

Why the TURING-Machine is not able to play the language game of WITTGENSTEIN

by Edgar Selzer, Vienna, 2006

Taking into account the insights of WITTGENSTEIN regarding the non-calculability of a natural (word) language, that is to say that it cannot be modelled in a formal manner on the one hand, and the absolute necessity of a human thought process for normal talking on the other hand, because both free formulation and meaningful content require an agent, called "mind", which is not only functioning like the physiological organ, our "brain", that can act for speaking - and a fortiori for talking - only a causal way, it appears not possible that the present-day computer can be made to replicate the mastering of a language like a human being.

0. Introduction

Within the framework of a project sponsored by the Austrian Society of the History of Informatics (ÖGIG) I have endeavoured to show cogently that the seminal work of Ludwig WITTGENSTEIN, especially the incisive insights of his later philosophy, does have a profound bearing on any eventual possibility of the digital computer to master in some way or other the capability of speaking a natural word language like a human being.

Most of all relevant for our purposes was the discovery by WITTGENSTEIN that the meaning of a word (concept) is given by its actual use in spoken language for the decisive reason that a human mind is inevitably needed not only to interpret correctly linguistic expressions but also even to give them suitable semantic content, a unique feat a mere machine could not do.

In fact, extensive research has yielded the convincing result that there is overwhelming and conclusive evidence to the effect that the whole set-up of the present-day digital computer does not allow already in principle to replicate completely and authentically the reasonable speaking ability of a normal person.

This impediment is due to the fundamental situation that there is an essential – and therefore not possible to overcome – difference between an individual subject freely and knowingly expressing himself in order to meaningfully communicate his own thoughts and the operating of an electronic device in order to produce a precisely determined data-output without any understanding at all what it is doing. In the tiniest nutshell: freedom versus coercion!

In this sense one has to remark that it is both well known as well as generally accepted that on the one hand, as WITTGENSTEIN already has pointed out, any sufficiently rich standard language cannot be formalized into an adequate calculus, and on the other hand every digital computer must absolutely be programmed by a totally formalized language in order to be capable of operating algorithmically.

So I think to be justified to hold unreservedly: "These twains shall never really meet!"

However, this conclusion should not be construed to mean that the computer could not attain a considerable level of practical proficiency to imitate human speech, albeit only in a manner of rather restricted, if not quite inferior simulation of some ordinary human talking, but be understood mainly to assert that such an achievement would still be a far cry away from all the extremely hopeful predictions by certain adherents of (strong) Artificial Intelligence (AI).

Besides other scientific accomplishments in linguistics and analytical philosophy they seem to have completely neglected the whole branch of "theories of thought" and, consequently, the "theories of meaning", most of them having been elaborated and further developed on the abovementioned fruitful and valid starting point ("Ansatz") pioneered by WITTGENSTEIN, not to speak of many pertinent "theories of mind" that hark basically back to yet unsurpassed results by KANT, especially concerning the human use of the understanding and reason by itself.

1. Some remarks on principal limitations of the TURING-machine as regards language

1.1

As already above indicated, we have to face in assessing in general terms the theoretically possible linguistic performance of the computer first of all the basic problem that a purely material object, although programmed by a set of instructions that has been elaborated by human mind, is nevertheless supposed somehow to acquire the capacity of speaking (or really talking at that) like any normal person.

Thus some of the first difficulties in this respect stem immediately from the necessary hardware, the fundamental structure of which is wholly that of a mechanical machine. Therefore, in the computer, being from bottom up a physical construction only, all technical functioning can only be done - or one or the other correspondingly duplicated - solely by causal relations which, needless to say, allow only for a minimum of flexibility at best.

Furthermore, the necessary flow of energy in such a machine, in our case clearly in the form of electricity, leads to the inevitable consequence that there exists a singular method of proceeding at the lowest (machine) level by adhering exclusively on "plus" or "negative", "open or "closed", or "yes" or "no", leaving again an absolute minimum of "degrees of freedom" at disposal.

Obviously, the idea suggests itself to use for any of these "two-way-decisions-only" nothing else but binary bits, i.e., "ones" or "zeros". So on the lowest, but everything else in the computer sustaining and therefore dominating level only the simplest choice between input-output is available for all other activities inside the machine. Moreover, it is unalterably ensured that it stays always within the bounds of the "realm of causation", that is the one in which the fact of "quantity" is the only ruler. As to my mind, there exists no route of escape out of this on-sided, nay monopolistic quandary, because with using quantity only one can never produce anything like quality, consequently no substantial content, i.e., finally, no semantic meaning. To wit: Out of bits alone, no information can ever result. Thus, all the information coded inside a computer comes from a specific and concrete data-input. So, for a very important example in that vein, as it seems to be totally impossible to program something like a (human) "consciousness", it is futile to expect that one way or the other - by serendipity?- miraculously something similar could come into being in a digital computer.

1.2

Furthermore, as the instructions have to be stored in the form of bits, both their numerical category as well as the only alternative between "1" ("yes") or "0" ("no") see to it without fail that all coded "information" as regards functioning remains always on the one hand not only formal - solely logical and/or mathematical - , but by the same token as such completely contentless, i.e. semantically meaningless. (Just an analogy as a relevant example: if there would be a - fictitious - "living language" of a certain people having only two words, namely "yes" and "no", at disposal, what kind of sensible message could be exchanged? Worse, no significant fact could be stated or some pertinent question formulated!)

In my opinion, all this shows clearly that there is no "sensible or significant" information handled in the computer itself, but only strings of bits (symbols) which by themselves have no semantic meaning at all as, for instance the particular sounds or separate letters of a - spoken or written - language - only by themselves; always a human mind is needed in addition to interpret and thereby to understand them.

1.3.1

Just for completeness sake, it has to be pointed out that the heart of the computer, its “central processing unit (CPU)” must be exactly the same as an everyday calculator, i.e., a device in order to make – only – mathematical calculations. (Thus the instruction code principally and rigorously determines solely some specific operations to be performed, namely addition, multiplication or decision, and nothing else, assuring thereby the simple linear general method of all processing.)

Once again, we find all the inevitable constraints of full formal proceedings with their like constructs, impeding completely any meaningful linguistic content in the inner workings of the machine.

1.3.2

Also, computer storage, although magnetic, is – must naturally “be” – completely compatible to the mathematical system, that is to say that the binary numbers “0” or “1” are by electrical pulses transmitted and indicated by the two states of a storage – component without exception.

1.3.3

In sum, it is easy to see that because of the necessary interdependency of all the functional elements of the computer an overall homogenous working system – encompassing the physical, logical, and mathematical aspects harmoniously – is imperatively demanded, compelling it, however, to stay always inside the domain of “quantity”!

1.4

Lastly, on and above the mentioned specifics of the essential design of the hardware of the digital computer rests, of course, the software – program and data – with the working condition sine qua non that is that it is properly adjusted to the said entirely fixed requirements of the general as well as the particular computer system.

So nothing different can be programmed than what is completely adapted to the reigning rules already existing in the machine prior to the loading of anything like, for instance, the governing set of instructions for the CPU. Therefore, also nothing can be changed as regards the core of the mathematical-logical operations. On the contrary, the programming languages have to be “exactly geared” beforehand in order to express adequately the data to the for respective task necessary algorithm in the CPU.

Apart from purely arithmetical-logical operations, the unalterable fact that the general “hardware”-situation remains always exactly the same can be seen by the example of the “decision-making procedures” pertaining to the logical operations of “more” or “less” exclusively. Such comparisons consist in essence in nothing but the “weighing” (sive measuring) of different quantities, so that it transpires only once more that no “escape route” from this principle limitation to the computer exists.

2. There exists no “bridge” between machine and mind

2.1

Between the realization of a technical device and the bringing-about of a phenomenon like the human mind many a step and essentially different levels would be indispensably involved, if one would dare to try directly to create an identical replica: from the physical basis to the stage of chemical reactions, from there on to the intricacies of the biological domain, and finally to the plateau of the being of an individual person.

Inasmuch as the computer inevitable is forever stuck completely in its physical prison, it is clearly lacking all these different prerequisites, especially most of all the factum of “life”, in order to reach the pinnacle of the mental activities, that is autonomous mental process.

As it is doubtlessly evident that a concrete object of matter-energy alone never could account for the emergence of the necessary steps to establish the new levels with their not existing before

properties, because every one of them would be also only an object consisting exclusively of matter-energy, i.e., a machine could at best create only another machine but never something “realiter living”, an organism, the ensemble of all these not available requirements gives rise to an insurmountable dissimilarity blocking totally the way also by the machine itself to attain higher-life qualities.

So it is principally impossible that a TURING-machine could think, but also practically not conceivable nor imaginable, because there is simply nothing in the computer at hand that could be considered to be “thinking” even remotely like a human mind, that is to say on an adult and normal person, not to mention, for example only, creative inspirations and/or the insights of a genius.

As we do not really fully understand how the intellectual accomplishments, for instance, of our mind originally spring up and are maintained in developing them further and to the better, i.e., spiritually in and by themselves, it is therefore – at least for the time being – moreover also fully precluded, apart from the abovementioned physical (and technical) problems, to form even a design or plan of a eventual solution to these difficulties.

In any case, it looks certain that the present-day computer shall never be improved to the effect to “embody” to have something like a “brain” that could really think by itself.

2.2

All the data inside the computer are coded information and there is nothing in it that has access to its external meaning. So the machine doesn’t know at all what it is doing, exactly like a clockwork doesn’t know that it is used to measure time or a TURING-machine to calculate functions.

This situation pertains to the unalterable fact, as has been already explicitly indicated, that all symbols per se have no semantic meaning at all. They must unflinchingly be interpreted by the understanding (and/or reason) in order to use them in a thought process.

The absolute minimum is to perceive the meaning of a single word (expression) like “stop!” or “danger”. However, in order to grasp the complete concept of such a single utterance, not only its use in practice, i.e., the establishing of its meaning in a language game for instance by a mother explaining the connotation to her child, but also to handle such an expression in daily life to communicate its content to other people in all respective possible circumstances requires a rather comprehensive command of the language in question, that is to say that one is able to cope with it already on a higher, a meta-level for knowing also the denotation (reference) in the form of a (mental) sentence. (“It is obligatory to stop here” or “Danger looms around the corner.”)

In other words, it has become widely recognised that to master a natural language more or less correctly and fully, one has to be able to understand and to formulate whole sentences really, also, as a matter of course, because for sure people are talking as a rule in certain phrases.

An artificial and material system, wholly formalised and programmed moreover, has no means at all at disposal to accomplish the necessary premises for truly – semantically – talking, let alone, for example only, to understand inside itself the independent sense of several sentences connected in a context, e.g., in a poem. (Just a line only profiling some English mentality: “I want to go down to the sea again, to the lonely sea and the sky, and all I want is a tall ship and a star to steer her by!” What would - or could - a computer make of it?)

Nothing in a computer – as has more than enough been shown – resembles anything like a “mind”, and therefore to construe – vide especially the concoction of the cyborg – the possibility that eventually it nevertheless could have something like a “self” – a person’s own individuality as object of introspection or reflexive action (Oxford English Dictionary – OED) or “an individual typical character or behaviour (Merriam-Webster, M-W)” is in my opinion nothing less than preposterous, because something that doubtlessly – without any semantically meaning – cannot be fully formalised is totally out of reach of an algorithmic process.

3. Only with a “mind” a “self” becomes possible

3.1

Leaving aside all psychological and philosophical considerations and also abstaining from wandering away into the fields of cultural or social anthropology, it is still necessary to stress in principal beginning that people are freely expressing themselves in meaningful messages to each other, whereas in a computer nothing as stark data (or contentless signals) are strictly processed in a rigorously fixed way. For the human faculty to use a natural language, however, more than the mere manipulation of bits is required, namely “self-consciousness” and “thinking”.

According to the “OED”, “self-consciousness” can be understood as having the faculty of “self-contemplation”, i.e., “viewing mentally oneself”. In addition, another important point in our context is the concept of “self-hood” expressing the fact that the personality is a separate and conscious existence. The “M-W” similarly explains “self-consciousness” as being conscious of one’s own acts and states as belonging to or originating in oneself or being aware of oneself as an individual.

Seen in this vein, the basic idea of the “self-concept” amounts to an individual’s view of himself.

In comparison, a computer, not possessing anything like a “self” because it doesn’t have its own “mind” not only for the reasons and causes set forth above, but also by virtue of its whole structure as a deterministic system, is bound to endure owing to its state of affairs a lot of consequences. For example:

- A) It cannot have a “first person”-perspective.
- B) It cannot know its own identity.
- C) It cannot have anything like intentionality.
- D) It cannot think “by itself”.
- E) It cannot talk to “itself”.

However, all these – and even some more – fundamental capacities are absolutely necessary in order to have the linguistic competence of a normal person. On the other side, to obtain them within the framework of its present set-up is obviously to tall an order for the digital computer to rise to, not even speaking of the WITTGENSTEIN-truth that principally “meaning” in language is established by human behaviour in its social role in the community, that is using a word in real conversation.

Also it has to be mentioned that our mental talent enables us i.a. to create new ideas and to express them freely as to our liking, all of which naturally a mere machine cannot do, nay even simulate. Any purposeful action wholly on its own is out of question for the computer, as also, e.g., spontaneous remarks.

3.2

At this stage of my analysis, it seems appropriate also to emphasize that even if the human brain and mind would be functioning like the digital computer, a contention I deny at any rate in principle, the – theoretical – analogy, for example, could not – and never – hold true for the human level of reasoning, because in the analogy only the method of proceeding, the mere manner of functioning, is involved, and not the self-reflective creation of new contents of thinking. Stated a little bit different and simpler in other words: The computer needs a human-made program, the programmer not.

Thus, human thinking involves much more than simple digital or analogue functioning, i.e., substantial – not only formal – semantical meaning. This can be shown very clearly in the following way:

Although it is undeniable that “thinking” exists – fundamentally by the minimum ontic content of the “cogito ergo sum” and epistemologically by the situation that in order to refuse to acknowledge its real presence one has to “think” about the intended disavowal – in whatever manner in something we call our “mind”, whatever that may be by itself, it is easy to empirically prove this statement by demonstrating it just by me writing these very lines.

My hand is nothing but a material instrument for drawing black signs on white paper. The guiding of its movements is done exclusively by a thought process going on in my mind because I not only direct it completely, but also in thinking a little bit in advance what and how I want to express I am constituting the specific thought process itself, in other words creating it. On both ends of this connected sequence, namely thinking and reading the thoughts, an interpreter, a “self” as a subject, is needed for understanding my sentences, because otherwise either a “mumbo-jumbo” would have been put on the paper, or in spite of being meaningful expressions on the paper, no one would be there to make any sense out of it. Therefore, it is an empirical – exemplary, because a host of similar actions exist like the genuine analogy of speaking – fact that “the mind could not write without a hand” and “the hand would not write without a mind”.

However, and this seems to be of utmost importance, thereby play two essentially different relationships a decisive role, namely the mental one of thinking and reading and the physical one of directing the hand in execution of the characteristic (personal) letters done by the brain, because the latter one is only by cause and effect. (So a computer can also print something “written”, however, from its point of “view” meaningless symbols.)

The former relationship, though, rests clearly and plainly in the case of human perception – of the external world – in the true meaning of objective judgements in regard to empirical sensations, thereby assuring a concrete, correct content of the respective particular thoughts. They are hence no mere data, formal symbols only. ((Therefore a person can speak and write, apart from abstract considerations in his “mindscape (Denkwelt)”, in pertinent realistic terms as shown in everyday life.))

Of the two levels, the causal and the mental one, the computer as a TURING-machine can only partake in the first as an essentially mechanical device. (Automata have already vouched for this!) Furthermore, it becomes distinctly clear why a computer cannot “handle” the “language game” in the very sense of WITTGENSTEIN:

- A) In the first place, for using a word in speaking like the mind uses it – or uses a hand in writing – the computer would have to understand generally – as a rule – the complete concept of “meaning” in order to not only working always with total formal (contentless) symbols, that is to say that, as for example a person is only able to write in a true sense by hand when expressing meaningful contents, the computer – in genuine analogy – would have to understand the “words” – or “sentences” – employed by it in order to talk really “meaningfully”.
- B) In the second place, the causal relation involved in speaking or writing originates in the brain, as such a physiological organ consisting in various manners basically of matter and energy. In this sense the body indeed functions principally like a kind of a machine. However, this sort of (technical-mechanical) biological relationship can act only within the limits of the physical and chemical laws which by themselves do not lend them at all for reasonable thinking because, amongst other missing things, no “quality” can be found in them.

Thus, there is an essential and existential difference between material (concrete) brain and the immaterial (spiritual) mind, so that even in the case that it would be possible – completely theoretically speaking – to construct technically something that would be exactly like a “brain”, nevertheless the “living spirit” would be missing, totally indispensable, i.a., for normal thinking.

The bottom-line is here: if for instance a computer should be able, amongst other activities, to truly talk exactly like a person, it would have to be, at least in the involved faculties, identical with a human being.

4. Some correspondent thoughts on thinking

Again separating our subject in general from psychological deliberations and especially also from studies of feelings and emotions, although both kinds of endeavours could contribute much to our enterprise, for brevity's sake I shall make an effort to focus only on the activities of our understanding and our reason in the thought processes, leaving thereby also aside the complex problem of the free will with the in our case irrefutable justification that the computer doesn't have one by definition and by construction.

Thus, the way is cleared for starting by explaining the principle difference between perception and intellect: whereas the former is the ability to become aware of the external world, thinking is a manifold activity inside the mind, e.g., to form logical correct and substantially true judgements on the strength of one's own considerations. Needless to say that a computer is not apt at all to perform at least the latter remarkable achievement.

Thinking is normally expressed by either speaking or writing. That is why the difficult problem of the interdependent connection between these two human capabilities arises. Although the dependence of thinking on speaking or writing is by no means imperative, the other way round it is incontestable: no meaningful speaking or writing without prior or parallel thinking.

Whereas the understanding functions "discursively", i.e., logically according to the categories and other concepts, the reason per se is the highest level of human thinking, basing itself on a priori principles and ideas and can be defined as the supreme mental power for knowledge a priori, for us, most of all allowing to be "self-reflective" and, naturally amongst many other activities, to control the doings of our understanding. Such a special feat is way above any possibilities of every machine conceivable.

Thinking, by all definitions and descriptions, is a conscious mental activity. Therefore a person, as an individual subject, is knowing what he is thinking, linking it firmly to "self-consciousness" with its various ramifications, all of which cannot be found nor installed in a computer, because it is in fact only "matter (energy)", devoid of anything spiritual.

In the form of "reasoning" thinking not only by the word expresses the application of reason to logically correct understanding of perceptions or ideas, but also to pass higher level judgments in general, for example of value or even on the quality of one's own thoughts, i.e., their veracity and/or completeness, something a TURING-machine never can do because of GÖDEL's theorems.

In the latter vein the blatant fact can be explained that such a machine in a general way is not able to cope with new situations of any kind, that is to say finding by itself solutions not existing before, significant insights, or creative ideas. It follows from this, that in a – theoretically imagined – conversation with a normal person, the computer is never prepared to really have a dialogue, but merely is pretending to do so, reacting to the human formulations, but in no way complying with the regular demands of a sensible discussion, namely also to import to it relevant considerations found out in the spur of the moment on its own "thinking". No new information is ever developed in the computer!

The human manner to perceive the external world is usually described as interpreting and thereby giving meaning to the sensory stimuli coming from the outside. Also here exist severe doubts if the computer can be programmed to go through the necessary steps at one level or the other in order to conceptualize worldly objects, states and processes in any meaningful way. In fact, as to the results of this analysis taken together, the machine is even not up to true thinking or supreme reasoning. It simply cannot know what is actually going on on the outside of it, notwithstanding strictly fixed prior instructions for a special situation, of which, naturally, exists a countless number.

As to the possibility of problem solving, schematically regarded, there has to be a concrete process of decision making, culminating in suitable judgement. A *conditio sine qua non* for this sequence of actions to succeed is obviously an understanding of the problem itself in the very beginning. As the computer cannot interpret on its own any new – not yet programmed – situation, in a realiter

meaningful way – it can only constitute something on the basis of a foregoing formal structural separation of the parts of some whole, but nothing with a substantial concrete content by itself, e.g., speaking about a lecture just going on by discussing its merits or eventually given fallacies or omissions, or writing a paper or a book on a just specified subject, goal, etc. – for finding the right direction in steering such a process towards an appropriate end – result, it once again clearly transpires that the machine will never be able to master complex problems which require the recognition not only of purely quantitatively measurable circumstances, but also of qualitatively descriptive aspects, i.e., new pragmatically effective solutions for instance in response to political, economical, social, or moral questions. It always is a tool only, never in a position to leave the strait-jacket of its program in order to be independent, for instance to develop by itself original opinions on any suddenly cropping-up subject in a conversation.

In a way, the digital computer is not only a descendent of the long line of purely calculating machines, but belongs also to the family of general automata as a strictly mechanical device.

5. Also some short comments on talking and meaning

5.1

According to the “M-W”, one can describe “speaking” as to utter words or articulate utterances or to use utterances in ordinary (not singing) voice, whereas “talking” is to deliver or express in speech ideas, or to use language for conversing, communicating, discussing, etc., hence in the human “Lebenswelt”.

It immediately becomes clear that the essential difference in the two words lies in “expressing one’s own mind” in the latter case, namely saying something meaningful (by words) or sensible (by sentences) to a listening “addressee”, at absolute minimum to oneself. (Although here the phenomenon of “intentionality” would have to be taken into account, I shall refrain from considering this very pertinent concept because I like to make another point.) Anyway, in both cases the necessary premise is the state of “self-consciousness”, in the second one in addition the personal effort of “self-thinking”, i.e., not repeating something like a parrot. In practice, “talking” amounts to choose himself the proper words and to form or phrase significant sentences in a normal “language game”, usually in a dialogue.

In view of the already expounded actual state of the computer as being a concrete model of the TURING-machine it becomes evident, that it cannot really participate in a real discussion the human way, i.e., guided by a special mental agent, generally called “mind”, because the normal train of thought must have been fully produced in an individual manner for the usual talking of a person.

Talking seen in such a way is in my steadfast opinion completely out of question for an algorithmic machine, especially because the data inside the computer as mere symbols do not have per se any meaning. On the other side, there happens often unique spontaneity in the thought of a person and therefore an original profile (or certain streak) in the talking of human beings, because they are – inter alia – empowered in principle to generate new ideas, for example only inventors and innovators.

Also, it has to be explicitly noted that TURING himself - in his famous paper “Computing Machinery and Intelligence” of 1950 – stated that he is not trying by applying his test to provide a – behavioural – definition of what thinking is, i.e., to propose the necessary and sufficient conditions for thinking, because he thought that the question whether machines can think is too “meaningless to deserve discussion”, but recommended instead to substitute this question by another question, namely to ask how machines could realize an “imitation game”. So the present-day TURING-TEST rests on a misunderstanding.

5.2

In consequence of the fact that “talking” supposes not only that the utterances are logically – or at that grammatically – correct, but also substantially of interesting importance, the required more or less continuously on-going thought process must rely on meaningful contents. In his later

philosophy WITTGENSTEIN set convincingly forth that the meaning of a word is its use in the language. Therefore, the particular and proper meaning of a given word can only be ascertained by its factual use in the pertinent language game. The manner of using a word is laid down by the rules of the respective language. Thus, the community of the users create the meaning in their “Lebenswelt” by intersubjective communication.

In short, the social moment plays a decisive role in establishing the appropriate meanings of the commonly employed words.

In my opinion, it is hard to see how a digital computer could on the one hand be actively participating on its own in all the necessary language games according to the rules and on the other hand also perform equally like a human being in the daily life of the community.

6. Conclusion

We arrive finally at the unqualified result of our analysis that the digital computer is not capable of truly talking at all, but only may simulate reasonable human speech by mindlessly mimicking it, because on the one hand all its data are – at least – in one phase or at one level completely coded by binary digits, and on the other hand there is no “ghost” (or other kindred spirit) existing in the machine which could understand the meaning of said data, even if there were any to have it.

In my mind these obstacles cannot be overcome, neither by changing the hardware nor the software, because nothing can make out of a mere machine something in the least near to a human being, amongst so many various valuable attributes, the natural gift of “biological intelligence” enabling him to create new things, innovations and inventions as well as abstract ideas, incisive insights and fruitful thoughts, e.g., even language.

As such mental processes and their formidable outcome are not “measurable” in physical terms, it follows that “quality” cannot be attained solely by materialistic means. Any device therefore that is in principle nothing but a mechanical machine must always remain within the limits of its technical set-up, definitely stated in quantity and numbers, never expressed in meaningful words and/or significant sentences.

At the same token, in my opinion even the brain, regarded strictly as a physiological organ, can in the exemplary case of writing – entirely analogous to the one of speaking – only give causal instructions to the realiter acting hand, so that on and above it the mind is absolutely necessary for the required thought process in this cultural behaviour, rendering any “naturalistic reduction” pointless that wants to identify the “mind” with its brain, the latter being in fact a material, concrete object.

As the gap between thinking in man and calculating in the machine is to such an extent enormous, it becomes very difficult to fathom the manifold claims of the propagators of the (strong) AI, because they neglect apparently completely all existing “theories of mind” in their predictions. But as here demonstrated, the natural sciences plus mathematics and logic alone can neither explain the higher-life qualities nor the mental phenomenon of thinking in the human beings, less for sure, equalling, nay in future even greatly surpassing, all or parts of them by the algorithmic functioning of a digital working computer.