

CAN MACHINES BE SELF-AWARE?

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ABSTRACT

This paper is a summary of the impact that the impetuous development of information, science and technology may have on emphasizing trends and the role of artificial intelligence. It sets out to explain what conscience is, the way in which information is processed in the system of human thought, the relationship between this system and the study of human conscience and the way in which man-to-man, man-to-machine and machine-to-machine intercommunication is made. Some controversial views will also be displayed regarding the possibility of the existence of machines with a conscience are presented and then demonstrated why it would not possible to build such machines in the future. The conclusion is that, in the upcoming future, machines with a conscience are not consistent with reality and that the best thing would be to state that it will be possible in the future to build machines not with human intelligence, but only machines with algorithmic, binary intelligence.

Keywords: Artificial intelligence; Conscience; Intercommunication; Human intelligence; Algorithmic, binary intelligence.

1. Introduction

Science and information technology is one of the areas that have evolved and fast evolving, with implications most spectacular economic and social, and artificial intelligence is an important factor of development of science and information technology.

♣ Interaction between microelectronics and photonics¹⁹ “new science” with Nano chemistry and biotechnology has brought to the forefront of progress ISOC

¹⁹ Photonics is the science and technology of generating and controlling photons, particularly in the visible spectrum and infrared light in the vicinity. Photonics, as a science is related to quantum optics and optoelectronics with somewhat unclear boundaries between these areas.

technology (Intelligent Systems on a Chip) tip appreciated as innovative processes that will enable the development of new circuits and new systems smart.

♣ In these circumstances, in recent years, the literature has increasingly talked about the similarity between man and machine, between the brain and the computer:

Man is considered to be a sophisticated machine made of billions of biomolecules that interact according to rules derived from science, supposed to be very well defined, but by laws that are not yet fully known.

♣ If we work like machines and if we could know and assimilate all these rules that govern our minds, then, in principle, there should be no reason why we would not have the opportunity to reproduce in silicon and steel, machines that operate under their rules created by man.

♣ The question that remains to be clarified is if we function like machines or not - if so - are we able to identify all the rules by which we operate.

♣ Explanation of the brain, mind and consciousness is considered today by many scientists as the last frontier of science.

2. What is consciousness?

♣ The nature of consciousness is not yet understood and therefore, scientifically speaking, a conclusive answer to the question “what is consciousness?” has yet to be provided.

The study of consciousness has been around long before philosophy and religion.

♣ Recently there has been a debate over conscience and biologists, especially neurobiologists who hope that having cerebral images and reading electrical signals of the brain will reveal “a neural correlation of consciousness” and there are some statements that would make some progress in the field.

Through the study of telepathy, it has been proved that the transmission distance is not only electromagnetic thoughts (subjects placed in shielded electromagnetic enclosures continued to communicate telepathically). In these circumstances, it seems

Photonics is a field of optics and optical engineering. The photon, is the elementary particle responsible for all electromagnetic phenomena. Photons participate in electromagnetic interactions; all forms of light (not just visible) are made up of photons. The rest mass of the photon is zero; so, in the absence of any interaction photon velocity (speed of light, c) is the same in all frames of reference. When energy is absorbed the photon transmits energy matter, impulses and its kinetic momentum and timing. Like all elementary particles, photons have both properties of a particle as well as a wave – which represents dualism in the wave particles – it is generally considered that when an interaction with matter photons occur they behave mostly like particles and during the period of free propagation they behave like waves.

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that it not only makes sense to talk about the electromagnetic field of the brain or the heart, but rather there must be some other ways of transmitting thoughts etc.

♣ Epigenetics²⁰ has shown that genes are activated or inhibited as a result of brain commands transmitted by various chemical mediators.

By choosing conscious thoughts we can generate certain emotions, which through chemical mediators activate or inhibit some genes and over time cause changes in the physical body.

For further clarification I recommend reading; “Biology of Faith”, by Bruce Lipton, which was also published in Romania.

♣ Quantum physicists would also like to contribute to the definition of consciousness;

But, attention! Trying to explain “paranormal” phenomena, through a pseudoscience does nothing more than to cast a shadow of doubt on matters subject to criticism and malicious comments.

♣ At present, it is unclear which brain activities makes us aware.

♣ Based on some opinions, conscience should be primarily considered to be in unison with the social activity of humans based on the type of transformation of their surroundings, basically, adapting to our environment.

♣ It is considered that a conscience is formed in time, while under the influence of society and its principles; family, schools, books, through verbal exchange with individuals of a society and through individual thoughts formed while coming into contact with the environment around them.

Of all the species on earth, man has the ability to become just like his fellows, if and only if they can adapt and evolve to the standards imposed by society. Man becomes man, if isolated from human society (actual examples of people behaving like monkeys, wolfs, etc.)

♣ There exists working definitions of consciousness that tries to cover all possible types – biological or non-biological bases.

²⁰ Epigenetics is a new field of molecular biology, which investigates the subtle mechanisms of genetic polymorphism. It studies how ambient conditions can affect the individual genome during its development, as well as in developing offspring, all without affecting the structure of DNA. In biology the term "Epigenetic" refers to disorders of phenotype gene expression caused by mechanisms other than those changing the DNA sequence and is derived from the Greek words “epi” - above and “genno”- genes, which gives birth to a branch of biology that studies the phenomena and laws of heredity and variability of organisms.

Brain and behavior research highlights epigenetic mechanisms which are unknown to the nervous system development, plasticity and homeostasis, aging, neurological etiology of various diseases, neural regenerative processes, etc.

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♣ Consciousness is an entity based on semantic information (processor and memory), (always mentally - i.e. structural-phenomena which in turn present experiential phenomena, qualia²¹, awareness, is self-conscious and knows and understands that by demonstrating it.

♣ Another definition, perhaps more poetic but no less rigorous: Consciousness is a mind unit of ideas "to be" "to know" and "I", plus the full informational content and processing information around these ideas.

♣ According to some statements; „the human conscience, is the most evolved form of psychological reflection”, the objective of reality through sensation, perception and thought in the form of representations, concepts and judgments, including affective processes.

♣ Based on another opinion, conscience is not a moral instance that tells you what is good and what is bad, but rather is based on intelligence and not human attributes.

♣ But obviously artificial intelligence demonstrates how intelligence operates without conscience and in fact, suggests consciousness implies intelligence and not vice versa.

♣ Net consciousness should be well delimited from consciousness.

♣ To have a conscience means to hear "the inner voice" that always shows us the good and truth. Free will, unfortunately sometimes gives us the right to bypass our conscience.

Consciousness gives us the ability to distinguish between reality and make-believe, as well as having the possibility to adapt to our surrounding environment, fulfill our responsibilities and duties to society while striving to accomplish the goals we set out to achieve.

♣ We, as humans, have to ability to continuously self-improve by simply understanding that, in ordering, compiled by reason we created awareness which is superior to thought and we have an obligation to live rationally and therefore responsibly. Yet, society, of which we each contribute to the formation of, will in turn become responsible for our actions.

3. How the human mind processes information

♣ The tenth decade of the twentieth century was the decade of the brain, a period, during which we accumulated more new knowledge about the brain than we were able to accumulated in seven or eight decades earlier.

²¹ Qualia – Understanding of what is happening around us, based on experience.

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♣ The idea of a neural network also occurs in the XX century, during the 1960's to be more exact, but it wasn't until the '90s that it could be put into practice, due to the introduction of neural scanners.

♣ Today, based on studies of these phenomena, an accepted model has been put into place, namely the "conscious workspace". Based on this model, it seems that our neurons are organized into two distinct regions:

On the one hand we have small brain circuits, a kind of "processors", which generate mental representations of consciousness.

On the other hand, we have a "workspace" responsible for representations of consciousness. This "workspace" cannot be occupied by only one image at a time, and therefore each processor, in order to send their image, is in competition with the others.

♣ There are several factors that makes a representation impose on another. This happens, for example, when we focus on admiring a painting – or have another concern - but our concentration is instantly broken when someone calls out your name.

♣ This is the most accepted model of "acknowledgment", but it's still a long way from explaining everything, for example, we do not yet know the "language and manner" by which neurons communicate with each other.

♣ In 2000, Arvid Carlsson, Paul Greengard and Eric R. Kandel received the Nobel Prize in Medicine for their discoveries in the understanding how the "normal" human brain operates.

♣ The study of the functional connection between the brain and mind was made simultaneously with a computer connection – a program, although the brain is not a computer, based on some opinions, the distinction between brain, mind and human reason would be comparable to the distinction between machines (hardware), or slightly lower level programs (i.e. Operating systems) and higher level programs.

♣ I personally believe that as of yet it is unknown what the nature of human reason as a higher form of a functional connection between the brain and mind. A comparative study of the relationship between the brain and mind by rules similar to those of computer or computing programs is just the start of the study, which could become beneficial, in the first place, to the development of science and information technology.

Although during the past 10-15 years there have been very important steps made in the study of information processing, the same cannot be said for system or human thinking, because at the moment, we have not managed to decipher the mechanism of human thought and therefore we cannot make assumptions about the thinking mechanism generating new knowledge.

♣ Although a computer is able to handle a large number of "0" and "1", it would be very difficult, if not impossible for it to identify an object or to read a manuscript, if

these functions have not been previously included in its database of tasks, yet when it comes to the brain it makes no special effort and therefore these tasks are considered to be easy.

- ♣ The effectiveness of the human brain, as stated by a team of Swiss-Americans from the Institute of Neuro-Informatics in Zurich, is due to its hybrid nature, both binary and analog.

- ♣ In comparison with the human brain, a computer presents advantages in the sense that if it has the correct software and is intelligently developed, it does not forget and does not err.

- ♣ The human brain, which is based on continuous evolution and adaptation has managed to achieve a high degree of perfection, yet it can still forget and make errors. Why ? It seems that this is evidence that the human brain processes information differently than a computer.

- ♣ The thought process is a non-algorithmic process, operating primarily with images, an algorithmic computer is a machine, using rigorous logic, even when we tell it process erroneous data.

Consequently, the similarity between the brain/mind and a computer/program is inconsistent and unjustifiable.

4. Intercommunication Human-Human, human-machine and machine-to-machine

4.1. Intercommunication Human-Human

- ♣ The main way of human-human intercommunication is spoken language. Any form of human communication is:

- ♣ Both a desired effect,

- ♣ And one that is unpredictable and sometimes even unwanted by the speaker.

- ♣ Interpersonal communication, mood and desire to intercommunicate with the receptor may play a pivotal role in achieving an efficient exchange of ideas and information.

- ♣ In developing interpersonal communication a special role is played by the following:

- ♣ Context of the act of communication.

- ♣ Duration, level of knowledge and intercommunication between speakers

- ♣ The level of knowledge in the field pertaining to the conversation.

- ♣ The current human language uses a large number of metaphors (e.g. “don’t judge a book by its cover” and the problem of not understanding the metaphor is

related to living, the central theme of conversation and understanding the notion of conscience.

♣ A familiar environment can make us understand and master the complex phenomena, experiencing a phenomenon (a situation), being fundamental to understanding them (the phenomenon).

4.2. Human-machine intercommunication

♣ So far, there hasn't been a computer program developed which allows human-machine or machine-to-machine intercommunication, using a general dialogue which is perfectly identical with the dialogue used in human communication.

♣ Problems in a verbal dialog with a machine are generated in particular by:

♣ Idiomatic language²² According to some authors, the problems of idiomatic language would be insurmountable in understanding the meanings of sentences.

♣ When referring to dialogue programs with machines the problems have a defining context, yet in the human language the sequence of remarks can signify the content of the entire communication.

♣ Any communication that involves a man-machine interface consists of:

♣ Physical elements (keyboard, screen, mouse etc.)

♣ Virtual elements (windows, menus and other ways of viewing and interaction on the screen)

♣ Software involved in the dialogue between a human and a computer or a computer network.

In the design and operation of such interfaces, the human factor has a decisive role.

²² There is a level (a way) of understanding the world contained in the language aspect of each language, in its structures, in the polysemy of words, in grammar (morphology and syntax), and this level of idiomatic understanding of the world has a strong social character, in the sense that, basically, the entire society, all speakers of a language will eventually reach this level. The common people, who do not have much schooling or have access to specialized literature, remain at the same level of understanding of the world a level that was ensured to everyone, the "language which they were born into", as Varlaam said we see *avant la lettre* ... An educated, well-read human being, especially a scientist, exceeds this level and through personal effort cultivates what we might call a scientific knowledge of the world. In conclusion, we have two models of understanding (interpreting) the world: the idiomatic (to which we have access as speakers of a language, similarities between the languages of the world is more essential than differences) and popular science (with a distinctive personal, individual character to which we can gain access through the effort to learn - even if sometimes against our will).

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♣ The human-machine dialogue, determines the effect it has on the informational interaction, physical interaction between man and machine having only a supporting role (pressing some keys, moving the mouse etc.).

♣ Both man and machine (the computer from the control system) have different representations of information (computers in the form of bit memory or to a higher level of symbolic structures in programming languages and humans in the form of symbolic structures and images from memory).

♣ The machine provides the interlocutor (humans) with some form of information (alphanumeric, graphics, imaging, hearing, touch, etc.), and it assumes, makes certain judgments and results, selects a particular variation processing and gives some orders.

♣ People will interact with the computer and it is hoped that it will become able to respond and show signs of understanding. This type of technology is already being experimented with in a laboratory somewhere.

♣ Verbal communication technology augmented with a natural understanding of a language causes a computer to understand and participate in the interaction.

♣ In 2008, researchers at IBM Israel released the “Hermes” program which should have enable the realization of equipment targeted to help the elderly have an external memory assisted by a computer. According to the technical literature studied it seems that this issue has been resolved.

♣ Researchers from the Honda Research Institute have managed to design and build a robot, of the Asimo type, who performed various tasks, while a researcher was executing the orders, orders not transmitted verbally, but mentally.

The researcher who commanded the robot, wore a helmet equipped with electronic features that allowed the wearer to control the actions of the robot by the power of thought. This helmet represented the first “brain-machine interface”

The brain activity received in the helmet is recorded and transmitted in the form of electrical signals to a computer and with the use a suitable program it is able to identify the movement which the researcher that gave the order was thinking about.

With the help of a computer, man will be free from daily routine tasks, creating more time for personal goals and activities, family etc. What today is presented as being a dream within the next decade of the 21st century, these dreams will become a reality.

♣ We will learn to entrust the logical, routine, algorithm-based thinking of a computer, the same way we did at the start of the first industrial revolution, trust the muscular arm of the powerful machines.

4.3. Machine-Machine intercommunication

♣ The problems of industrial robots and current areas of automated production are simpler than the robot of a human type, but more complex than those of the first robots – *The mechanical duck*²³ - or other means of production that lack controls and regulation.

♣ Artificial intelligence has become a feature of automated production only after humans had the means to generate an electronic form.

♣ Machine-machine communication, although it is in the beginning stages of development, it is in constant expansion. However, so far it has not created an infrastructure allowing intercommunication between devices or general telecommunication, embedded in machines equipped with artificial intelligence.

♣ According to some literature it was estimated that in 2010 the number of communication devices integrated into machines equipped with artificial intelligence will be 1000 times more than the number of mobile phones, which in 2010 was already more than a billion. I do not know if this statement was brought to fruition or not.

♣ When all existing communication devices will be connected to the Internet, new opportunities will appear for machine-machine intercommunication.

♣ The Usenet Project (an omnipresent network service for machine-machine/M2M communication) launched the Eureka / ITEA 2 in 2008 and proposed a plan that within three years it would be able solve the problem of interoperability, providing collection, transmission and processing information and interactive machines will be fitted with communication. In 2011 the Usenet project was not yet completed.

♣ This ubiquitous network M2M service was established to provide opportunities and advantages essential for the conduct of various companies, in particular by ensuring that they have control over the deployment of their main processes which can use information in real time, generated by the M2M intercommunication system.

²³ In the winter of 1738-1739, Jacques de Vaucanson (1709-1782) French engineer, built a mechanical duck and made a demonstration of it in Paris. Considered to be the first robot that was able to peck grains, which after a reasonable interval, necessary to “digestion” disposed of them. Along with the mechanical duck, at the same demonstration two mechanical constructions representing a flutist and a drummer holding a tambourine and a flute singer were presented. In addition to the commercial success, these three contraptions were also successful on the philosophical, popular and professional levels, which greatly impressed Voltaire and led him to dub Vaucanson as the “rival of Prometheus” later gaining the admiration of Frederick the Great, who invited the creator to the court . Vaucanson declined, but went on to become the inspector of manufactures under Louis XV. He was chosen over Diderot, who was a member of the Academy of Sciences in Paris.

♣ The main result of the operation of the M2M system will be interconnected, so companies will be able to increase quality, reduce costs and increase customer satisfaction.

5. Can Machines be Self-Aware?

♣ At present there are more machines whose "behavior" would suggest that they are equipped with a mental processes. For example, airplanes can fly with autopilot on planned air routes responding by themselves to external "sensory" information, being able to "take decisions" about the flight by itself and "communicate" with other aircrafts, to "know" when it "needs" fuel, they are able to "feel" a potential threat, etc.

♣ Based on the way automatic pilot works it ultimately begs the question: Is it only people who can make decisions, communicate? Can machines do the same? For some researchers, strong artificial intelligence is not just a tool to formulate and test hypotheses regarding the human world, however, if well programmed it could become a mind that would appear to understand and has other cognitive processes, in short, a conscious mind.

Other researchers considered that only a machine made from "flesh and blood" or neuro-proteins might be self-aware, silicon metal make it inaccessible to the phenomenon of consciousness.

♣ The human brain has been regarded as a supercomputer that could interact with ordinary computers.

♣ Some literature states that in the next 25 years it will be possible for a person to "transfer" its mind, memory, intelligence and his whole personality into a machine which will ultimately become self-aware.

♣ As of now such statements are and will be considered to be sci-fi scenarios, but only as long as it is not known how the human brain works and therefore does not know what consciousness is.

♣ All states which are not optimistic forecasts cannot explain the strict requirements for a machine to have a conscience.

♣ We can only assume that the conscience of a machine should not have anything extra than that of a human.

An answer to such a problem could also refer to the amount of integrated information that a human being or a machine could generate.

♣ From this point of view man and machine act differently. Each denote a distinct existing condition.

For example, a man and a photo detecting cell can signal if a nearby screen is bright or dark.

- When the photocell receives a light signal it falls into one of two possible states;

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- A human sees the screen as dark when entering a large number of possible states. If you see black that means that you don't see blue, red, green etc. For humans, the dark screen does not only mean the absence of light, but can also mean lack of images previously seen and appreciated.

♣ As a result, being aware is supposed to be an entity with a huge repertory of states and a level of consciousness that is given by the amount of integrated information that can be generated.

♣ A test to see if a machine can have intelligence, which may or may not involve a conscience, might be compared to being asked to clearly describe a scene witnessed for the first time and which is clearly differentiated from the huge number of scenes stored in its database.

In 1986, using an electron microscope, an artificial model of the brain with over synapses 6000 was developed. 25 years later they are still working on the functional model of the minimal nervous system.

♣ Giorgio Buttazo showed how complex the human brain can be by calculating the huge number of synapses (10^{12} neurons each, on average 10^3 synaptic connections with other neurons, so a total of 10^{15} synapses - for each synapse²⁴ that is needed in a 4 byte memory computer) resulting in the requirement of a 4 million Gbyte memory, memory that might be achieved in the years 2029-2030.

♣ Remember, however, that by making such a memory it would solve only one of the physical conditions required to simulate a GIANT NEURAL MODEL. By doing this we hope that it might determine how to form a conscience based on a huge number of parameters whose values are only vaguely alleged and therefore, I personally think that such a simulation is highly unlikely to be achieved in the foreseeable future.

Some literature considers that the development of nano-based technology, molecular nano-electronics and quantum devices will make it possible to replace the MOS technology with ISOC technology since 2015, which opens new perspectives of data storage capacity.

♣ Improving computer technology alone will not help to tackle brain knowledge and theory of the mind and a consciousness based only on structures and structural fundamental forces of nature is not possible.

♣ If we were to understand how it was built and how the human brain works that would be an important step in understanding how human consciousness is formed. But

²⁴ A synapse is the region of communication between two neurons or a neuron and an effector organ (muscle, gland, etc.). Nerve impulse transmission is not performed by an electric leap since the postsynaptic membrane is electrically excitable, the transmission is made through a chemical mechanism.

remember, only one more step and that is why the issue of forming the human consciousness is very unlikely to be resolved in this century.

Conclusions

1. The awareness we have today is the result of continuous interaction for millions of years, the tools (i.e. limbs), thinking (i.e. brain/mind), communication (i.e. interaction with society) and the cultural development of the individual becoming increasingly more intense.

♣ Therefore, there has been established a character which is extremely different from self-consciousness; consciousness exists even some animals while they also possess some form of intelligence.

♣ It is now clear that human consciousness is part of the natural world, which results in a reduced physical human evolution in favor of human cultural evolution.

2. Nowadays, there are some machines that have the ability to read and understand some texts written in the human language strictly pertaining to that specific field, to recognize shapes and process images, there are machines that are able to communicate with each other, exchanging information and enriching their databases. However, it is not known if:

♣ Computer programs have been designed in order to:

Give a machine the ability to be self-aware;

Allowing the machine to identify the space in which it is located and what is the appropriate route to take in order to reach another spatial location.

♣ Noticeably, there is still no program that can certify authority to a machine in order to travel to a totally unknown area or to a known area which can be easily modified.

• The GPS addresses the driver of the car, not the car itself.

3. Explaining the mode of action of the brain and mind was made possible by taking into account the evolution of science and information technology, yet many conclusions were made on the possible functioning of the brain based on the known operations of an electronic computer.

♣ The possibility of higher levels of structural organization of quantum information processing in the brain should be considered, levels that can be identified through further research.

♣ Russian physicist Vladimir Poponin produced some famous experiments in the early 90s of the twentieth century and the conclusion of Poponin's experiments was that there is a quantum field that exists all around us and unites us all. Through this field, we are always connected with everyone and everything, whether we are conscious of it or not.

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4. Currently, it is unknown whether human consciousness depends only on natural laws (still imperfectly known) or if it is formed as a result of the action of unknown energy fields.

♣ Only after we are able to fully comprehend the whole system of quantum information processing of the brain can we truly tell if machines can be self-aware or not.

♣ These facts leads us to the conclusion, that at present, there is no a prerequisite to make us believe that, in the near future it would be possible to build machines with a conscience similar to that of a human.

5. The human species is distinguished from other species in that it is the only species that has affected the natural environment.

♣ Through research, the practical implementation of new scientific discoveries and new technologies should not fight against the natural world created but rather against the energy and movements of world powers which create an unnatural and hostile environment.

♣ Human intelligence has deciphered the genome of its species, we are already cloning species and organs, we were able to regenerate a picture of a supposed Big Bang, we are able to explore the solar system but we fail to explore and know our own planet, to know and understand the genesis and destiny of mankind in the universe.

♣ In this context, to affirm that it is possible for sure to build a machine with a conscience, would not be in line with reality.

Perhaps the best answer would be that in the foreseeable future, it will not be possible to build machines with human intelligence, let alone with a conscience similar to that of a human, the only type of intelligence that can be sustained in the near future for machines is that of an algorithmic binary.

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