The Computer and its Project

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0. Introduction. The World is the Computer™

"... we, all of us, have made the world too much into a computer, and this remaking of the world in the image of the computer started long before there were any electronic computers. Now that we have computers it becomes somewhat easier to see this imaginative transformation we have worked on the world. Now we can use the computer itself - that is the idea of the computer - as a metaphor to help us understand what we have done and what we are doing."[1]

This claim is something quite unbelievable. We, humankind, have transformed the world into a computer long before there where any electronic computer? And now, with the actual computer it is just easier to recognize this fantastic transformation?
What is it, that makes Computer so special and different? What are the underlying facts of the operation methods? It is possible to compare the operation methods of World and Computer?

I would like to sketch out the history of both and compare them where relevant. The borders of this field of suspense can be seen as investigations of the following:

counting and calculating
quantisation and formation
digitisation and digitalisation
synchronisation and virtualisation
automatization and algorithmisation
computability and incomputability

The questions remain to be answered.

Does the World operate like a Computer?
Is thinking calculating?

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[1] Joseph Weizenbaum, Computer Power and Human Reason, 1976, p. ix

1. Codes

What are Codes? Codes are structures in both society and machine. Codes are structures in one language that refer to structures in another language. The single most pertinent point of codes is, that codes are always codes for something else. It is necessary to arrange agreements on the use of codes, on the encoding and on their decoding.

Counting and Difference

(Cultural) Natural Numbers

The invention of numbers and of counting can be seen as an adaption of the human brain to the regularities of the perceived environment. Number and counting are the first discretisation[2] of nature through man. This ability to transform the infinitive intangible to a finitive tangible is a first important step.
Mathematics is concerned with the knowledge about the infinite. This infinite is concealed in counting. The word ´natural´ number references to the nature, i.e to the essence of counting. Counting as an action is so immediate insightful that it is only possible to describe it, but not to make any further simple explanations. Any counting begins with the natural number One:

$$1$$

and proceeds from the natural number n to the increased by One natural number n + 1:

$$n \rightarrow n + 1$$

A never ending sequence follows:

$$1 \rightarrow 2 \rightarrow 3 \rightarrow 4 \rightarrow \ldots \rightarrow n \rightarrow n + 1 \rightarrow \ldots$$

I will leave the fact aside for, that the description of number through digits is also an invention. The history of this invention and their ways and wrong-ways might be historically interesting but statement-technically not relevant.

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[2] I describe discretisation as the process of transforming things into seperate parts or units.

Much more important are the two points, how counting actual works. On the one hand through the repetition of the individual operation (+ 1), on the other hand through the differencation of the developed sum within a certain number-description-system.

The differencation is precondition for repetition. That means only discrete states can be passed on.

Excursus 1: analog/digital, continuous/discrete

It is necessary to repeat that the meaning of analog/digital does not map exactly to the meaning of continuous/discrete.
Analog can be seen as something having the property of being analogous to something else, so it appears to be a link, an index of something else. Digital cannot deny its roots coming from the Latin word of ´finger´. Again a resemblance between digit for finger and number and digitalisation for counting. Discrete (from lat. discernere) is in the middle of an etymological explosion. Sky, ski, skin, science, shit, etc. meaning essentially the difference between two things. The difference that differs. Continuous means ´without interruption, thus denying the difference.

As an implication of this facts can be stated: Everything, that can be said, has to be differentiated, therefore everything, that can be said, is discrete.
Nothing is lost with this fact by now, nor something is won.

Medium and Form

Media are environment, in which repetition repeats themselves. Starting from the notions of repetition and differencation it is possible to construct a concept of media.
After the repetition it is necessary to make differences. It is this fundamental difference between the one and not the other, between foreground and background, between form and system that makes the difference.
According to the psychologist Fritz Heider, is whatever one observes as a medium, one observes under the aspect of a loosely connected set of differences. These differences can form a multitude of connections among each other. These connections, the grouping of the differences into a form, the in-formation, describes the form of the medium.

A form is a firm coupling of differences in the medium. The concept of media is defined hereby by the difference between medium and form, and the form as difference between loose and firm coupling.
This definition of the concept of medium is capable of incorporating other uses of the word; the medium as parapsychological extrasensual perception; the physical notion of medium as the thing in between, filling the space in between completely, transferring actions. Also the Greek origin of the word can be included, where the speaker (the subject) is included in an action in the interest of the speaker. "*I* am washing *my* hands."

Phonetic Alphabet

A big change in the history of humankind and in the history of media was the introduction of the Greek phonetic alphabet. This alfa-beta (or abc) is the result of an increased abstraction of the written word.
Writing before consisted of descripting single things or phenomena, but an expansion of the written language could not maintain this 1 to 1 mapping[3].
The result is a written language, where the letters have no more similarity with the denoted thing at all. It became a phonetic illustration of the spoken word.
With this digitalisation[4] of language it was possible to form a principle infinite amount of words from a very finite amount of letters. The information of the letter played an essential role in the development of media for storage and media for transport.
One can see the installation of the printing press with movable letters through Johannes Gutenberg as a necessary logical consequence of the not-ambiguousness of the phonetic letters per se. The printing press mechanised, serialised and uniformised the production of text and in the same time its distribution and processability.

Positional Numbering

It was the Greeks, who digitised writing, but it must have been the Arabs, who did the some

3 Nevertheless it is interesting to investigate other writing systems, especially of the Japanese. It ranges from symbol meaning of the letters in the case of the (from china imported) *kanji* writing system, to the Japanese *katakana* and *hiragana*, which almost resemble the phonetic system.

4 finger-isation, number-isation of the word

thing for the number and for counting. They accomplished to step away from the cumulative description of numbers, common with Egyptians, Greek and Romans.[5]

It is to note that with this cumulative numbering system there where limits of representability. Because numbers are by definition indefinite one encounter problem when depicting very large numbers[6].

The problem was solved with the introduction of a numbering system based on positional numbering. The overall value of a number is not only determined by its value, but by the relative position of individual numbers.

These new ´numerals´ could not only cope easily with large numbers, also calculating, the handling[7] of numbers, opened up to new possibilities.

It is remarkable, that the discovery of Zero happened not until much later. The Zero, or the idea of it, owns its success probably to mercantile calculation and double accounting. The zero-sum as an element of control.

On comparison of the history of the phonetic alphabet and the history of the positional numbering system, the fact must draw attention, that in both cases abstraction, the decreasment of complexity, increased.

Following the given path to its end, one arrives at the basic distinction, the minimal difference. For numbers this is bivalent logic and Boole´s algebra. In 1854 it was George Boole´s achievement to minimise the description of numbers to a maximum. 0 and 1, the minimal difference with maximal possible differencation obtain through him the status of an universal description language[8].

As a cumulation from the last chapter: Every discrete thing can be said with 0 and 1.

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5 1 = |, 2 = ||, 3 = |||, 4 = ||||, ...

6 A similar effect can be seen now in the description of very large numbers. Million, Milliards, Billion, Billiards, etc. In this case it is just the naming of numbers it does not actually represent them.

7 Handling digits... The connections with ´hand´ and ´finger´(digit) are striking.

8 One could argue that Samuel Morse´s Code can be seen as an equivalent to George Boole´s Algebra. Although he also translated letter to his two-valued transmission code, consisting of dots (.) and lines (-) for long and short signals.
The difference between Boole´s algebra and Morse´s Code is simply therein, that one is a code (storing, transmitting) and the other an algebra (processing).

2. Algorithms

Abu Ja´far Mohammed ibn Musa al-Kwarizmi

Algebra and Algorithm are the two words and concepts deriving from the name of this 9th century Persian mathematician.
Algebra made history by describing the branch of mathematics, which deals with the properties of numbers and quantities by means of letters and other general symbols.
An algorithm can be defined as a set of instructions, as the stepwise working off of a bigger problem, by means of splitting it up into smaller solvable problems. Algorithms are simply step-by-step procedures[9], in which each step is exactly stated, so that the problem can be blindly solved by following these instructions by a man or a machine.
This principle of explicit commands and implicit following of these commands can be seen as the essence of algorithms.

Although algorithms were implemented in tools to extend to physical possibilities of man, it was not until the arrive of calculating tools and further calculating machine, that apparent integral functions of the human´s brain become externalised.
The term ´computer´stems originally from the human com-puter, notable mostly women[10], blindly calculation the instructions of someone else.

The interesting and important thing is not the fact that algorithms can be followed, but that algorithms also have to be specified. Someone has to invent new way of solving a particular problem. This can be seen as the start of the distinction between commander/follower, master/slave, programmer/user.

9 functions, routines, *sub*-functions, *sub*-routines

10 It is interesting to note that the first operators of typewriters and the first operators of computers were women, follow the instructions of men.

American Vice of Modular Repetition[11]

This quotation from Thomas Pynchon novel Gravity´s Rainbow as headline points to the fact that America can be see as the birthplace of industrial modular repetition.
The automatic reflex answer to these clues would inevitable be ´Henry Ford´, but I am thinking of someone else. It was Samuel Colt who patented his Revolver in 1932. Colt did not only use the principle of industrial serial production, but with his ´Colt´ is was possible for the first time to fire six shots within a short time. Colonel Colt liked to show his amazed audience over and over again, that it was feasible to put six revolvers on a table, completely dismantle them, then to shake them hefty, and then to built six functional revolver out of the mixed-up parts. The Colt´s other name, ´Great Equalizer´, regarded likely to the equality each man achieved, once owning a Revolver. More grasping is the fact that the Colt accomplished repetition in two ways. Repetition as a shooting sequence in time and repetition as a device sequence in space.[12]

The transformation from manufactures to factories[13] can be best seen can be best seen with the introduction of the assembly line at Henry Ford´s Highland Park in 1915. This was achieved by the standardisation of the car parts on the one hand, on the other hand by the discretisation of the working steps. As a result Ford achieved total control over his cars, and simultaneous total control over his workers. It was usual even in car companies, that workers were highly specialised and worked on different levels of the construction process. With the assembly line a worker did not need many skills, he only had to perform one single task. It is fair to say, that Ford did not only introduce the assembly line, but in the same moment he also his workers into the first industrial robots[14].

The father of this principle of the man-robot must be Frederick W. Taylor with his scientific management. He can be seen as a forerunner of Ford, but not a mentor. Ford was a self-made

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[11] Thomas Pynchon, Gravity´s Rainbow, p545, 1973

[12] This repetition in time and repetition in space formed the principle for the movie camera. Marey´s chronophotographic rifle, the predecessor of all movie cameras, could by no way deny its direct kinship to Colt´s Revolver. Repetition of space through repetition in time.

[13] The dream-factory as Hollywood is also know, owes its success to the space-time repetition of the movie camera, but also to the endless repetition of actors and remakes. An endless repetition.

[14] The word robot originated from the Czech ´rabotnik´ for worker. I grew up in rural Austria, the word ´robotn´was used for a collective work each farmer had to make himself available for. Mostly cutting wood.

man, he did not need any mentors. Taylor´s goals was the optimisation of the working process. He mechanised the work, and he also mechanised the human.

It was then when certain questions first arose: When one works like a machine, and thinks like a machine, does one become a machine?

Marshall McLuhan retold a short story from Werner Heisenberg´s *The Physicist´s Conception of Nature*. Tzu-Gun saw an old man draining a ditch. His work did only progress slowly, if it progressed at all. Tzu-Gun, in an attempt to make to work for the old man easier, explained him the advantages a simple draw-well would have over his painful labour. But the old man got angry and replied:

"I have heard my teacher say that whoever uses machines does all his work like a machine. He who does his work like a machine grows a heart like a machine, and he who carries the heart of a machine in his breast loses his simplicity. He who has lost his simplicity becomes unsure in the strivings of his soul. Uncertainty in the strivings of his soul is something which does not agree with honest sense. It is not that I do not know of such things; I am ashamed to use them."[15]

Although the old man in the story is furiously opposed to the suggested simple machine, he did not recognise the fact that he was already working like a machine. Even the argumentation against the machine he brought forward is constructed like an algorithm.

The Big Tact Giver

The Mechanical Clock: The First Virtualisation

The first virtualisation was completed by a machine, which is in no way an extension of man. The mechanical clock.
According to Lewis Mumford "the clock, not the steam engine, is the key-machine of the modern industrial age."[16]
Marshall McLuhan suggests that the printing press preceded the clock "in order of influence on

15 McLuhan, Marshall: Understanding Media. The Extensions of Man, MIT Press, 1994, p63.

16 Lewis Mumford, Technics and Civilization, Routledge London, 1934, p10

the mechanization of society."[17] I oppose that both technologies can be seen as brother of a technological trend, I do not think that the clock is a descendant of the printing press. Both share the method of discretisation, one dissects space, the other time.

The mechanical clock disassembles time through repetitive steps into discrete units. Time is no longer measured by natural repetition in the observed environment, like sunrise and sunset, but according to an artificial rule, an endless repetition. The long now disappears, an exact past can be recorded, an exact future can be foreseen.
The obsession with humans to accuracy and respective the lack of humans to adapt to the virtual time can be interesting psychological phenomena (or problems), which I do not want to deepen here.
This accurate dissection of the before continuous time dimension into a discrete sample time is only a precondition for the other effect the introduction of the mechanical, environment independent, virtual clock had.
The aftereffect of the introduction of the clock was the synchronisation of society. Again from Lewis Mumford´s Techics and Civilisation: "... for the clock is not merely a means of keeping track of the hours, but synchronising the actions of men."[18]
With this synchronisation of man and society as a whole the role of the clock is not only to measure time, but to give time. It is the clock, which removed the sun as the center of the universe and it is the clock who becomes the big universal tact giver[19] [20].
Another drastic example of synchronisation, this time between different technologies, is the synchronisation of the machine gun and the propeller. During the Second World War the French Roland Garros invented the method of shooting ´through the rotating propeller blades by adapting the tact of the machine gun to the tact of the propeller.´ The gun only fired, when the propeller was out of way. Flying and Shooting are following the same tact.

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17 McLuhan, Marshall: Understanding Media. The Extensions of Man, MIT Press, 1994 , p147

18 Lewis Mumford, Technics and Civilization, Routledge London, 1934, p11

19 Remarkable that one of the first calculating machines, namely the one Wilhelm Schickhard build in 1623, was named by him ´Rechenuhr´ - Calculating Clock.

20 I do not know if it is coincidence or not, but the physical unit of frequency is called ´Hertz´after Heinrich Hertz. In German the pronunciation of ´Hertz´ is exactly the same as of ´Herz´, which stand for ´heart´. The accelerating heartbeat of the world is measured in Hertz, Mhz, Ghz.

3. Universal Machines

Weaving Algebraic Patterns

When Ada Lovelace, the first computer programmer, saw Charles Babbage´s Analytical Engine at work she wrote: "The Analytical Engine weaves algebraic patterns just as the Jacquard loom weaves flowers and leaves."[21]
The link between the computer and the loom was the way of storing information. Babbage transferred the technology of using punch cards as a storage devise to his machine. These punch cards, holes for letting a needle through, no holes for no needles were now working with the computer.
The observation and comparison by Ada Lovelace were more than correct. It shows, that the underlying principle of following a certain algorithm supplied on the punched cards, applied to both machines.
Interestingly Babbage differentiated between the numbers he wanted to calculate and the algorithm he fed into the machine. Although both were encoded in the some storage medium the distinction was still intact.

IF and THEN Codex implemented

Computers are per definition for calculation. They put things together. Computers compute.
In 1936 the German engineer Konrad Zuse built his first computer[22].
Zuse´s Computer was not only the first completely digital one, he also came up with a drastic improvement. Algorithms specify a set of rules, which can be executed any number of time. Zuse used for the first time conditional clauses, IF / THEN loop. This introduction made a qualitative difference between the computer as a slightly better typewriter and the computer as a decision maker. IF a preprogrammed statement is true, THEN this rule has to be followed.
As a result another bastion of human superiority fell. Not only humans were only capable of making decision, but also computers were. Even Zuse was not fully persuaded by his

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21 Charles Eames: A computer perspective: background to the computer age; Harvard University Press, 1990, p19

22 Later, with his Z4, Zuse can be credited as the inventor of computer special effects for film. Because he used discarded 35mm movie film as a storage medium. The film strips had punched holes in them, in principle similar to Babagge´s and Jacquard´s method of storing information.

introduction. He stated his doubts:

"Since programs, like numbers, are built from series of bit, it was only a matter of course that programs be stored as well. With that it was possible to make conditional jumps, as we say today, and to convert addresses. From the point of view of schematics, there are several solutions for it. They all rest on the common thought: the feedback of the result of the calculation on the process and on the configuration of the program itself. Symbolically, one can envision that through a single wire. I was, frankly, nervous about taking that. As long as that wire has not been laid, computers can easily be overseen and controlled in their possibilities and effects. But once unrestricted program processing becomes a possibility, it is difficult to recognize the point a which one could say: up to this point, but no further."[23]

The logic of IF and THEN is not an invention of the computer age, it can be traced back to the first written law. But what does a law tell us? What is special about the written law?
The writing of a law and hereby its realization in fixed, visible form, marks the beginnings of the law as well the beginning of codes[24]. The word Codex, synonym for written law, owes its existence to stocks of trees, which were covered with wax in order to receive written words. The Codex transformed from a storage media, to the power of the written text. Codex were man made conditional clauses. IF you do not follow this rule THEN you will go to hell (where it will be horrible).

Computercode is computerlaw.

Universal Power with Halting Problems

The computer is a calculating machine, which works in a similar way humans do calculations. This ability of duplication a certain part of human thinking made them a danger, at least for the human self esteem.
One could ask, why is it, that computers are seen as so powerful machine? Where do they get their power from?
The answer must be: Because they can compute everything that is computable.
But: There are limits, there is a glitch, there is something computers cannot compute. No

[23] Friedrich Kittler quoting Konrad Zuse in the English translation of Kittler´s Grammophone, Film, Typewriter, Stanford University Press, 1999, p258

[24] The essence of a code, that what makes a code to a code, is its ability to be translatable into another code.

computer can computer incomputable computations.
Alan Mathison Turing modelled in 1936 the prototype of all following computers, the Universal Turing Machine, in an attempt to solve of problem of mathematical fundamental research brought up by the mathematician David Hilbert. He was concerned with the question, whether mathematics as a system was complete. In 1928 his ´Hilbert-Project´ consisted of three postulates, which should guarantee the closeness of mathematics[25]:

1. Completeness. Provability or Disprovability of all mathematical propositions.
2. Free of Inconsistency. Mathematics must be consistent. No sequence of correct deductions can come to the result of i.e. 2 + 2 = 5.
3. Decidability. A statement must be provable for within a finite amount of time.

His endeavour lasted only until 1931. The completely unknown Kurt Gödel came and destroyed Hilbert´s program single-minded. In his essay "Über formal unendscheidbare Sätze der Principia Mathematica und verwandter Systeme" Gödel proved that Mathematics as a system is either incomplete or inconsistent, but it never can be complete and consistent at the same time.
His Trick, the same one is Turing going to use later, was the use of the so-called ´Gödel-Numbering´. The specific thing about his code was, that he used numbers for describing number-theoretical statements AND statements about the number theory itsel. By this elegant means it was possible to formulate logical and consistent paradoxes in arithmetic in the kind of the self-contradictory liar-paradox. "I am a Crete. All Crete are liars." Maybe the shortest possible form of the liar-paradox: "I lie." When I assume the sentence as true, than it is a lie; but when it is lie, the sentence must be true, etc.[26]

Thus the first two of Hilbert´s questions were answered negatively by Gödel, but it was up to Turing to answer the question for Decidability. He therefore developed a thought experiment. In his own words: "We may compare a man in the process of computing a real number to a machine which is only capable of a finite number of conditions .. which will be called ´m-configurations´. The machine is supplied with a ´tape´(the analogue of paper) running through it, and divided into sections (called ´squares´) each

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25 What whould have actually been the result of his program of fully formalised mathematics? If you could define everything, you could compute everything...

26 A direct line of though can be laid between Babbage, Zuse and Gödel/Turing. Whereas Babbage insisted on the distinction between numbers and structure data, Zuse used it, although he did not feel good about it (sic!). Gödel and Turing instrumentalised this amalgamation of data and structure, of algorithm and code. They turned the commanding letters into numbers and thus made them computable.

capable of bearing a ´symbol´. At any moment there is just one square ... which is ´in the machine´. We may call this square the ´scanned square´. The symbol on the scanned square my be called ´scanned symbol´. The ´scanned symbol´is the only one of which the machine is, so to speak, ´directly aware´..."[27]

This machine is called ´Universal´, because it is capable of simulating any other computing machine. The fact that these kind of machine can easily be trapped in infinity-loops is the core of Turing´s negative answer to Hilbert´s Decision problem. Using a similar trick a Gödel before, Turing showed that it is not possible to mechanise computability completely. There are propositions, which can not be decided by a machine in an ending amount of steps. A computer cannot compute the incomputable.

It is necessary to state that although Turing has the claim of inventing the principle of the computer, he was not considering the computing machines of his days. He wanted to model the human mind.

Although similar in their approach Gödel and Turing came to different conclusions. Gödel thought he proved the superiority of the human intellect, Turing came to the rather subtle statement that computatibility is based on the mechanical.

Excursus 2: Logic and Atomic Bombs

Turing showed that computers cannot deal with the incomputable, because they are strictly logical environments. But also the logic within a computer can be brought to a halt. One example is the so-called Logic Bomb. It can be simple produced on any Unix style operating system, with just one line of code:

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main(for(;;)fork();
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This tiny program explodes by recursively making copies of itself, it grows exponentially. But any computer system is only capable of dealing with a limited number of processes, so rather sooner than later the Logic Bomb brings the logic environment to a stand still.

The thing that puzzled me was the striking resemblance between Logic and Atomic Bombs. They were not only both invented at nearly the same time, but also their operation method is similar. Logical atoms, in the sense of the last unbreakable objects, from which everything, matter and sense, is made of. The end of this point of view by splitting up and destroying atoms destroyed human logic at the same time.

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[27]Andrew Hodges: Turing, Phoenix Paperback, 1997, p9

Washing the Brain with Number

"When we talk mathematics, we may be discussing a *secondary* language, built on the *primary* language truly used by the central nervous system. Thus the outward forms of *our* mathematics are not absolutely relevant from the point of view of evaluating what the mathematical or logical language *truly* used by the central nervous system is."[28]

John von Neumann, one principle inventor of the computer and an excellent mathematician, doubted that mathematics is the original, underlying language of the brain.
I have shown that the computer is a discrete logical machine. But how about the human brain? Is calculation enough for the assumption that humans are machines as well?
Numbers and the ability to deal with number are an essential part of humankind. Where does the number come from? Either numbers were ´always there´ and man only recognize them, because evolution gave him a sense for numbers. Or Numbers are completely and totally and a human invention, before the wheel, phonetic alphabet, etc.
It is undeniable that things were ´there´. There must always have been an environment, a surrounding. It is also impossible to deny that certain thing occurred circular and repetitions, but that does not imply that number were ´there´and only need to be discovered by men. Number are definitive an invention.
The decisive fact of the story of the success of numbers was the fact that numbers were always descriptive. They always point to something else. Now, with discrete media and discrete computer the number is the underlying fact. But what does it means? Is it possible to observe numbers directly? No, I and nobody would not know how. Only through the artificial lens of abstraction it is possible to risk a gaze, but it always remained the (user)surface.
Numbers do not have significance, but they can be loaded with significance. Numbers are processable and computable. This combination of uploaded meaning and acceleration through computing is important.

Gödel argument that Human Brain can deal with inconsistency and therefore are superior, is worth a closes look. Also von Neumann´suspicion fits into the picture.
Humans are different, they are fascinated by the other, exactly because they do not know what the other is.

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28 John von Neumann: The Computer and the Brain; New Haven, Conn.: Yale University Press, 1958, p82

Whereas for the computer his thinking is only calculating, for the human thinking is calculating + 1, plus something else, plus the difference that makes the difference.

Conclusion

The point of the exercise was to investigate whether or not the ´World´ behaves similary to a ´Computer´. In order to answer this question it was necessary to dismantle the functions and history of both. Through similarities and projection from one area to the other I tried to gain insights.
The most interesting viewpoints were created by applying the model of the Computer in retrospect to the model of the world.
The first key event was the invention of digital numbers and letters. This discretisation enabled letters and numbers to be stored and transported, in the same time creating media, things-in-between to transport and store numbers and letters. Opposite to the letters the strength of the numbers was that they did not describe actual things. They could be loaded with any meaning, they could be processed.
This processing of numbers was soon formalised by words in the form of algorithms. Algorithms are set of rules and order, designed to break down large problems into smaller, solvable problems. Mapped to human history an equivalent can be found in the form of Codex. Laws which were there to be obeyed. In the same way as the Codex is followed by humans, the Code is followed by computers.
I portrayed the introduction of the clock as the universal tact giver, unifying actions of man. This first virtualisation was no extension of man, it had no predecessor. The clock achieved with the quantisation of time what the printing press had achieved for the quantisation of the word, and the revolver and movie camera would do for space.
The resemblances of the idea of the world and the idea of the computer in terms of descretesation were striking.
The more computing machinery evolved, the often one could hear the suspicion of the computer as an electronic brain. This fact must be criticised in two ways. First and foremost, the fact that a computer is able to calculate and therefore perform the same operation as a human calculator is not a proof. Calculating is a direct result of the digitalisation of language and counting. The fact that humans and computers can calculate show only that both were in-formed by the same letter and number system.
Second, there is a tendency of mystifying the actions of calculations in a computer as ´thinking´. humans tend to anthropomorphize things they are often confronted with. Emotional relationship to inanimate objects can be interpreted as a basic need for humans to communicate

with others humans. If there are no humans around, I make my own. But these stepping-stones and metaphors tend to become a substitution for the other, true thing. Computers compute, and nothing more.

Computers are no all powerful, they have limitations, and these limitations can be proved. Kurt Gödel destroyed the illusion that mathematics can be whole and consistent, Turing built upon this and showed there are incomputable number, which no computer ever can compute.

Computer and world can be compared using numbers, algorithms, tacts, codes. But it is also exactly these numbers, algorithms, tacts and codes that obscure and confuse. What is it that these codes represent? What do I have to do to read them?

The primary aim must be decipher the codes and structures. To find a buried meaning hidden by too many algorithms. Humans have the brain. Humans have to take the power.

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