Minds, Machines and Gödel: Another Reply to Mr. Lucas

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machine which, when presented with a formula, always attempts to provide a proof of this formula from certain axioms and rules of inference; which, when it has found a proof, shows a green light, or spells out the words 'I have proved the formula', and when it has reached a deadlock or tried all the relevant combinations without success, shows a red light or spells out the words 'I cannot prove the formula'? Then, if these lights or words are treated as assertions, we have provided the machine with a way of asserting that the Gödel formula is unprovable by it, which is all that the human mind can do. Thus the Gödel theorem does not demonstrate a difference between minds and machines.

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MINDS, MACHINES AND GÖDEL:

Another Reply to Mr Lucas

F. H. GEORGE

I would like to draw attention to the basic defect in the argument used by Mr J. R. Lucas (Minds, Machines and Gödel, *Philosophy*, July 1961, p. 112).

Mr Lucas there states that Gödel's theorem shows that any consistent formal system strong enough to produce arithmetic fails to prove, within its own structure, theorems that we, as humans ('minds'), can nevertheless see to be true. From this he argues that 'minds' can do more than machines, since machines are essentially formal systems of this same type, and subject to the limitation implied by Gödel's theorem.

This is a very brief summary of what is a more complex and interesting argument, which does indeed show that what we might call 'deduction systems' are limited by factors that do not limit human beings. Now the trouble is that this only disposes of *deductive machines* and these are really of no cybernetic interest in any case. Cybernetics has been almost wholly concerned with what are called 'Inductive Systems', or probablistic machines that are capable of producing the axioms from which deductive operations start, and these are obviously beyond the range of being formal systems in the sense that makes Gödel's theorem applicable to them.

It may be argued that it has not yet been fully demonstrated that machines can perform inductions and can learn, think, etc., but whether this is so or not, it is quite certain that such machines are not liable to the criteria which Mr Lucas would like to impose. Or, to put the matter another way, as it was put by Professor D. M. MacKay at a recent meeting at Oxford, if you introduce the person (or mind) who goes beyond the purely deductive system, then there is no reason why mind and deductive system should not be collectively mechanised.

The point really is that in cybernetics we are not dealing with machines that are wholly specified in advance. They are self-programming or self-organising and their subsequent behaviour will depend upon the environ-

ment in which they operate, so that even the principles on which they start to process their environment may themselves change in the course of time. Thus there is no difficulty in exhibiting an artificial system which will change its own original 'goals', for example. It is therefore clear that no limit of the kind implied by Gödel's theorem can be placed on possible machines, where by machines we mean anything which can be *effectively constructed*. Thus I shall also argue that the conclusions Mr Lucas draws from his argument, to the effect that the bogey of mechanist determinism may be lifted from us, if these words are as simple in meaning as they look, is simply not true.

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PROFESSOR WADDINGTON'S NATURALISTIC ETHICS

LORD HALSBURY

In an interesting work 'The Ethical Animal' Professor C. H. Waddington valiantly attempts to bridge the gap between 'ought' and 'is' without, it seems, succeeding in doing so. Notwithstanding his erudition, honesty of purpose and charm in exposition, the gulf remains unbridged. Indeed there are passages where it is difficult to be certain whether the author considers that he has bridged it or even what standpoint he finally adopts. In a key chapter entitled 'The naturalistic fallacy' the following passages occur in sequence:

(a) . . . 'But apart from the manner of expression employed, the intuitionists do seem to have established the point that ethical statements cannot be reduced to non-ethical statements without omitting something which they originally contained; any full translation of an ethical statement into other phrases must still include at least one ethical word.'

(b) . . . 'As a matter of fact, I am not certain I am prepared to accept the refutation of the naturalistic fallacy even in its application to the normal ethical concepts to which it is properly applicable.'

(c) . . . 'However, for my major purpose the validity or otherwise of the refutation of the naturalistic fallacy is irrelevant. I wish to maintain that it is possible to discuss, and perhaps to discover, a criterion which is not of an ethical nature, but is, if you wish, of a supra-ethical character; a criterion, that is to say, which would make it possible to decide whether a certain ethical system of values is in some definite and important sense preferable to another.'

(d) . . . ' "What would it be wise for me to do and for what reasons?" can be deduced from the answer to the question: "What has the world at large been doing during its history and from what causes?" '

It is not easy to discover from the above exactly what Waddington now does believe, and a critic of (d) might well answer that the world at large has been doing such very odd things for so long that no unambiguous