Review Article

What is it like to be an AI bat?

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Consciousness is a natural phenomenon, familiar to every person. At the same time, it cannot be described in singular terms. The rise of Artificial Intelligence in recent years has made the topic of Artificial Consciousness highly debated. The paper discusses the main general theories of consciousness and their relationship with proposed Artificial Consciousness solutions. There are a number of well-established models accepted in the area of research: Higher Order Thoughts/Higher Order Perception, Global Network Workspace, Integrated Information Theory, reflexive, representative, functional, connective, Multiple Draft Model, Neural Correlate of Consciousness, quantum consciousness, to name just a few. Some theories overlap, which allows for speaking about more advanced, complex models. The disagreement in theories leads to different views on animal consciousness and human conscious states. As a result, there are also variations in the opinions about Artificial Consciousness based on the discrepancy between qualia and the nature of AI. The hard problem of consciousness, an epitome of qualia, is often seen as an insurmountable barrier or, at least, an "explanatory gap". Nevertheless, AI constructs allow imitations of some models in silico, which are presented by several authors as full-fledged Artificial Consciousness or as strong AI. This itself does not make the translation of consciousness into the AI space easier but allows decent progress in the domain. As argued in this paper, there will be no universal solution to the Artificial Consciousness problem, and the answer depends on the type of consciousness model. A more pragmatic view suggests the instrumental interaction between humans and AI in the environment of the Fifth Industrial Revolution, limiting expectations of strong AI outcomes to cognition but not consciousness in wide terms.

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I. Introduction

The recent rapid advance in the development of Artificial Intelligence renewed an old-age debate about the nature of intelligence itself. While many experts are satisfied with identifying it with computational power [1], perception abilities and data processing, not everyone agrees with such a reductionist approach [2]. The wider understanding of intelligence often includes additional options, which are not synonymous with enhanced intelligence. The strong or full AI is supposed to possess consciousness. There is a debate about the correlation between consciousness and intelligence and the nature of consciousness [3]. While weak AI is generally understood on a consensual basis of measurable parameters and performed tasks, there is less concord about consciousness itself and the possibility for any non-human or non-biological system to have any or all of its characteristics [4].

The term "Artificial Consciousness" (AC) first appeared in English scientific literature in 1969 [5]. Several attributes are presumed necessary for consciousness to be recognized as such. According to different opinions, the conscious system has self-awareness, perceptual awareness, intentionality, reflexive functions, awakeness state, autopoiesis, self-representation, and self-control [6][7][8]. A few theories which combine these requirements to describe models of consciousness or answer specific questions are mentioned above. We will discuss the main theories and try to systematize their answers to comprehend the possibility of AC [9] implementation from their point of view.

The problem of consciousness was formulated as early as the discussion in antiquity about human behaviour independent from higher spiritual entities. Philosophers and scholastics proposed a pre-scientific vision, which was replaced by nature-philosophic and, today, by a scientific one. However, as some researchers think, scientific theories are not free from remnants of previous views or insufficient explanatory power [2]. Elements of vitalism, biologism, anthropocentrism, cartesian dualism, mysticism, physicalism, psychologism and cognitivism are often criticized and thought to be obstacles in the way of fundamental consciousness understanding. Without this understanding, it is impossible to say if consciousness applies to machines and if it will be fully understood in the future.

It is possible to reformulate questions. Let us say that consciousness is a feature of a complex information-processing system [10][11]. Does it mean the system has to be autonomous to be conscious [12]? If consciousness is of a complex nature, which elements are sufficient to be in superposition for the system to be recognized as conscious [13]? If consciousness is a general

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phenomenon, not limited by our involuntary anthropocentric understanding, how far goes the difference [14]? Are we able to understand the radically different consciousness or at least appreciate it exists [15]? The question, often asked by experts and non-experts alike, if Artificial Intelligence development can lead to the appearance of artificial conscious systems, what are possible ethical and general outcomes for the society and future of humankind [12][15]?

II. Consciousness. Models and Types

Consciousness is a matter of interest for a wide spectrum of disciplines, from philosophy, mathematics, anthropology and psychology to sociology, biology, neurophysiology and technology. The ontological approach sees the phenomenon of consciousness in the world context of existence [16]. The psychological and functional view is focused on frames of cognition, memory, associated emotions, reflective abilities and qualia, and complex phenomenal states of mind [17]. Neurophysiology is occupied with physiological and biological functional conditions and biological substrate or neural system structures responsible for consciousness [16]. The current technological vision of consciousness is a combination of philosophical, functional and formal structural approaches, where functions related to biological structures of consciousness are less relevant [18]. Autopoiesis, e.g. autonomy of active existence, self-oriented functions or evolutionary mechanisms in strictly biological terms [19] are not directly applicable to technological systems. Nevertheless, there are models of consciousness with different importance of these aspects [20].

There are several significant components of consciousness [21]. The metacognitive or supervisory element is important in several theories. Some models recognize perceptive and cognitive roles as essential for functional consciousness. In a functional paradigm, consciousness is the mere ability to sense, analyze and adequately reflect and react. The physicalist approach places an accent on the underlying physical structures and physical processes of consciousness. Dynamic models underline the time frames. Some theories give importance to self-awareness until the level of introspection, others prioritize levels of awakeness or intentionality. In any case, there is no simplistic theory with a one-for-all explanation.

The Higher Order (HO) group of theories point out the necessity for a meta-cognitive state for consciousness [22]. The Higher Order Thoughts explanation puts an emphasis on the supervisory part, which oversees the Lower Orders of thoughts and operations, the “unconscious” ones [23]. In the conscious state, a person is aware of being conscious and can report it in the first-person account. Self-awareness is crucial for this model. Introspective thought abilities are important for Higher Order Thought theories. The Higher Order Perception theories [22] are more focused on perceptive abilities. For example, external perception requires both perceptive and internally intensive acts, with simultaneous application to internal sensory data. The perceptive act is a sort of, in the words of Max Clowes, “controlled hallucination” [24], while partial or full loss of control leads to uncontrolled hallucinations. There is a discussion between HO theoreticians about [25] the need for intentionality to be conscious. If it is not necessary, animals can be conscious in accordance with simple HO requirements. In the case of necessity, animals and children are excluded. The Higher Order Global State (HOGS) theory is more functionalist and reflective when intentionality is a merely pragmatic necessity produced by perceptive stimuli [26][27].

The Neural Correlate of Consciousness group of theories (NCC) is occupied with consciousness's neuroanatomical and neurophysiological basis, avoiding questions of qualia until later. First, this approach was proposed by Francis Crick [28]. The cellular basis is neuronal. There are estimations of neurons in the human brain from 8.6×10^{10} [29] to 1.3×10^{11}. An average number is usually claimed to be 10^{11} neurons, which form 10^{14} connections. The neuron is capable of processing a significant volume of information as a separate processing unit and can make up to 1000 connections. Consciousness depends on the brain structure and functions of interconnected nuclei fields and lobes. While one group of researchers emphasizes the prefrontal and parietal neocortex, others find deeper structures which are critically important for the conscious state [30]. The brainstem nuclei in the reticular formation, which are not directly involved in the homeostatic functions, are supposed to be the most important part of the “proto-self” system, together with basal ganglia, hypothalamus and somatosensory cortical area S2. The neural map of “self” is formed by these areas in accordance with signals from exteroceptive and interoceptive parts of the brain. The reticular formation reaches the medium brain, the mesencephalon. The Mesencephalic Reticular Formation (MRF) is one of the most important elements of consciousness formation. It takes part in the production of the ‘gamma’ 35-44 Hz frequency [31], which correlates with “conscious” states. There are also theories of two NCCs, phenomenal and access correlates [32].

Global Workspace Theory (GWT) is an extension of NCC-type theory, with the addition of structural and functional elements of a different order. It presumes the existence of the all-brain network, where broadcasting forms a temporary “bright spot” of consciousness [33] on the backstage of the unconscious contexts. Learning Intelligent Distribution Agent (LIDA) is a supporting part of Global Workspace Theory

(GWT) [34]. Brain structures produce global cycles with the involvement of different ensembles. These cycles are directly related to consciousness and different types of memory. Mechanisms involve the CogAff (cognition and affect) framework: reactive, deliberative and meta-management [35]. The updated version of GWT, Global Neuronal Workspace (GNW), speaks about the network of specific significant areas of the brain [36], where local networks` "processors" are connected by a global network. The complex activity in the GNW is analysed functionally and physiologically. Levels of consciousness can be explained by the global connective activity and individual activity levels of local areas or modules. The specific modular theory is formulated by Fodor [37], where lower-level information modules are observed by higher non-modular cognition levels.

Multiple Draft Model (MDM) is a conceptual description of the consciousness framework [38]. The model criticizes the central representation idea as a Cartesian theatre with a supposed "homunculus" taking a central position in the view of changing scenes. MDM denies the necessity for the strictly fixed central agent of consciousness. Instead, more active combinations of activated areas of the brain occasionally dominate at a certain time, while consciousness is simply a constant change of dominating combinations, appearing as a stream and not a static state. Some close theories claim the necessity for potential consciousness agents to be in constant Darwinian competition when the most dominating process occupies an upper place, similar to one in HO theories. While disagreeing with an obligatory top-conscious agent, MDM also denies any place for the so-called "hard problem". The seminal paper "What is like to be a bat?" [39] claims the inability of other creatures to experience unique qualia of specific phenomenal experience. Non-bats cannot imagine or reproduce, let alone feel and "know" from the perspective of first-person anything like that. The hard problem is a fundamental barrier which is impossible to overcome [40][41], or at least it produces an explanatory gap [42] in understanding. MDM postulates a constant flow of consciousness and conscious agents` combination with no one-for-all top stricture with the highest conscious level. According to this model, there is no hard problem at all, and the lack of a full explanation is imaginary. There is never a full explanation and no gap between highest-order consciousness and qualia. Qualia itself can be distilled into a sensory experience of a different sort, with no mystique about it [43].

An important aspect of consciousness is the level of awareness or activity. There are several well-known states of consciousness: nonconsciousness, general anaesthesia, deep sleep, REM sleep, dreamlike state and normal awakeness. There are also states of changed or altered consciousness, which are produced by meditation, medications, organic influences on the brain or psychoactive substances. According to

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Integrated Information Theory (IIT) [11], the various states of consciousness are registrable and measurable. Consciousness in IIT is not just a hierarchical model or stream of states and interactions between different brain structures. It is a complex condition with several variables. The level of consciousness is possible to quantify, and the state can be described in accordance with experimental data. There is an instrumental way to distinguish between levels and states of consciousness by the combination of measured parameters and the resulting 'phi' value. The IIT theory possesses a developed mathematical apparatus and is placed on a physical and physiological basis. At the same time, the formulation of the theory allows a wide formal frame for the information blocks and their physical basis. Following IIT principles, any suitable physical system has information and is potentially able to unite for the consciousness to appear. There is a criticism of this theory as one that uses panpsychism [14] instead of an explanation for the phenomenon itself. However, critics also put a controversial argument of "philosophical zombie" against any conscious system without qualia, reformulating hard problems for lower conscious systems [44][45].

Quantum Consciousness (QC) is another physicalist solution. The group of theories goes further than IIT and postulates a quantum mechanical basis for the functionality of the basic brain processing units. Several principles were proposed to support different QC theories. There is a hypothesis about the holographic nature of consciousness as a result of multiple quantum processes [46]. According to other QC theories [47], the quantum process occurs in the cytoskeletal tubulin microtubes of the cell, specifically the neurone, and produces the gamma rhythm. The collapse of wave function leads to "orchestrated objective reduction (OrchOR)" and gives an explanation of the consciousness phenomenon that is more fundamental than computational or neuro-integrative models. QC can potentially solve the problem of free will and explain readiness potential [48][49] in experiments of conscious control of movements through temporal non-locality. There are even wider quantum consciousness theories, such as "it from bit" [50] or Mathematical Universe [51]. However, the last hypotheses remain highly theoretical. Table 1 highlights the characteristics of consciousness theories.

Consciousness Theory	Short Summary	Variants and Forms	Important Features and Elements	References in Text
Higher Order group of theories (HOT)	Meta-cognitive state as consciousness, phenomenal	HOTT, HOP, HOGS and some others	Metacognitive or Metaperceptive element	[22][23][24][25][26][27]
Neural Correlate of Consciousness group of theories (NCC)	Neuroanatomical and neurophysiological basis of consciousness	PFC-based, S2-based "map of self", MRF "gamma-frequency"-based	Biological brain: neurons possibly with glial cells, S2, MRF; qualia are less important	[29][28][30][31][32]
Global Workspace Theory (GWT)	All-brain network broadcasting forms a temporary "bright spot" of consciousness	Non-dualistic "cartesian theatre"-like, LIDA-based	Global Workspace Models (GWM), Learning Intelligent Distribution Agent (LIDA), Cogaff, GNW	[33][34][35][36][37]
Multiple Draft Model (MDM)	Not-static stream of dominating combinations with constant change	Phenomenal -Qualia are sensory-based; Neurophysiological: activated brain areas competition;	No "cartesian theatre", no "hard problem" or qualia problem, no top structure, no higher consciousness gap	[38][39][40][41][42][43]
Integrated Information Theory (IIT)	Hierarchical model, stream of states and interactions between different brain structures	More Physics oriented, Biology oriented or Information oriented	Information blocks and their physical basis, special mathematical apparatus; no "philosophical zombie"	[11], [14], [44][45]
Quantum consciousness (QC)	Holographic nature of consciousness is a result of multiple quantum processes	Holographic consciousness, "it from bit", "Mathematical Universe"	Quantum phenomena, Orch OR, temporal non-locality	[46][47][48][49][50][51]

Table 1. Main consciousness theories

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III. Non-human Brain

Theories strictly focused on the functions of the human brain and unique qualia of human experience are criticized as anthropocentric. According to these critics, consciousness has to be seen as a general property of neural tissues with a certain level of organization and activity or even as an intrinsic quality of physical and information processes. With the narrow definition of the term, not only children [52] and mentally disabled [53] do not fit into the settings, but also sleeping and people in other levels of low awareness and altered states are denied consciousness. Certainly, in this case, animals, even with the most developed cognition, cannot possess anything more than pre-consciousness, and machines are not qualified for it by default. At the same time, computational intelligence is registered at the lowest levels of life. The slime mould Physarum polycephalum [54] is found to be "rational" enough to find the shortest way through the maze. Fungal hyphae are found to transmit informative electric impulses [55]. Their ending parts behaviour can be explained as a meeting place for information from outside and inside. According to some opinions [56], sensations of the autonomous organism are private, and they are the primary source of consciousness in more complex biological systems. Other authors further claim consciousness to be recursive spatio-temporal self-location [57].

It is difficult to define consciousness in a phrase with a single meaning. The term is much wider, more complex and utterly defies simplification. While meta-awareness is a potentially important component, awareness itself, perception, self-perception, intentionality, and intelligence are also significant [58]. Together with reflexivity, it can be called cognition. Intelligence is often described as information processing and can be attributed to non-biological systems [11][20] or having meta-explanation [14], but can be ascribed to biological systems. Living organisms possess necessary autonomy, and as a result, a significant part of intentional behaviour and volition are directed towards the support of internal homeostasis and predictability of external events. The ability of the biological system to actively support its own operations is called autopoiesis [19]. Functions that are not directed towards homeostasis, perpetual self-reproduction, and autonomy are called allopoietic. All living organisms are autopoietic, while artificial machines are generally allopoietic, regardless of the type of production, material or cognitive. Living systems are actually homeostatic or homeodynamic [59], with flowing physical matter and information, while non-biological computers, at least artificial, mostly receive information through electromagnetic flow.

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Autopoietic systems, starting from viruses and cells, can actively support and reproduce themselves [19]. Ensembles of cells are united in tissues, organs, systems and multicellular organisms. Every level of a more complex organization is autopoietic by itself. Autonomous organisms are also autopoietic and, with sufficient intellectual power and cognition, conscious in wide terms of using the nervous system and brain for it. Many researchers have a tendency to explain natural consciousness as an outcome of the evolutionary development of a multilevel self-reproducing autopoietic super-system [16]. Attention Schema Theory (AST) postulates self-awareness as an interiorized projection of external models [60][61]. Social functions, social organization, language and other instruments of communication can also be seen as a result of these processes [30]. In this case, biological consciousness is radically different from any proposed machine analogue, with qualia uniquely related to multilevel autopoietic systems and their groups. At the same time, human consciousness is just a consequential level of biological development, and conscious systems can be potentially more or less developed, depending on the magnitude of the phenomenon on a continuous scale.

Intelligence potentially can be measured by formal quantitative metrics. Several processing units, e.g. neurons and a number of synapses, give the average general power of the intelligent system. There are 105 neurons in the fruit fly brain [62]. The honeybee has a relatively large cephalic ganglion with less than 106 neurons [63]. The mouse brain is composed of 70 million neurons, with about 12 million in the cortex [64]. The cat's brain holds 1.2 billion neurons, 250 million of which are in the cortex [65]. A dog has 2.3 billion and 527 million, respectively, a lion 4.7 billion and 545 million, and brown bears – 9.6 billion and 250 million, respectively [65]. The elephant brain has 257 billion neurons, but 97.5% or 251 billion are in the cerebellum [66]. The human brain looks like a scaled-up primate brain. The density of neurons and their relationship with glial non-neuronal brain cells is also important [67]. Neurons of the cortex can code numbers and handle qualitative information because of the distance between neurons with different coding results [68]. By some estimations, the human brain has 5 million GB of RAM [69], and according to the current projections, this computer power barrier will be overtaken after 2029. Table 2 provides a comparison of neuron numbers in several biological species and humans.

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Type	Number of Neurons	Cortex Neurons
Fruit fly	10^5	-
Honeybee	10^6	-
Mouse	$7x10^7$	$1.2x10^7$
Cat	$1.2x10^9$	$25x10^7$
Dog	$2.3x10^9$	$52.7x10^7$
Lion	$4.7x10^9$	$54.5x10^7$
Brown bear	$9.6x10^9$	$25x10^7$
Elephant	$257x10^9$	$5.6x10^9$
Homo sapiens	$86x10^9$	$16x10^9$

Table 2. Number of brain neurons in some biological species

The human brain possesses from 86 billion to 100 billion neurons but structurally differs from the brains of elephants or other species in some aspects despite multiple anatomical and physiological similarities. The closest species are hominids. Still, animal brains have enough anatomic and physiological features to be comparable with the human brain. Structures responsible for perception, awareness, intentionality, self-perception and basic cognition can be found even in insects [63]. Many researchers, however, do not see low levels of intelligence and cognition as examples of consciousness [70]. Cognition and brain structure have to reach a critical level of complexity to have it. Others suppose consciousness to be just a subset of cognitive activity, and to reach the conscious level, it is necessary to start with low-level cognitive activities [71].

IV. Artificial Consciousness

Artificial Consciousness (AC) has been a topic of serious debate for the last several decades. Opponents insist on the impossibility of AC due to the inability of computers to maintain autopoietic functions, to

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experience qualia or to have sufficient multilevel complexity for the consciousness. The “Chinese room” thought experiment by Searle [72] is constructed to disprove the hard problem thesis. According to the created imaginary framework, there is no need for the perfect machine to be intelligent, let alone conscious, to produce a necessary outcome. A human being cannot be seen as just a biological machine with upgraded intellectual functions and their extension as consciousness. No machine will have human intelligence and consciousness, no matter how intelligent it is. Hard problem manifestation rules out not only AI consciousness but also machine intelligence in human terms. There cannot be any AI bat or human-like philosophical zombie.

Proponents produce several arguments for the case of AC. Philosophical explanations are often based on other thought experiments, refusal of sceptical thought experiments, and functional, structural or cognitive explanations. The “Chinese room” argument is rejected on the basis of consciousness as epiphenomena in the case of the argument itself, while strict functionalism, the absence of real interactivity, and the context do not demonstrate strength against AI or AC [73]. The “Mary`s Room” [74] thought experiment is formulated to show no necessity for a really phenomenal experience. Abundant descriptive knowledge about the physical phenomena is sufficient to fully understand them. There is no need for direct physical experience. The “Brain in Vat” [75] argument has to show the inability of the mind to differentiate between the “real” world and the “virtual” world projected into the brain. If so, there is no way for the machine not to possess intelligence or even consciousness similar to humans.

Another famous thought proposition is the Turing test. There are claims that computers passed the test while playing “Chess and Go”, and, on some occasions, chatbots impressed panellists enough to be recognized as humans. However, the test is recognized as insufficient [76]. Shannon and McCarthy reflected on the Turing proposal with scepticism [77]. Even in the case when there is a machine with all possible human-like answers, this is not an intuitive concept of thinking [78]. If it is such a machine, it will have no possibility to pass the test. It is nomologically impossible. Some researchers prefer to see the Turing test as a metaphor [79]. And if we genuinely want to measure machines or any other intelligence, the test must comply with several rules [80]. It should be non-boolean since intelligence is not a non-continuous phenomenon. It has to be factorial because intelligence is multi-dimensional and depends on various contexts. The test should be non-anthropomorphic and encompass any possible form of intelligence. So, the intelligence itself must be formulated in clear terms and be measurable by universal metrics. Problems of consciousness, as long as they are not just a computational function, are more extensive and cannot be attributed only to human-like features, evaluated by humans with no external, “objective” means. Still, this is not an easy approach. There are suggestions that if AC appears, it will suffer cognitive and emotional deficits similar to those in newborn children [81]. According to Judea Pearl, strong AI will not appear until a 3-year-old child-comparable AI is equipped with mastery of causation [82]. Other authors place different human ages on a scale of growing consciousness capabilities [83], where the upper level is occupied by systems with several parallel conscious streams.

Theories of consciousness, which do not require a biological substrate, are often used for the modelling of AC. Higher Order group of theories are suitable candidates. Meta-cognition or first-order representative overseeing cognitive function allows constructing an artificial model in silico. However, critics mention the possibility of unconscious meta-cognition, which diminishes the role of HOT [84]. Consciousness has to be described in objective terms without the limitations of first-person experience [85]. IIT also allows the creation of not only an intelligent system but a conscious one from any suitable substrate, regardless of its biological or non-biological nature. If consciousness is a product of higher intelligence, a threshold should exist for it to appear [86]. GWT, and especially LIDA, create a functional topology for a possible AI-conscious system. In any case, neural network architecture or analogue will produce Artificial General Intelligence (AGI) or human-level AI powerful and sophisticated enough to have sufficient cognition, re-representation, self-awareness, self-perception, meta-cognition and other necessary functions of AC. AGI will soon produce AI+ machines that are able to design other, more effective AI++ machines [87]. At this moment, AI will overtake humankind intellectually and will be independent enough to possess an artificial consciousness. In order to achieve it, parallel computing has to be combined with symbolic reasoning [88].

Quantum computing gives another potential solution for the AC. Quantum consciousness theories explain consciousness through processes based on quantum mechanics mechanisms. Quantum processes in brain structures can be potentially replicated with an appropriate quantum computer. While quantum computers are only in the early stages of development, there is significant progress in the field. The principle is based on a certain quantum process, which creates a quantum bit, or qubit, radically different from the classical bit of information. Qubit reflects continuous quantum superposition, where 0 and 1 exist at the same moment of time [89]. This gives quantum computing systems potentially much higher performance, significantly overtaking classical computing systems. Photonic, electron-spin, ionic, superconducting, and some other types of quantum logical gates allow the building of a quantum computing machine, working with the help of special quantum algorithms. Sufficient power and appropriate architecture will give quantum computer consciousness, or at least sentience, to solve a hard problem for machines. Quantum computers do not necessarily need to work based on quantum consciousness principles; they can be other AC models replicated in a quantum computing environment. The current limitation of quantum computing is the control of operational consistency and quantum decoherence errors with a growing number of qubits [89]. The number of qubits for the effective personal machine is 10^3-10^5, while the number of states or continuous variables would be 2^{1000}, around 10^{300}. Noisy Intermediate-Scale Quantum (NISQ) [90] is supposed to be a future solution for 50-100 qubit machines and open possibilities for upscale quantum computers.

V. Problems and Solution

Discussion about the possibility of machines possessing consciousness is quite multi-facetious and touches on many relatively complex topics. If intelligence is a prerequisite for consciousness, the problem looks simplified, but the nature of computational power itself does not translate into intelligence directly. Despite this, some researchers claim the ability of machine intelligence to outperform any human functions with a sufficient number of neurons, connections and processing power [86]. Another problem is the physical and intrinsic operative dissimilarity between neural cells and machine neural network neurons. Biological cells, synapses, axons and dendrites are not directly similar to AI neurons and Neural Network connections. The closest analogy is the architecture of processing nodes. As mentioned above, living organisms are built from autopoietic layers, while artificially intelligent machines are quite different in most of their physical aspects. The similarity can be seen as functional and formally structural in terms of some theories, such as HOT, IIT, modular GWT, and others. The questions remain about the closeness of human, biological, and machine consciousness and if it can be constructed. The sheer functionality, weak AI, is certainly easier to achieve.

The gap between autonomous biological systems and AI systems is quite wide. The evolutionary approach postulates a utilitarian explanation for emotions, feelings, needs and rational perception and behaviour, which does not leave space for the nonmaterialistic description of all mental states and phenomena. Thought experiments and predictions are effective for constructive discussion, but they cannot provide conclusive proof. The inability to finally prove or disprove AC by thought experiments or predictions somehow dilutes the value of the theoretical schemes. The actual situation with AC can be changed by practical experience. Until now, we could speak about achievements in perceptive and analytical information processing below the level of animal cognition or sentience. At the same time, AI provides instrumental solutions in wide areas of applications.

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Automatics and AI appeared as instrumental solutions to the quickly growing number of tasks and enormous informational flow. An average person is exposed to 34 GB per day with 5.4% yearly growth [91]. Machine data processing capacity is growing steadily, while human brain capacity is limited by biological abilities. Historically, Data acceleration times caused initial societal stress [92]. Adaptive technologies have been used over millennia, starting from the first writing systems. The data processing was done by specially trained individuals, united by overarching social organizations and enabled with special data processing and storing techniques. The distributed network was gradually empowered with instruments in a process, which led to computerization and AI development. Today, the processing possibilities of machines are necessary to support human intellectual abilities and information processing. The general machine capacity will overtake the general humankind brain capacity as an inevitable outcome of dataisation. But it certainly does not mean a shift from human control to machines.

The autopoietic brain CPUs with low energy consumption, around 20 watts, are supported by external machines` CPUs with high energy consumption, and it looks more like an instrumental addition. Cell neurons have a response time of 10^{-3} seconds, while an artificial processor's response time is 10^{-9} seconds [69]. Machines routinely outperform humans in tasks they are designed for, but they exist only as an instrumental extension. The composite network of networks for data processing becomes a human-machine complex of distributed cognition [93]. The growing data flow requires specific tools. There is no "mind" in Google search or any other internet data source, merely information uploaded by humans, as well as no "consciousness" in human-written algorithms or Siri. There is no question about qualia in such a machine. The feelings of the AI bat are irrelevant in this case. Concerning instruments, it is only possible to ask, "What is it like to be a thermostat?" [94] if the connotation of consciousness is about strictly predefined information processing without wide perceptive reflection.

Human interaction with smart machines and a smart environment is important for contemporary and future society [5]. As a human is not fully conscious and intellectual without growing in the cultural environment, humankind has to be prepared to exist as a network of networks between AI-empowered humans and machine nodes [93]. The general approach, "common sense", will be supplemented with AI power, and "humans should adapt to AI system, nor vice versa" [95]. There are a wide number of initiatives to be prepared for it, from the Cyc [96] project and the Internet of Things to trans-humanistic cyborg enhancements. There is still a "knowledge acquisition" bottleneck, as the Cyc project shows. However, concerns about the dangers of strong AI can be solved by altered AI with limited abilities. Weak

AI [97] is sufficient and instrumental enough to be used in the Fifth Industrial Revolution, with cyber-biological space created by the interaction of digital and biological/natural twins [98].

Ethical questions about AI and AC are usually seen as social implications of expanding the circle when more creatures are considered suitable for an ethical approach. It is so-called literal altruism [99], opposite to utilitarian instrumentalism. There is still a problem, shown in the model Conscious Satisfaction/Suffering. These states are not easy to assess, while intelligence can be measured, and intellectual abilities can be checked practically. Self-awareness also cannot be measured [69]. The focus must be shifted, at least today, from the moral status of potential AC to the societal and psychological changes caused by AI while keeping the responsibility of humans for machine actions. AI with intentionally or unintentionally biased data can be of real concern [95] because the system inherently lacks ethics. Weizenbaum argued in "Computer Power and Human Reason" [100] that machines lack human qualities of judgment and empathy, so AI's decisions must be always controlled by operators. Computers are not in a human context [101]. Consciousness is inseparable from function [102], and function is instrumental. AI is necessary as an extension of human abilities and not as an uncontrolled phenomenon.

VI. Conclusion

The computerization of modern life is an all-encompassing process. With swiftly growing computer power and distributed computing, networks of networks, smart environment and automatization, there is a place for the expectation of a complex human-machine environment. The discussion about the possibility of consciousness appearance in sacrificial intelligent devices is valuable, and constructive lessons from it are fruitful. Theoretical debate and practical laboratory research are mechanisms of scientific and technological progress. However, any research must be placed into the social context. The direct and indirect effects of widespread AI implementation must be measured not only by its narrow utilitarian results but also by societal and psychological outcomes. While the possibility of AC is still a question, there is no doubt about the transformational influence of new technologies. Modern society cannot carry on its functions as before and is not able to give up progressive development because of imaginary threats. Balanced collaboration of humankind, empowered with AI instruments in conditions of the Fourth and Fifth Industrial Revolutions, is a key to the future.

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