**INFO II ZI-C- 07.12.2022**

**WHAT IS ARTIFICIAL INTELLIGENCE? (III)**

**VII. Make sentences of your own with the following:**

* *to carry out*
* *to be aware of*
* *to set out to*
* *to pose a question*
* *to fool somebody into something*
* *to pass/fail a test*
* *to aim at*
* *to base an argument on*
* *to attach meaning to something*
* *to point out*
* *to strike at the heart of something*
* *to hold a belief*
* *in defence of*
* *(taken) as a whole*
* *to put forward*
* *to puzzle over something*
* *to require skills*
* *to be aware of*
* *to adhere to*
* *to wink an eye*

**VIII. Choose from the following words to complete the text below. Pay attention that some forms of the words must be changed:**

*antiquity, goal, individual, setbacks, machines, communication, subfields, textbooks, central, to coin, specific, intelligence, philosophical, to simulate.*

Artificial intelligence (AI) is the [intelligence](http://en.wikipedia.org/wiki/Intelligence) of 1)… and the branch of [computer science](http://en.wikipedia.org/wiki/Computer_science) that aims to create it. 2)… define the field as "the study and design of [intelligent agents](http://en.wikipedia.org/wiki/Intelligent_agent)" where an intelligent agent is a system that perceives its environment and takes actions that maximize its chances of success. [John McCarthy](http://en.wikipedia.org/wiki/John_McCarthy_%28computer_scientist%29), who 3)… the term in 1956, defines it as "the science and engineering of making intelligent machines."

The field was founded on the claim that a central property of humans, 4)…—the [sapience](http://en.wikipedia.org/wiki/Sapience) of [Homo sapiens](http://en.wikipedia.org/wiki/Homo_sapiens) — can be so precisely described that it can be 5)… by a machine. This raises 6)… issues about the nature of the [mind](http://en.wikipedia.org/wiki/Mind) and limits of scientific [hubris](http://en.wikipedia.org/wiki/Hubris), issues which have been addressed by [myth](http://en.wikipedia.org/wiki/History_of_AI#AI_in_myth.2C_fiction_and_speculation), [fiction](http://en.wikipedia.org/wiki/Artificial_intelligence_in_fiction) and [philosophy](http://en.wikipedia.org/wiki/Philosophy_of_AI) since 7)… . Artificial intelligence has been the subject of optimism, but has also suffered 8)… and, today, has become an essential part of the technology industry, providing the heavy lifting for many of the most difficult problems in computer science.

AI research is highly technical and specialized, deeply divided into 9)… that often fail to communicate with each other. Subfields have grown up around particular institutions, the work of 10)… researchers, the solution of 11)… problems, longstanding differences of opinion about how AI should be done and the application of widely differing tools. The 12)… problems of AI include such traits as reasoning, knowledge, planning, learning, 13)… , perception and the ability to move and manipulate objects. General intelligence (or "[strong AI](http://en.wikipedia.org/wiki/Strong_AI)") is still a long-term 14)… of (some) research.

**IX. Translate into Romanian:**

**A.** When talking about artificial intelligence, there first has to be answered the question what artificial intelligence actually is – or at least what it should be. The definitions that can be found about artificial intelligence are various: “Artificial intelligence is a branch of computer science concerned with making computers behave like humans.” Taking a look on the web or on non-scientific press, the concept that non-engineers and non-scientists often have about artificial intelligence is heavily

influenced by film industry. One classical example is the android Data in Star Trek: An artificial, intelligent being, possessing similar or superior intelligence as humans have and maybe lacking a bit of emotions and feelings. Their expectation is that research is not too far away from this aim. What comes up with this expectation are concerns and discussions about ethics. On the one hand, if machines get superior intelligence as we have, there arises the fear that machines will rule the world, kill us, or keep us as slaves (as we see in movies like Terminator or Matrix). On the other hand, if we assume that machines will not possess superior intelligence but feelings and a soul, questions of ethics will come up concerning the rights of machines, as we might keep them as slaves for doing our work. Scientists talking to public press are often confronted with this question of ethics. One answer given in 2007 by Gerhard Zucker, one of the keynote speakers, is the following: “Society will find a way to handle these issues like society found solutions before for slavery and animal testing”. Actually, this is a wise answer for a scientist in terms of publicity. It implies that our research is already in a very advanced stage and it is time to face these questions. However, reality is still very different. Today, science is still far away from the goal of creating something that is at least close in intelligence to humans and it is not yet sure whether we will ever reach this goal.

**B.** **A Brief History of AI**

The wish to create artificial intelligent life might be as old as mankind. Already in the

ancient Greece, we can find myths about the Greek god of technology Hephaestus who was lame and therefore constructed two golden robots to help him move about. Another well-known narrative is the one of the British scientist Frankenstein who designed a human being from scavenged body parts. Such literature clearly shows that the intention to create human-like intelligent beings was already there for at least some thousand years, only the required means were missing. This situation seemed to change after 1950. Round 1950, it was the time of the advent of the first computers. With their processing power, they offered completely new possibilities. For the first time, the dream of designing an electronic brain seemed to be realizable. The research field of artificial intelligence started to emerge.

**The Golden Years (1950-1975)**

The first years of artificial intelligence were marked by great successes. It was the era of discovery and sprinting across new ground. The programs developed during this time were, to most people, simply “astonishing”. Computers were playing chess, solving algebra problems, proving theorems in geometry, and learning to speak English. Few people at that time would have believed that such “intelligent” behavior of machines was possible at all. Machines were seemingly easily executing “cognitive” tasks that were difficult even for humans. A lot of public money was invested into this promising area, and researchers were very optimistic that a fully intelligent machine would soon be built. The following well-known statements may best catch the spirit of this time:

* 1965, H. A. Simon: “Machines will be capable, within twenty years, of doing any work a man can do.”
* 1967, M. Minsky: “Within a generation ... the problem of creating <<artificial intelligence>> will substantially be solved.”
* 1970, M. Minsky: “In from three to eight years we will have a machine with the general intelligence of an average human being.”

The question that logically arose at the same time with the attempt of building intelligent machines was the question of how to prove intelligence of machines. There was the need for a certain evaluation mechanism. The most prominent and best accepted evaluation mechanism suggested for this purpose at that time was the so-called Turing test designed by Alan Turing in 1950.

Around 1970, researchers were very optimistic that machines would soon (latest in one generation) reach human intelligence level. There already existed the first programs passing the Turing test, which was the official test for proving computer intelligence. Looking at statements of that time today and recognizing that approximately 40 years have passed since then, the logical question that arises is why there are still no intelligent machines among us.

**The Years of Reconsideration (1975-2000)**

In 1996, round 30 years after the statement of M. Minsky that “within a generation ... the problem of creating 'artificial intelligence' will substantially be solved”, a young scientist called Push Singh, who happened to work under M. Minsky, published an article with the title: “Why AI failed”. This fact clearly illustrates that after the first years of enthusiasm, AI went through a change. AI began to get stuck. Researchers had to admit that making computers actually think – even on a childlike level – was far more complicated than they expected. One explanation for this could be that in the first years, scientists focused on problems that were difficult for humans (like playing chess, solving algebra problems) and therefore seemed to be particularly challenging for intelligent machine design. Researchers generally considered constrained problems and problem domains. They had the illusionary hope that when accumulating all single efforts together, soon an intelligent machine would emerge. They did so far not put emphasis on problems that were easy for humans like e.g., perceiving their surroundings, evaluating complex situations (what is currently important?), and taking decisions in real world environments. When starting to consider these issues, it turned out that they were very difficult to implement into a computer.

**The Current State of AI**

Today, artificial intelligence has split into two branches. These branches are probably best referred to as method-based artificial intelligence and brain-inspired artificial intelligence. Nowadays, many researches are still not aware of the existence of these two sub-disciplines which are in fact very disparate in their basic dogmas.

**Method-based AI**

During the history of artificial intelligence, it had to be admitted that creating human-like intelligence is far from trivial. When recognizing that creating truly intelligent machines seemed to be almost infeasible, researchers started to focus on simpler and more constraint problems. The goal was no longer to achieve a machine with a human intelligence level for all circumstances but to develop particular solutions for particular problems. Examples of classical methods of methodbased AI are symbolic systems, expert systems, genetic algorithms, artificial neural networks, etc. This classical AI domain is a mature research field. Hundreds of textbooks can be found about these methods. Problems that are solved with these methods are pattern recognition problems (image processing, language processing, etc.), prognoses, path planning, etc. These problems are solved by certain mathematical models and algorithms but have hardly anything to do with how the brain works and solves these problems or with human intelligence. One fact that might be surprising is that also tools like artificial neural networks are assigned to this category as they are inspired from the function of biological neurons in the brain. Artificial neural networks however do not emulate a neural brain network but just quite simplified neurons. The way in which artificial neurons are interconnected has not much to do with how interconnection takes place in the brain, which rather seems to be the secret of the complexity of the brain than the function of single neurons alone.

**Brain-inspired AI**

So far, there is no technical system that can even nearly compete with the capacity and the capabilities of the human mind. Within the last years, it had to be admitted that the reducedapproaches often focused on in classical method-based AI can never lead to technical systems with skills and capabilities comparable to humans’ mental abilities. Therefore, “like atthe beginning of artificial intelligence research, again, findings about how natural intelligence works have to be the basis for developing concepts for technical approaches trying to achieve intelligence”. This is the basic dogma of the new generation of brain-inspired AI approaches. Here, archetypes for model development of intelligent systems are the structure, functional systems, and information processing strategies of the brain. Approaches followed in this area are various and based on different disciplines of brain research like neuroscience, psychology, pedagogy, psychoanalysis, etc. The following section is aimed at mediating a basic understanding of what research efforts are currently going on in this research community based on some concrete projects realized within the last 10 years by an about 25-headed interdisciplinary research team of the Vienna University of Technology.

**Future Perspectives of AI**

Concerning the vision on how the research area of artificial intelligence will develop, there exist two different opinions – a pessimistic and an optimistic one. According to the pessimistic view, we will never be able to build machines similarly intelligent to humans. The main reason for this is that we will not be capable of understanding how the brain works, or even that there is more about the brain and the mind than just a huge bunch of neurons interacting with each other. The computer pioneer Prof. Heinz Zemanek, who also formed part of the early artificial intelligence community, used to say: “If one light switch is not intelligent, why 1000 should be” and he generally added: “I built a computer. I can tell you that there is nothing intelligent in it... and if you call the computer intelligent, then I am not, then I am something else.”

On the other hand, there also exist more optimistic views considering the task of emulating the human brain as feasible, maybe not with today's computer technology but with technologies using the structural organization and information processing principles of the human brain as archetype. According to Etienne Barnard, there exist two different possibilities for how this research field will progress. One possibility is that as until now, small but continuous progress will be made. The other possibility is that the next Albert Einstein – the Einstein of Artificial Intelligence – will appear and a big leap forward will be made. Assuming that the optimistic views hold true, an outlook on a number of challenges that will have to be faced in the research area of artificial intelligence in the future should now be given. For sure, the most challenging goal of research in this area is to achieve consciousness of machines.

Consciousness of an individual is its subjective experience – to know what it is like to be oneself. Metaphorically speaking, the aim is to create a machine that one day opens its eyes and asks us “Who am I?” and maybe adds “And who are you?” It does not ask, because we have programmed it to do so, but because it is aware of itself as an individual living being. Today, there are many discussions going on in different research communities concerning conscious machines. The fact is that we are still far away from this goal. Modeling consciousness is last but not least a problem because it is subjective and not measurable. According to, not even a human being can be sure about the consciousness of other human beings. Consciousness cannot be technically modeled by adding a further function block (the consciousness block) to a brain model. It rather emerges from the sum of all other physiological and mental functions. Therefore, to model consciousness, the focus of research has first to be directed towards issues that are a prerequisite for it. We shall further mention some of these issues. One issue that we might have to integrate into machines is constituted by emotions. So far, the role of emotions in thinking and intelligence has widely been ignored. New research results however show that they have a major influence on our thinking and our decision-making processes. In the first model introduced in the last section, as well as in models of some other research groups, the concept of emotions was already integrated. Nevertheless, emotions are still a topic needing further thorough investigation from both the perspectives of brain research and engineering.

A second point is the embodiment of machines. According to the theory of embodied

intelligence, we can never be intelligent and conscious without having a living body that has needs, that has sensors to perceive its environment and its body, and actuators to act on the body and the environment. A third point that might have to be considered when creating artificial intelligent life is survival and reproduction. It is an uncontestable fact that the brain becomes useless as soon as the organism dies. According to the neuroscientist and psychoanalyst Mark Solms, who tries to give the

meaning of life on a scientific basis, the purpose of life is “survival for reproduction”. He further outlines what is necessary to achieve this goal: We as human beings with our body live in an environment – the world. To survive and reproduce, we need to get from the environment food and a partner of the opposite sex for reproduction. For this purpose, we have to be able to perceive the environment and to act on it. All these tasks of perceiving, of evaluating what was perceived, and reacting accordingly are controlled by the brain. The task of the brain is to mediate between the internal needs (I am hungry, I want social interaction) of our body and the environment in which our

needs can be satisfied. The brain perceives the environment and the internal needs of our body, evaluates these perceptions, decides what to do, and prepares signals for (re-)acting on the environment. As the whole organism and the brain seem to be designed to achieve the basic goal of survival for reproduction, it might not make sense or even not be feasible to design true artificial intelligence without considering this issue. Having mentioned reproduction, a related topic for investigation is evolution. Our brain did not evolve from one day to the other but is the result of millions of years of optimization processes through variation and selection. Therefore, it might not be the best way to rely on “intelligent design” only but rather to make available mechanisms for self-optimization as it is the case in evolution.

In conclusion, it can be said that the research domain of biologically and brain-inspired artificial intelligence is by far not saturated. It is an area where still astonishing discoveries can be made, secrets can be unveiled, and new grounds can be broken. To achieve this, engineers will have to join forces with brain scientists and life scientists and carry out research in a tight collaboration.

**C.** The Chinese room is a [thought experiment](http://en.wikipedia.org/wiki/Thought_experiment) by [John Searle](http://en.wikipedia.org/wiki/John_Searle) which first appeared in his paper "Minds, Brains, and Programs", published in [Behavioral and Brain Sciences](http://en.wikipedia.org/wiki/Behavioral_and_Brain_Sciences) in 1980. It addresses the question: if a machine can convincingly simulate an intelligent conversation, does it necessarily understand? In the experiment, Searle imagines himself in a room acting as a [computer](http://en.wikipedia.org/wiki/Computer) by manually executing a [program](http://en.wikipedia.org/wiki/Computer_program) that convincingly simulates the behavior of a native Chinese speaker. People outside the room slide Chinese characters under the door and Searle, to whom "Chinese writing is just so many meaningless squiggles", is able to create sensible replies, in Chinese, by following the instructions of the program; that is, by moving papers around. The question arises whether Searle can be said to understand Chinese in the same way that, as Searle says, "according to strong AI, . . . the appropriately programmed computer really is a mind, in the sense that computers given the right programs can be literally said to understand and have other cognitive states." The experiment is the centerpiece of Searle's Chinese Room Argument which holds that a program cannot give a computer a "mind" or "understanding", regardless of how intelligently it may make it behave. He concludes that "programs are neither constitutive of nor sufficient for minds." "I can have any formal program you like, but I still understand nothing." The Chinese room is an argument against certain claims of leading thinkers in the field of [artificial intelligence](http://en.wikipedia.org/wiki/Artificial_intelligence), and is not concerned with the level of intelligence that an AI program can display. Searle's argument is directed against [functionalism](http://en.wikipedia.org/wiki/Functionalism) and [computationalism](http://en.wikipedia.org/wiki/Computationalism) (philosophical positions inspired by AI), rather than the goals of applied AI research itself. The argument leaves aside the question of creating an artificial mind by methods other than symbol manipulation. Controversial, and the subject of an entire literature of counterargument, it became [Behavioral and Brain Sciences](http://en.wikipedia.org/wiki/Behavioral_and_Brain_Sciences)'s "most influential target article",generating an enormous number of commentaries and responses in the ensuing decades.

**X. Translate into English:**

La început, crearea şi cercetarea inteligenţei artificiale s-a desfăşurat pe domeniul psihologiei, punându-se accent pe inteligenţa lingvistică, ca de exemplu la [testul Turing](http://ro.wikipedia.org/wiki/Testul_Turing). Acest test constă într-o conversaţie în limbaj uman natural cu o maşină (computer) care a fost programată special pentru acest test. Există un juriu uman care conversează cu acest computer, dar şi cu un om, prin câte un canal pur text (fără ca ei să se vadă sau să se audă). În cazul în care juriul nu poate să-şi dea seama care este computerul şi care omul, atunci inteligenţa artficială (programul calculatorului) a trecut testul.

[Turing](http://ro.wikipedia.org/wiki/Turing) a prezis în [1950](http://ro.wikipedia.org/wiki/1950) că până în anul [2000](http://ro.wikipedia.org/wiki/2000) vor exista maşini (calculatoare) cu 109 bytes (1 GB) de memorie care vor putea "păcăli" 30% din juriile umane într-un test de 5 minute. Însă, în timp ce pe de-o parte tehnologia chiar a depăşit previziunile lui Turing, inteligenţa artificială este încă departe de a fi realizată. Noile previziuni ale experţilor se bazează pe aşa-numita [legea lui Moore](http://ro.wikipedia.org/w/index.php?title=Legea_lui_Moore&action=edit&redlink=1) ("numărul de tranzistori pe un [circuit integrat](http://ro.wikipedia.org/wiki/Circuit_integrat) se va dubla la fiecare 18 luni, prin urmare şi puterea de calcul"), "lege" care s-a îndeplinit pentru ultimii 30 de ani destul de bine, şi poate că va mai fi valabilă încă 5-10 ani. Pentru viitor se speră că noile tehnologii (cuantice, optice, holografice, nanotehnologiile ș.a.) vor permite menţinerea creşterii exponenţiale, astfel că în maximum 20 de ani computerele să depăşească puterea de procesare a creierului uman (vezi: [Singularitate tehnologică](http://ro.wikipedia.org/wiki/Singularitate_tehnologic%C4%83)).