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THE BRAIN AND COMPUTERS

Introduction "Reasoning is but reckoning," said Hobbes in the earliest expression of the computational view. Three centuries later, with the development of electronic computers, his idea finally began to catch on: and now, in three decades, it has become the single most important theoretical hypothesis in psychology, and also the basis of an exciting new research field, called "artificial intelligence."

What is a computer? It is an automatic formal system, and a formal system is as a game in which tokens, for example, are manipulated according to rules, in order to see what configurations can be obtained. Basically, to define such a hypothetical game, three things have to be specified:

1. What tokens are; what they represent for a human observer (semantic level)
2. What the starting position is;
3. What moves are allowed in any given position.

Three important considerations follow from the previous point.

First, a formal system is entirely *self-contained*. The "outside world" makes no difference whatsoever in the game. Then, a formal system can consider only the things inside its world, only the knowledge that someone has put in its memory.

Second, every relevant feature of the game is *perfectly definite*; there are no ambiguities, approximations, or "judgement calls" in determining what the position is, or whether a certain move is legal or not. For this reason that computers are also defined as machines a discrete state.

Third, the moves are *finitely checkable*, in the sense that for each position and each candidate move, only a finite number of things have to be checked to see whether that move

would be legal in that position. This happens because otherwise it should be possible not to find a solution in a finite time.

If a game or a system has all three proprieties is will be called *digital*. All formal systems are digital, with this important consequence: two systems that seem to be quite different many nevertheless be essentially the same. This characteristic, called formal equivalence, implies that if the brain would be a formal system than it would have been possible to built machines completely equivalent to the mind!

Automatic formal system It is a physical device that automatically manipulates the tokens, the data or everything, of some formal system according to the rules of that system. It is like a chess set that sits there and plays chess by itself. Such system can be built and looked at the right way is exactly what a computer is. A computer programmed with an AI software can, for example, play chess by itsself, learn from its errors and improve its strategies.

Computer system A computer is constituted by different parts. *Input components* as the keyboards, the mice, etc. are necessary to put the information, that has to be elaborated, inside the machine; the *computer system* that, composed by hardware, software, CPU, etc. allows the elaboration of the data; the *output components* as videos, printers, etc. that permit us to see the final results. Computer system, since it processes the information, can be considered the "brain" of the our machine. Computer system can be defined as an integrated functioning of computer components as a single entity, divided as in the following table .

1. Components of a computer system

Hardware component	Software component
main memory	operating system
mass storage	compilers
I/Q processor	interpreters
CPU	assembler
bus network	editor
	application programs

These components below at each computer, but we have to make an important distinction. The computers that possess only conventional program, have only the

characteristic exposed in the previous table; they know nothing about the world, they follow mere formal procedure and they are able to resolve only recursive problem[1] without learning, without using strategies. The computers that use Artificial Intelligence applications have the same technical characteristic of the conventional one but they differ from conventional programs in that AI programs need also to represent the information, or knowledge, of a given domain, and given this knowledge, need operator to deduce information from it. Then AI programs are able to face a problem that they would require “infinite” possibilities (for example the “infinite” locations where my token could be) like the chess play, using inferential processes, cognitive strategies. This kind of programs can make a mistake and improve their strategies from these mistakes, more or less like a human being. We must say that the computers that use the AI program are less efficient than the conventional one, and this because the knowledge has a very high cost in terms of memory and complexity.

The following characteristics show the differences respect the conventional computer

2. issue related to Computer System for AI Applications

Issue	Examples
-representation of knowledge	-Hardware support for knowledge representation
-knowledge base	-Hardware support for operations on knowledge
-control	-Hardware support for parallelism
-human-computer interface	-Real time interface with the computer system

The cognitive psychology attends to the field of the AI "as an interdisciplinary approach to understanding human intelligence that has as its common thread the computer as an experimental vehicle."

The computer metaphor of mind. Now, it could be useful to consider certain apparent similarity between computer and human brain, and to consider how these similarities can bring some new possibility to comprehend mental process:

[1]A problem is recursive when is described by a fuction in which the “N” case can be explained from the “N-1”

1. Both computers and brain can be viewed as processors of information. In fact, they take inputs from various sources, transform and manipulate them, and at the end they produce outputs.
2. Both can be described as achieving their diverse results by combination of many similar elements performing simple factions. In computers, electrical cells get switched on and off. In brain, nerve cells are excited or inhibited.
3. Both computer and brain can be seen as general purpose devices. They can perform many different operations with the same hardware.
4. Both can store and use large amounts of information.
5. Both might be said to follow organised plans for action (programs).

Cognitivism In psychology and philosophy it is roughly the position that intelligent behaviour can only be explained by appeal to internal "cognitive process," that is, rational though in a very broad sense. Cognitivism tries to formulate scientific explanations of the world and how the brain perceives, memorises, elaborates the environment. Scientific explanations differ from the common-sense explanation at least in being more explicit, more precise, more general, more deliberately integrated with one another. If it were possible to create a machine that is capable to give the same output of the brain, given the same input, it could be the most tangible proof of the brain's functioning.

Algorithm and human behaviour It could be useful to consider that sometimes the human behaviour is very similar to the computer behaviour. Have a look at this very simple example.

A boy is going to take a can of Coke in a machine. He checks in his pocket if he has some coins. In this case he takes the first coin from him pocket and he inserts it in the machines. He does this with the first coin, but one is not enough and then the machine does not give the can. He looks for another coin in his pocket and he finds it. He puts this coin in the machine that give to him the Coke. The boy takes the can and goes away, happy for the success. This boy, without knowing, followed a formal procedure, called algorithm, in the

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case.

same way that a computer would have been able to do it. The “formal” algorithm that it could permit to a computer to solve the same problem could be something as the follow one:

1. aim: to have a Coke
2. Do you need a coin? Yes, go on; no, go to 6
3. Do you have a coin? Yes, go on; no, go to 7
4. insert a coin
5. It is enough? Yes, go to 6 ; no, go back to 3
6. take the Coke; you have reached the aim 1, go to 8
7. I am sorry. You have failed
8. End

The computer can solve only the problems of which I can write the algorithm. Unfortunately, often it is impossible to write a conventional algorithm (a conventional should be more efficient) and this for two reasons: the first is that the algorithm does not exist (the task cannot be represented by a recursive function), the second is that it needs too much time to be finished. An example of the first case could be to write an algorithm about the behaviour of one child when he is playing: of the second to choose the best move in a match of chess.

I think is very meaningful the fact that few years ago one computer, programmed in AI, won versus the best chess player of the world, using the same strategies written by the best players and playing by itself, versus itself for a long time.

Brain and artificial intelligence (AI) There are two different positions in the field of artificial intelligence: the strong and the weak. According to strong AI, appropriately programmed computers literally have cognitive states, and therefore the programs are psychological theories. According to weak AI, the principal value of computers in the study of the mind is that it gives us a very powerful tool. For example, it enables us to formulate and test hypotheses in a more rigorous and precise fashion than before.

According the strong AI the appropriately programmed computer really is a mind in the sense that it can be literally said to understand and have other cognitive states. Then, the problems

are not mere tools that enable us to test psychological explanations, the programs are themselves the explanation.

The Schank's program can give us one example. The aim of the program is to simulate the human ability to understand the stories (simples and above all within a delimited environment, as a restaurant, for example), therefore to answer questions about the stories even though the information they give was not explicitly stated. In order to do so, the Schank' computer has a "representation" of the sort information that human being have about restaurant for example, which enables it to answer simple questions. Partisans of strong AI claim that it is not only the machine simulating a human ability but also the demonstration that 1) the machine can understand the story and provide answer to question and 2) the machine and its program explains the human ability to understand the story.

Again the first assertion Searle makes the following example. He is inside a room. He receives a message in English and he is able to associate to each English word a Chines symbol, only following the instructions written inside the room. Then, without knowing Chinese he can translate and answers questions in the written Chinese only because the rules, in his mother language, enable him to correlate one set of formal symbol with another set of formal symbol (it is the famous model of the Chinese room). Searle affirms that is clear that he does not understand the stories in Chinese even if, for a man outside the room, it is impossible to know that he cannot speak Chinese. Searle can have any formal system he likes, but he still understands nothing. Schank's computer, for the same reason understands nothing of any stories. As regards the second claim, that the program explains human understanding, Searle asserts that computer and its programs do not provide sufficient conditions of understanding, since the computer and the program are functioning and there is not understanding.

Semantic It represents the meaning of a logic program or an expression, practically what Searle affirms that computers have not. To derive the meaning of sentences, phrase, or word properly, the context must frequently be taken in account.

Computer and common sense It is meaningful to consider that the most difficult thing to teach to a computer is the common sense, that is the simplest way by which the persons give

sense at the daily activities. How can we explain to a computer for example that is better to smear the butter before the jam? The problem of the knowledge of gestures and heuristics, of something that it is too easy for a human being to have transformed in a formal sequence of cognitive steps, fills the memory of the actually computer and it cannot be resolved now.

Godel's theorem In this theorem he affirms that in any consistent system there are formulae that cannot be proved in the system, but which we can see to be true. It follows that no machine can be a complete or adequate model of the mind, that minds are essentially different from machines. Human beings, in fact, are not confined to making only deductive inference, then the model of the mind would have to allow for the possibility of making nondeductive inferences. For these reasons, professor Putnam has suggested that human beings are machines, but inconsistent machines.

Conclusion It is possible to make a lot of consideration about the problem of computer & mind. For example it could be very interesting making this question about the problem of the Searle's Chinese room. Clearly the individual inside the room does not understand Chinese, but does the "room" understand Chinese? And, in which sense we can claim that a man from China, who speaks Chinese, understands Chinese? Is it not possible that individuals use formal procedure as well? Is it not possible that the only dhfference (in the cognitive level) could be that individuals understand because they posses the semantic of the signs and because they are able to connect the worlds to the meanings and one meaning to the other?
To attend to these kinds of problems allows us to feel the complexity of the human intellect in understanding and thinking. It shows uc that we do not really know "anything" about the brain except the physiological reactions. But we do not have to forget the psychological and social problems linked in the, building of a, maybe, intelligent machine. Individuals are, in fact, used to consider that a machine can be better in washing dishes but I think it should be difficult to accept that we could need of a computer when our brain will not enough intelligent.

I think that we do not fear the computers even if they will become really intelligent. A computer can win every match in the chess' game, but it'll be never able to enjoy itself.

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