DO COMPUTERS THINK?

by Duncan Roper

Recently, I witnessed a T.V. programme depicting student lifeat an American Law School in which a somewhat vigorous competition developed between the Law Faculty and the Engineering Faculty over the power of a computer. It began with laying odds to the effect that the computer could produce a better case analysis than a student. After several students had failed the test, the illustrious professor challenged the computer (together with the professor who had programmed it, it should be added!). Even the Law professor, for all his knowledge of detail and principle, was just pipped at the post in respect of most of the judgments and cases that were cited. However, the professor resorted to a complex problem that had been posed to him by a junior student, and which, up till that point, he had fobbed off, and posed it to the computer. As it involved grappling with notions of justice in relation to a hypothetical situation in which existing case histories did not serve adequate precedent, the giant mainframe went into overload, and had to be switched off. Thus it was that the Law Faculty was able to regain some sense of pride, and indeed to justify its very existence!

The incidents reported here may have been fictitious, but they hone in on a very serious and important question that we will increasingly find ourselves having to address. Is a computer or a robot alive? Does it think? What is its relation to the human brain? What is the human brain in relation to our experience of thought, feeling and willing? Is the computer likely to outstrip man's powers of thought and design?

Already these questions are being given answers both at the popular and at the academic level. There are reports of young people becoming so addicted to computers that they spend almost half of their entire lives playing games and programming computers, convinced that the computers are alive and have minds of their own. Because of a whole range of factors, such influences have caused people to become psychologically disturbed.

Then at the academic level, interest in the prospects of thinking and learning machines has been a flourishing source of research ever since the development of Cybernetics on the part of Norbert Wiener during the Second World War.

Cybernetics has its origin in the designing of automatic anti-aircraft batteries, developed in an effort to deal with the problem that high speeds of aircraft, coupled with slow reaction times on the part of human gunners, posed for the protection of populations from attack from the air. In 1947, in close cooperation with physiologists, psychologists, mathematicians and electrotechnicians, it was decided to give the whole field of guidance and communication the name cybernetics, derived from Greek for 'steers-man'.

Of special importance to the development of this field since its inception has been the mathematical theory of probability, information theory, communication theory, control engineering, and communication engineering, and central to these are the concepts of 'the feedback principle', 'information' and 'communication'.

The basic idea of 'feedback control' is that any deviation of the actual path from a preset design is fed back into the mechanism so as to restore the actual path to its pre-set design. A thermostat or a float on a toilet cistern provides elementary examples of what is involved. In a sense the feedback principle rests on information, the information that is (a) fed into a device setting a pre-assigned path (the desired temperature of a room; the level of water in the cistern; the flight path of an aeroplane) and (b) received from the environment as measuring the actual performance of the device (the actual temperature of the room; the level of the water in the cistern; the position and flight path of the aeroplane).

Information as it is related to human knowledge, however, not only involves data that measures and quantifies physical properties. It also involves the exercise of cultural formative power with regard to the way these physical properties achieve the desired end. To this extent the necessary analysis, design and theorizing necessary to the functioning of such devices is excluded from 'the information' involved in their functioning once designed.

In the case of the toilet cistern, it is the human design involved in the floating ball-cock, connected to a means of cutting off the water-supply, that enables the system to be set up to function more-or-less automatically on the basis of a feedback mechanism. However, to achieve this situation, it is necessary to have some knowledge of the way objects float in water, and of the way that they might be utilised to shut off a water supply. Such knowledge, as information, may be neglected only once the system is functioning automatically in terms of feedback control. In the case of the thermostat, it is the human design involved in some device such as a bar made of two dissimilar metals, utilising the knowledge that metals when heated expand to different extents, thus causing them to bend on heating, thereby disconnecting the power supply, and interrupting the heat output, causing the temperature to drop to a pre-assigned level. Again, the information in the sense of the analysis and design of the device as such, is not included in the discussion of the functioning system as a physical system. Not all control systems need to be completely automatic. Indeed it is customary to distinguish between 'control' and 'state' variables in the mathematics of control engineering. The former are able to be pre-set by the human operator, whilst the latter are not. The general idea, of course, is to set the 'control' variables in such a way that the system achieves a desired end, in a minimum of time, by expending minimum energy etc.

Information theory, however, has been developed in a way that from the outset would appear to ignore the aspects of human conceptualisation, design, and symbolisation. This is particularly evident in the relationship that is supposed to exist between entropy and information. Entropy is a physical variable that relates especially to the energy of a thermodynamic system. As such, it relates to the tendency of an isolated system to tend toward 'disorder' and to function 'irreversibly'. By thinking of 'information' as the negative of 'entropy', it is thereby presumed to relate to the 'order' of the system. However, whilst the quantity of information, in this sense, may to some extent be able to be measured in accord with the formula I (information) = - p.log p, where p is the probability distribution of the states of the system, the issues involved in conceptualising and symbolising what we know of physical reality to achieve designed ends may not be so reduced to energy states.

Thus, the relationship between 'information' and 'entropy' would appear to indicate that information theory has little insight about the relationship between 'information' as conceptual, analytical, design knowledge, and the data that measures the state of a physical system. In reducing the former to the latter, human knowledge itself has already been reduced to energy states. Once 'information' has been defined in physically reductionistic terms communication is then understood as the transfer of information. Fundamentally, therefore, communication is the flow of energy. Such is the nature of the basic concepts that have been developed in information theory and communication theory.

One of the most important fruits of cybernetics is the digital computer, which, in terms of theory can itself be incorporated into the circular process of a feedback mechanism. There is a preset design that is set out by the programme to achieve certain ends. The programme has the possibility of being modified as it receives information concerning actual performance, in which case the programme itself may be somewhat modified. Such possibilities have contributed greatly to the theories of what is involved in 'learning' and 'self-reproduction' in machines such as robots and computers, and has developed to such an extent that many serious thinkers are debating the question not only as to whether or not computers think, but also as to whether they are alive, whether they can experience emotion, can make ethical and aesthetic decisions and should at some time in the future be given political rights.

The book Are Computers Alive? by Geoff Simons[1] is one such book that seriously puts forward the idea that computers are alive, that they think, and that they will shortly be capable of all manner of things. On the one hand the issues it raises seem very silly, almost laughable in places. On the other hand, however, the issues are very serious.

Central to the whole argument is a view of man, and Simons, along with many other modern thinkers, almost takes it for granted that man is a material monism in which all the other aspects of his or her make-up are capable of explanation via the physical substrate. Thus he writes that -

> Most scientists would agree with Lamettrie (L'Homme Machine) who proposed in the eighteenth century that the problem of mind was a problem of physics, suggesting that thought was a property of matter. Cyberneticists and functionalists may prefer a slightly different emphasis - to say that mind is a property of system organization with a capacity for information-processing. It is a weighty, albeit contingent fact, that the only systems of this sort that we have yet encountered are ones structured out of chemical elements.[2]

Utilizing the above notion of 'mind' together with a general idea of 'growth in complexity' in biology, animals, man and human culture, as well as of technology as 'evolution', one readily begins to grasp how easily this seemingly silly standpoint is given very plausible arguments. They are difficult to refute to the satisfaction of those putting them forward because they are so firmly rooted in ideas that have a very powerful spiritual grip upon our culture.

It is precisely for this reason that a thoroughgoing critique both of the technology of the computer and of anthropological theory is urgently required, and the most powerful tool for doing it adequately from a Christian standpoint is undoubtedly to be found in reformational philosophy, particularly as this has been developed by Egbert

Schuurmann in his book Technology and the Future.[3] Basic to this philosophy is the insight that created reality, as we experience it, has a number of irreducible aspects in which creatures may function as either subjects or objects. Human beings and stones, for example, are both physical subjects, but if I were to take a stone to write a message in the sand on the beach, then I, as a human being, function as a cultural, analytic, and lingual subject, whereas the stone, together with the sand, function as cultural, analytic and lingual objects, under the leading of me as subject. However, the stone, and the sand, undirected by a human subject, do not function as cultural, analytic or lingual subjects.

Similarly, electronic circuitry may function objectively in a number of ways, one of which is analytical or logical. Man utilises and develops these objective properties of electronic circuits to assist him in solving many of his problems. The computer itself, apart from the design and programming of the human subject, does not function analytically at all. Its subjective functioning is limited to the flow of energy. To function analytically it is necessary that man, functioning as an analytic, cultural and lingual subject, discovers and patterns the possibilities of electronic circuitry. Once this has been done, then the computer can function objectively to assist man in solving problems in new ways.

Man should do this with a view to developing and cultivating the earth in a way which is honouring to God, the Creator. As fallen creatures we can only do this with the help of the Holy Spirit through a living faith in Jesus Christ.

Thus for electronic pulses and marks on paper to qualify as 'information' there needs to be both an analytical conceptualization and a lingual symbolisation of what is involved. Information in this sense requires a leading activity on the part of an analytical and lingual subject. In the case of computers, in particular, this analytical and lingual subjective leading activity is accomplished by human beings, who use their technical skill to design these machines to function as analytical, social and lingual objects, with the purpose of assisting human beings in the furtherance of the cultural task.

To suggest, therefore, that a computer thinks or feels because it handles 'information' can be very misleading. It is undeniable that the computer is of great assistance to us in the handling of information, and that the responses that are made by it to us can have the appearance of communication. However, I suggest that the question that needs to be asked is: "Does the computer function as an analytical subject, or as a social and lingual subject?"

If I simulate a bark to a dog, no doubt there is a certain 'mode of communication', depending upon the mood of my bark. If I were to bark out the words 'Aristotle is a great philosopher' in such a way as to reproduce the general non-lingual and non-analytical features of my earlier 'communication' with the dog, then I doubt whether the dog and I are actually debating philosophy, although the dog may wag his tail and bark enthusiastically at my remarks! I might even teach my parrot to reply to the effect that "Aristotle's doctrine of substance is wrong!" Granted, I might be able to programme my computer to be able to present a more sophisticated appearance of learning some philosophy, but I'm inclined to the view that its subjective analytical life does not really get much beyond that of the parrot, and that its subjective communication does not get much beyond that of my interaction with the dog. The difference with the computer, of course, is that it has been designed by human beings

to achieve certain ends: the handling and storage of information. However, as I've already mentioned above, the whole discussion turns upon what is meant by information. The electronic circuitry of a computer functions subjectively as a flow of energy in terms of pulses that are either on or off. Insofar as the distinction of yes/no, true/false etc. in logic has physical analogies in the on/off functioning of electric circuits, they may be designed to objectify analytically and lingually qualified information, but to be able to do so requires that the programmer and the computer designer have utilised and developed the machinery for the said purposes. This requires the analytical and technological leading on the part of an analytical and cultural subject: man as programmer and designer.

The question of whether or not computers think, whether they can feel, whether they can recognise jokes, etc. is, therefore, really a rather misplaced kind of question. Computers have already been programmed to be able to assist human beings deal with certain aspects of very complicated conceptual problems, especially those involved in processing large quantities of numerical data, or sorting through large quantities of other data. This is because the electronic processes move exceedingly fast, and the computer is capable of storing large quantities of 'information' (i.e. electrical states that have been objectified as having analytical and lingual object functions).

It certainly is possible to programme a computer to exhibit similar object functions with respect to feeling, humour, ethics and aesthetics.[4] Indeed it wouldn't be too hard to programme the computer to answer the catechism correctly. I'm not sure that that would warrant its being judged regenerate and suitable for reception of Communion at the Lord's Supper!

Again it is interesting to note, for example, that a person like Julian Huxley would appear to be willing to concede that computers think, but balks at the possibility of their experiencing emotion. Simons quotes the case of a BBC TV Brains Trust in which he asked this question of Sir Julian as follows:

> In some important sense the intellectual faculty of the modern computer is well established: computers can, for instance, perform arithmetic operations, take decisions and argue logically. Is it likely that in the foreseeable future machines will be created that may be said to experience emotion?[5]

Huxley did not query the sense in which computers might be said 'to have an intellectual faculty' (namely in the terms I have tried briefly to discuss above), but sought to claim that emotion was necessarily an experience of living matter. From an evolutionary thinker like Huxley, this conclusion is indeed interesting, for he seems to be wanting to resist the implications of the man = computer equation, without an ability to philosophically do so.

Man, the image-bearer of God, is the cultivator of the earth's resources. He continues to be responsible to God for the unfolding and shaping of the earth. We develop tools to assist us in the task, but we may not idolise either our tools or our products without gross harm to ourselves. Well did the writer to the Hebrews say after quoting from Psalm 8, that:

> In putting everything in subjection to man, he left nothing outside his control. As it is, we do not see everything in subjection to him. But we see Jesus, who for a little while was made lower than the angels, crowned with glory and

> honour because of the suffering of death, so that by the grace of God he might taste death for every one.

Rather than see the possibilities of computers and robots becoming like us, perhaps we need to take a new look at Christ, and learn to subdue the earth in a spirit that learns from His headship of the new humanity! The humanism that has increasingly taken grip of Western culture has become infatuated with man's actual or potential cultural and technological achievements to the point that it seriously threatens the insight that humanity has been charged by God to take responsibility for the unfolding of the potential of the earth's resources. To look to computers and robots as aids is one thing, to look to them as deserving to be taken seriously as responsible creatures is quite another.

Jesus Christ, as the head of the new humanity, has renewed us from all idolatry, called us to look to him as our elder brother, to be redeemed fully in Him, that we, within the context of this fallen world, might once again take responsibility to rule the earth under God, wherein the Kingdom of God might take root in our midst. The task to do this with respect to the new technology is part of the challenge to the Christian Community.

REFERENCES

[1] Harvester Press 1983.
[2] Simons, ibid., p. 186. Emphasis added.
[3] Wedge, 1981.
[4] Refer for example to The Intimate Machine by Neil Frude, London: Century Publishing Co. 1983.
[5] {?} Simons, ibid., p. 185.