an equal distribution of sexes at the age of reproduction. Notice that monogamy is not demanded here: even if occasionally some males will have more than N/m offspring and some will have none, on average the number will be the same.

A more adequate solution is due to Ronald Fisher. It involves an additional idea of *parental expenditure*. Ignoring fathers, we imagine that a mother has a certain energy to spend on her offspring. Let E_m be the energy spent on male offspring and E_f be the energy spent on female offspring. We also assume that a mother invests equally in sons and daughters. Then we have: $mE_m = fE_f$. But since, as Arbuthnot already noticed, male mortality is higher, we have $E_m < E_f$. Then to preserve the equilibrium we should have $m > f$.

Definition of evolution. Sober begins with the question of the subject of the evolutionary theory. Some have proposed to define it as a 'change in gene frequency'. There are several objections to this idea. (1) There can be a change in genotype frequencies without a change in gene frequency. This happens in the case of non-random mating. Suppose before mating there were 400 individuals with 100 *AA*, 200 *Aa*, and 100 *aa* genotypes. The relevant frequencies are 1/4, 1/2, 1/4. The frequencies of both *A* and *a* are 1/2. A simple application of the Hardy-Weinberg principle shows that a non-random (assortative) mating would produce a change in those frequencies: 3/8, 1/4, 3/8 respectively. But the gene frequencies have not changed, remaining 1/2. However, it is not credible to deny that this process is not evolutionary. (2) There are elements outside the chromosomes that can influence inheritance. These hereditary features can affect phenotype. Consequently, it should be plausible to label these changes too as evolutionary. (3) A change in the number of organisms in the given species does not necessarily entail a change in gene frequencies. But such a change may still be evolutionary. (4) Finally, evolution was in play already before the emergence of the first genes.

The place of evolution in biology. Here we have to note that the evolutionary theory deals with (the already familiar) ultimate explanations. In explaining the behaviour of the given organism it looks into the distant past for identifying relevant causes. It is not interested in the mechanisms responsible for producing such behaviour. It rather asks why these, and not other, mechanisms emerged in the first place.

Elements of Darwinism. Many of the points made here are familiar from Kitcher's discussion. Darwin's theory rests on two major claims, the tree of life and natural selection. The tree of life claim consists in the speculation that many present species share common ancestors. This idea entails evolution, a change from one species to another. Moreover, in contrast to Lamarck, there is a single tree of life.

The claim of natural selection can be split into three components. (1) There is phenotypic variation among organisms. (2) There is fitness variation among organisms presumably caused proximally by phenotypic variation. Some are better adapted in terms of survival and reproduction than the other.

(3) Phenotypic traits are inherited. Heritability must be understood probabilistically. On average, parents with a certain trait pass it down to their offspring.

The tree of life contains two kinds of events, macroevolution and microevolution. The latter is relatively clear. There is a random emergence of an organism with a novel trait. Then there is a mating and inheritance of that trait. Macroevolution is much more controversial. Here we entertain the possibility that a new species can emerge from a another species. That is a major change. In explaining that kind of change, Darwin repeatedly insisted on graduality. Minute variations accumulate in time to result at the end in big variations. This is anagenesis. Then there is cladogenesis. Migration and environmental pressures can lead to a branching split of the given species. Interestingly, Darwin himself insisted on a single evolutionary mechanism in play in causing microevolution and macroevolution. He did that without much empirical data to support it. Current evidence seems to corroborate his speculation.

Evolutionary causes. Some of the causes we have already mentioned in passing. *Natural selection* ('survival of the fittest') is obviously one of them. *Migration* causes inflow and outflow of genetic material into and from the given population. Here we have a cause that is not all biological in nature. *Mutation* and *recombination* are two other causes. Special note should be taken of the *random genetic drift* (see illustration on the board). This phenomenon occurs due essentially to sampling error in a finite population. Consequently, it is felt much more strongly in relatively small isolated populations.

Biology and physics. Every biological phenomenon is obviously also a physical phenomenon. Organisms and their genetic material consist of the molecules and atoms that obey the laws of physics. Nevertheless there is preciously little to say about the links between biology and physics. Even if a reduction were possible in principle, its possibility is in no way (so it seems) helpful for the actual biological research.

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