Tests and Thought Experiments

The Turing Test

In 1950, Alan Turing wrote a paper called **Computer Machinery and Intelligence**, and it was published in the journal **Mind, Philosophical journal**. He outlined the idea of an operational test for whether you could say that a computer or machine was intelligent or had a human-like intelligence.

In 1936, '37 he wrote a paper,which introduced the idea of a **Turing machine**, which was a mathematical abstraction supposed to represent the idea of a computer.

The Imitation Game:
The basic idea is that you put a computer and a person behind two separate doors in two separate rooms, and the doors are closed and you as a judge come up to these two doors and you can type questions (teletype). You can get back textual answers from both rooms. One is a person just answering questions the way a person would. The other room contains a computer whose job it is to fool you the judge into thinking that it is a person. Your job is to tell the two apart. If you can't do that in about 15 minutes or so, then as far as Turing is concerned in this paper, you could say that the computer is intelligent.

Variations of Turing Test:

- Man and a woman where the man tried to imitate the woman
- Young and an old person where the young tries to imitate the old

Sample questions and answers provided by Turing in his paper:

Q : Please write me a sonnet on the subject of the Forth Bridge.
A : Count me out on this one. I never could write poetry.

Q : Add 34957 to 70764
A : (Pause about 30 seconds and then give as answer) 105621.

Q : Do you play chess?
A : Yes

Q: I have K at my K1, and no other pieces. You have only K at K6 and R at R1. It is your move. What do you play?
A: (After a pause of 15 seconds) R-R8 mate.

We might think that a computer would never get questions like arithmetics wrong. But here, the computer is designed to mimic human error as well. The error that's made here is not a wildly off base error, it might be the kind of error that a person would actually make in adding two numbers.

The idea again is that Turing is not saying that if a computer can pass this test, it's a human, nothing like that. All that he's arguing is that as far as we're concerned, we could think of this test as a way of just in a concrete way settling the argument about whether a machine could actually be intelligent.

Objections to Turing Test

1. **The Theological Objection**

   "Thinking is a function of man's immortal soul. God has given an immortal soul to every man and woman, but not to any other animal or to machines. Hence no animal or machine can think."

   Turing believes that this argument implies a serious restriction of the omnipotence of God. He gives an example of Galileo when he argued that the sun stood still and the earth revolved around it. At present, Galileo's argument may be futile to us but at that time, the knowledge was not available to the society and thus the argument made quite a different impression.

2. **The 'Heads in the Sand' Objection**

   "The consequences of machines thinking would be too dreadful. Let us hope and believe that they cannot do so."

   Turing states that the above argument is resonating the feeling of superiority in man. We, as human beings, consider ourselves superior to any other organism on this planet. Thus, this argument is more inclined towards superiority of Man on this power.

3. **The Mathematical Objection**

   "There are a number of results of mathematical logic which can be used to show that there are limitations to the powers of discrete-state machines. The best known of these results is known as Gödel's theorem, 1 and shows that in any sufficiently powerful logical system statements can be formulated which can neither be proved nor disproved within the system, unless possibly the system itself is inconsistent."

If we use **Gödel's theorem**, then we need to describe a logical system in terms of machine and vice versa. The resultant refers to a digital computer with infinite capacity, but again there are certain things that it cannot do. There may be some questions which cannot be answered correctly by a machine and which can be answered by another machine. So Turing is supporting the questions which can be answered in "Yes" and "No".

Turing states that although it is established that there are limitations to the powers of any particular machine, it has only been stated, without any sort of proof, that no such limitations apply to the human intellect. The machines cannot be right 100% but so do human beings. He says that, "there might be men cleverer than any given machine, but then again there might be other machines cleverer again".

4. The Argument from Consciousness

"Not until a machine can write a sonnet or compose a concerto because of thoughts and emotions felt, and not by the chance fall of symbols, could we agree that machine equals brain—that is, not only write it but know that it had written it. No mechanism could feel (and not merely artificially signal, an easy contrivance) pleasure at its successes, grief when its valves fuse, be warmed by flattery, be made miserable by its mistakes, be charmed by sex, be angry or depressed when it cannot get what it wants."

Turing says that this argument is a denial of the validity of the test. But the only possible way to be sure that the machine is thinking is to be the machine itself. One can describe what he thinks but he cannot justify.

5. Arguments from Various Disabilities

"I grant you that you can make machines do all the things you have mentioned but you will never be able to make one to do X"

There are many arguments which state that a machine cannot: Be kind, resourceful, beautiful, friendly, have initiative, have a sense of humour, tell right from wrong, make mistakes, fall in love, enjoy strawberries and cream. Turing says that many of these limitations are associated with small storage capacity of the machines. Also, the attempt of making a machine enjoy this delicious dish would be idiotic.

6. Lady Lovelace's Objection

"*The Analytical Engine has no pretensions to originate anything. It can do whatever we know how to order it to perform*"

A variant of Lady Lovelace's objection states that a machine can 'never do anything really new'. Turing says that machines do take him by surprise. He did calculate what should he expect of them, but the calculations are made in hurry and slipshod fashion, taking risks. He makes some assumptions but the result often surprises him and then the wrong assumptions are forgotten.

7. Argument from Continuity in the Nervous System

"The nervous system is certainly not a discrete-state machine. A small error in the information about the size of a nervous impulse impinging on a neuron, may make a large difference to the size of the outgoing impulse. It may be argued that, this being so, one cannot expect to be able to mimic the behaviour of the nervous system with a discrete-state system."

Turing agrees that a discrete-state machine must be different from a continuous machine, but this hardly matters for the Imitation Game as the interrogator would not be able to take advantage of this. He gives an example of a **differential analyzer**(a certain kind of machine not of the discrete-state type used for some kinds of calculation). The differential analyzer will choose a value at random between 3.12 - 3.16 with some random probabilities when asked for the value of Pi. It would be difficult for the interrogator to distinguish this from a digital computer.

8. The Argument from Informality of Behaviour

"It is not possible to produce a set of rules purporting to describe what a man should do in every conceivable set of circumstances. One might for instance have a rule that one is to stop when one sees a red traffic light, and to go if one sees a green one, but what if by some fault both appear together? One may perhaps decide that it is safest to stop. But some further difficulty may well arise from this decision later. To attempt to provide rules of conduct to cover every eventuality, even those arising from traffic lights, appears to be
impossible."

It is argued that we cannot be machines. The argument can be reproduced as "If each man had a definite set of rules of conduct by which to regulate his life he would be no better than a machine. But there are no such rules, so men cannot be machines." But Turing states that there is some undistributed middle in this argument. It is true that being regulated by laws of behaviour implies being some sort of machine but conversely conversely being such a machine implies being regulated by such laws. And there is no such circumstance under which we can say that we have searched enough and there are no laws.

9. **The Argument from Extra-Sensory Perception**

"I assume that the reader is familiar with the idea of extra-sensory perception, and the meaning of the four items of it, viz. telepathy, clairvoyance, precognition and psycho-kinesis. These disturbing phenomena seem to deny all our usual scientific ideas. How we should discredit them! Unfortunately the statistical evidence, at least for telepathy, is overwhelming. It is very difficult to rearrange one's ideas so as to fit these new facts in. Once one has accepted them it does not seem a very big step to believe in ghosts and bogies. The idea that our bodies move simply according to the known laws of physics, together with some others not yet discovered but somewhat similar, would be one of the first to go."

Turing states that it is possible for a man to guess the right answer(guess the number game) 130/400 times versus 104/400 times against a machine. But then again the machine may use a random number generator which will be subject to the psycho-kinetic powers of the interrogator. So the machine matches the accuracy of the man.

Learning Machines

There are three stages to the process of development of an adult human mind:

1. The initial state of the mind, say at birth
2. The education to which it has been subjected
3. Other experience, not to be described as education, to which it has been subjected.

Instead of trying to produce a programme to stimulate the adult mind, Turing proposes to produce a programme which stimulates the child's mind. Now we can divide the problem into two parts: the programme for a child's mind and educating the programme/mind.

Structure of the child machine	->	Hereditary material
Changes in the child machine	->	Mutation
Natural selection	->	Judgment of the experimenter

The **survival of the fittest** is a slow method. We can speed up the process by not restricting ourselves to random mutations. If we can trace for some cause of weakness, we can choose the appropriate mutation. We can teach the program to learn by using **rewards and punishments.** One might try to build a program with **prepositions fed into the system** which helps the child machine to relate to the communication well.