Turing's contributions to the philosophy of computation

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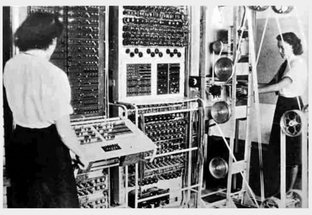
Alan Turing is often regarded as the pioneer of the digital era. Undoubtedly a breakthrough, a thought experiment that is today referred to by the name of a universal Turing machine, essentially gave the idea of a universal computing device that could be programmed and reprogrammed for a specific task, instead of constructing separate machines for different procedures.



Alan Turing is often called the father of computation but his most known contribution to philosophy is the Turing test for AI. Some have started wondering if the two could be related. Image credit: Wikimedia Commons (Public Domain)

A Turing machine is a conceptual devise running an infinite tape. It can inscribe a symbol or delete it, and it can move the tape right or left. A *universal* Turing machine is a Turing machine that can take other Turing machines as input. This may sound strange, but it essentially means that there can be a device which takes *programs* as inputs, thus doing away with the need of building separate gadgets for different purposes. That is exactly what modern computers do – they take programs as inputs and by this can compute whatever we tell them to.

These simple ideas allowed Turing and the whole legacy after him define computation itself and give a precise definition of an algorithm as whatever can be computed by a Turing machine.

Besides pioneering the field of computer science, Turing is also often credited with significant contributions to philosophy. The philosophical setting in the English speaking countries in the first half of the 20th century, permeated with the newly developed ideas in formal logic, was welcoming for Turing's logic- and mathematics-grounded ideas.

Perhaps the most well-known of Turing's contributions to philosophy is what is now called the Turing test – a criterion for a machine to be considered intelligent. But the most important contribution of the Turing test is often missed out – contrary to what is often thought, Turing did not invent the idea of artificial intelligence, which appeared almost each time a new technology developed since the late Middle Ages. What Turing did was give a precise way to think about what is and what is not intelligent: if we can not tell between a human being and a machine, then the machine is intelligent simply because we have no way of actually checking whether it is so.

The suggestion has appeared scandalous to some. It seems that humans do have *something* that a machine will never have. But the problem is – at least from a scientific point of view – that as of yet we have absolutely no way of telling what this something is, and even of verifying that it exists, despite our firm conviction that our minds are in some way special. In scientific terms, the latter claim is no different from the claim that unicorns exist, until there is some evidence to prove or disprove that.

The problem is a complex one and it invokes what some philosophers today call 'the problem of reduction'. It is basically a question of whether some phenomenon can be reduced into something more basic. In case of human mind, the question is whether it can be *fully* described in terms of computational (or biological, or computationally biological) processes. If it can, then our minds are just computers. If not, we do indeed have some mysterious faculty that make our minds special.

Recently some philosophers have started talking about another approach to reduction. It is called 'the levels of abstraction' approach and it states, roughly, that a phenomenon in question may be exactly the same as that which is described in more basic terms, it's just that there are many possible levels of describing reality. For example, human mind can be described as a computer but it is also a biological system, a physical system, as well as something that holds wishes, affections, fears and other things we commonly attribute to human mind. When we switch from one level of description to another, we *abstract away*, but this does not imply that we start talking about something else.

Is Turing's idea of a computing mind contrary to the levels of abstraction approach? Algorithmic information theorist and computational biologist Hector Zenil compares Turing's ideas to the legacy of another 20th century pioneer Claude E. Shannon – the person who started information theory and is essentially responsible for the concept of a bit as the minimal unit of information.

Shannon's idea of quantifiable information is a mathematically precise concept having little to do with the meaning of a sentence or a word. Information in information theoretic sense can be described as a certain unpredictability. For example, if someone keeps on repeating the same message, it is fully predictable and the information is null. But if someone keeps on changing the message, then the amount of information is equivalent to the difference between this message and the last.

Zenil claims that in case of information theory it is rather obvious that message content is not stripped of its meaning by quantifying how many bits it contains. One is merely choosing some level of description, one *abstracts away* from semantics and calculates what is useful in some context.

It is often claimed that Turing's idea of computing mind runs contrary to such interpretation. But Zenil invokes another, less fundamental of Turing's philosophical contributions, this time to philosophy of computation itself. The idea of a universal Turing machine, Zenil claims, erases the essential difference between various levels of computation. For example, it erases the distinction between *program* and *data*, because a program is data for a universal Turing machine – what such a machine does is essentially read the code and understand the instructions given – but it is also a program in the usual sense in relation to the data that is fed as input.

Thus a piece of code can be thought of as both – data for the computer program for its input. In other words, there are two ways we can look at it, two levels of abstraction that provide separate insights yet do not at all reduce one to the other.

Looking at Turing's often missed out contributions to the philosophy of computation, it may be possible to accommodate his ideas to the levels of abstraction approach which claims that there are many possible descriptions for the exact same phenomenon, each of them leaving all the others intact.

Article: arXiv: 1402.1099v1 [cs.GL] 5 Feb 2014, source link.

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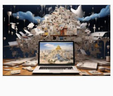

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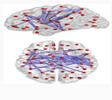

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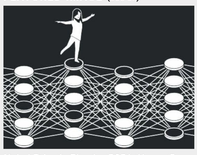

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