Karl Popper, Artificial Life, and the curious tale of the hopeful *behavioural* monster

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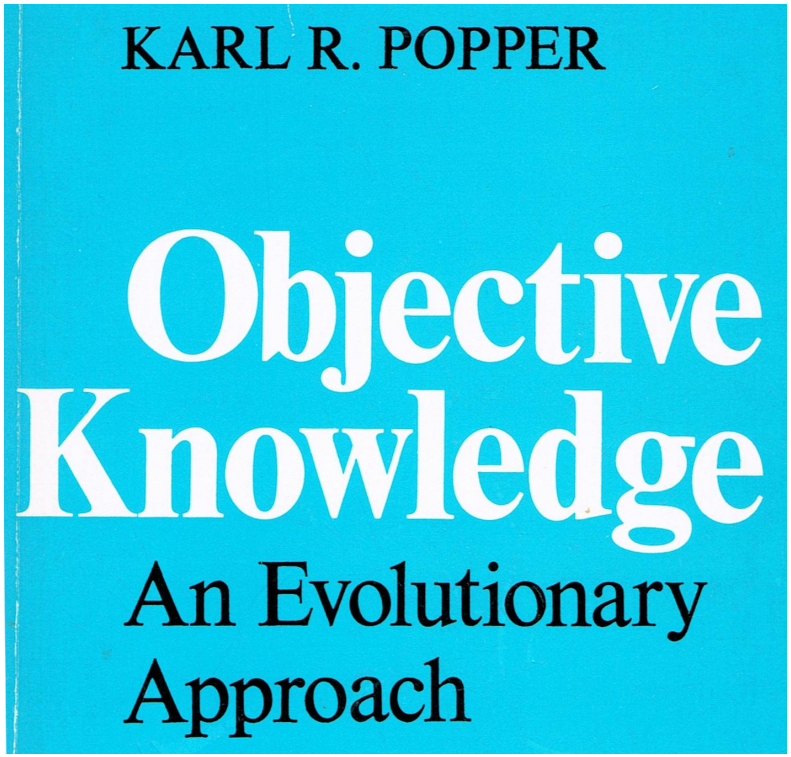
The greatest miracle?



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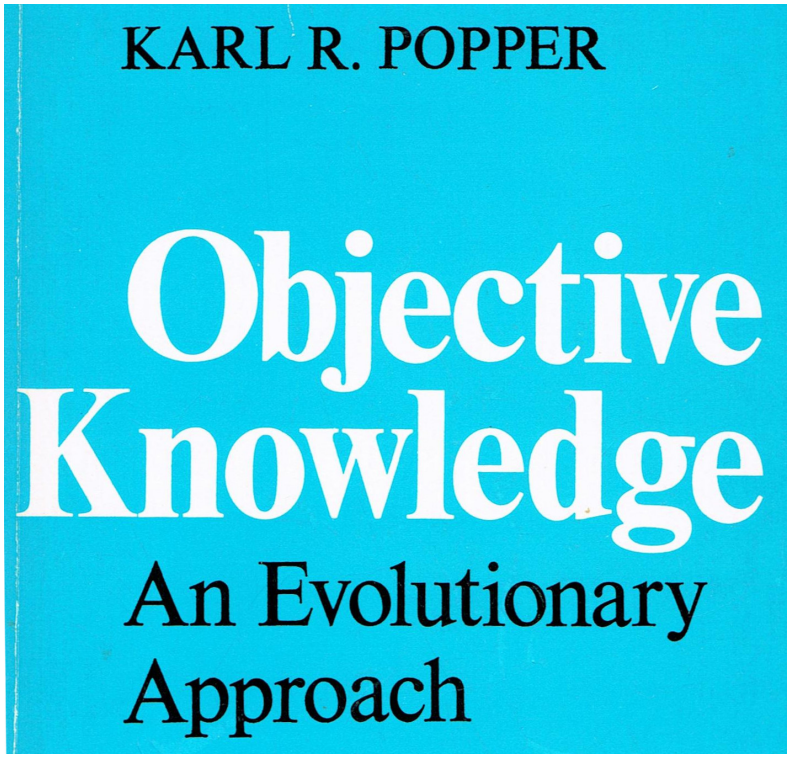

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What's our *problem*?

7. Evolution and the Tree of Knowledge

Based on the Herbert Spencer Lecture, delivered in Oxford on 30 Oct. 1961. The more significant additions, including whole new footnotes, have been indicated by square brackets, and the Addendum has been added in 1971.

The problem to be solved is the old problem of orthogenesis versus accidental and independent mutation — Samual Butler's problem of luck or cunning. It arises from the difficulty of understanding how a complicated organ, such as the eye, can ever result from the purely accidental co-operation of independent mutations.

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Back to the future

I take as my model an aeroplane — for example, a fighter plane — steered by an automatic pilot. The aeroplane, we assume, is built for certain definite purposes, and the automatic pilot is furnished with a number of inbuilt reactions, which amount to 'instructions' to attack a weaker enemy, to support a friend in attack or defence, to flee from a stronger enemy, and so on.

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Looking inside the box: hierarchical control

The mechanical parts of the automatic pilot upon which these 'instructions' depend constitute the physical basis of what I shall call the **aim-structure** *of my model. In addition, there is what I shall call its* **skill-structure**. *This consists of such things as stabilization mechanisms; steering controls; aiming controls; and so on. Together [the aim-structure and the skill-structure] constitute what I propose to call the* **central propensity structure** *of the automatic pilot, or, if you will, its* **'mind'**.

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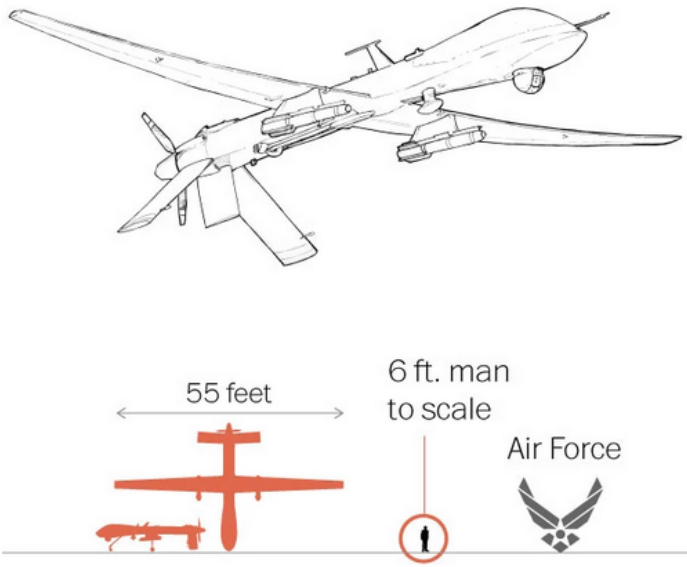

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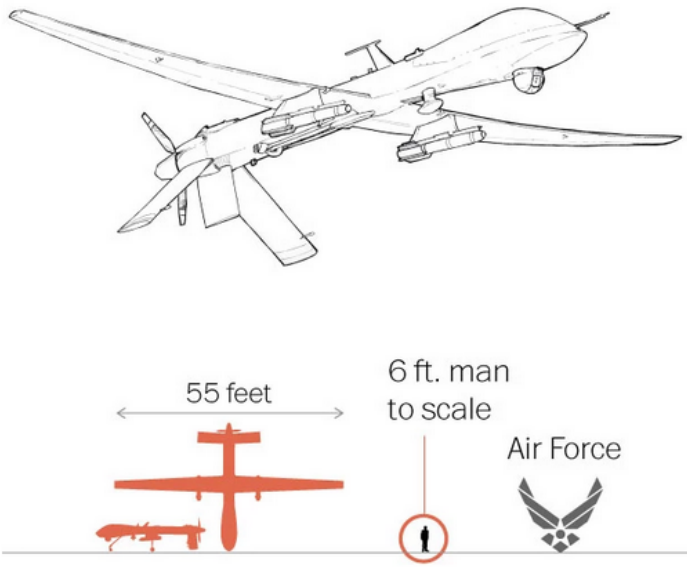

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A spanner in the works?

Now to take an example. Let us say a mutation gives all the engines greater power so that the plane may fly faster. This must be considered favourable both for attacking an enemy and for fleeing; and we can assume that its aim-structure will induce the automatic pilot to make full use of the increased power and speed. But its skill-structure will be adjusted to the old engine and top speed . . . the speed will be too fast for it and the plane will crash.

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So what?

Our main result is this. Once a new aim of tendency or disposition, or a new skill, or a new way of behaving, has evolved in the central propensity structure, this fact will influence the effects of natural selection in such a way that previously unfavourable (though "potentially" favourable) mutations become actually favourable if they support the newly established tendency.

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Parting thoughts

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I do not think that [this] hypothesis can be very easily tested. Yet I do not think it is untestable. However, before possible tests can be serious discussed, the hypothesis will have to be critically examined from the point of view of whether it is consistent; whether, if true, it would solve the problems it sets out to solve, and whether it can be improved, by simplifying it, and by sharpening it. At the moment I offer it as no more than a possible line of thought.

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$$P_1 \begin{cases} \nearrow & TT_a \rightarrow EE_a \rightarrow P_{2a} \\ \rightarrow & TT_b \rightarrow EE_b \rightarrow P_{2b} \\ \searrow & TT_n \rightarrow EE_n \rightarrow P_{2n} \end{cases}$$

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References I

Popper, K. R. (1961). Evolution and the tree of knowledge. In *Objective Knowledge: An Evolutionary Approach*, chapter 7, pages 256–280. Oxford University Press, Oxford. Based on the Herbert Spencer Lecture, delivered in Oxford on 30 Oct. 1961; addendum, 1971.

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