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**Consciousness: New perspectives and their implications for artificial consciousness and the scientific progress of psychology**

**Preface**

What is the purpose of the present book? This is a complicated question that is very difficult to answer. It is quite easy to answer the question about the purpose of books such as "Introduction to Psychology" or "Introduction to the Philosophy of Science", because the answer is almost self-evident. The purpose of the introduction to psychology is to present to the student the main scientific knowledge accumulated as results of research in psychology (e.g., experimental findings, theoretical explanations and an agreed methodological approach). A similar answer can be offered regarding the book on the philosophy of science. However, what answer can be offered to such a tricky and elusive subject as the mind/body problem, the consciousness/brain problem or in short the "consciousness-problem"? Chalmers (1996) opens his book *The conscious mind: in search of a fundamental theory*, with the sentences: “Consciousness is the biggest mystery. It may be the largest outstanding obstacle in our quest for scientific understanding of the universe.” (p. xi). Indeed, the current issue to this day is considered a great conundrum. Well, with that in mind, what is the purpose of the book?

I can start by answering that the book does not offer a solution to the question of consciousness (CΨ). Furthermore, the book opens with chapters that review various theoretical/empirical proposals for the consciousness-question, a review that substantiates the claim that to this day no accepted theory has yet been found to explain the phenomenon of CΨ. What is quite clear is that CΨ is created somehow by the brain, but no one is able to propose a theory that explains how the brain does this – a theory that is accepted by the scientific community. It is clear that except for the brain CΨ does not depend on other parts of the human (or animal) body. Damage to other parts of the body or their amputation, such as hands, feet, kidneys and even a heart (that can be replaced with an artificial heart) does not impair a person's ability to be in a state of CΨ. On the contrary. Amputation of a hand or a leg only causes the individual to be in the sad awareness that he/she is in the unfortunate state of disability. Furthermore, research into the neurophysiological processes of the brain proposes that not all of its parts are involved in generating CΨ (e.g., Koch, 2018).

In light of the above (that there is no solution to the problem of CΨ) what the book offers are three relatively new things. First, the book shows that in addition to the mechanistic explanation accepted in the sciences and psychology, a mentalistic explanation based on the individual's CΨ has to be used. Second, the book offers an outline for a solution to the question of how a state of non-consciousness becomes conscious. This question is probably easier than the consciousness-problem. Finally, the last part of the book uses the developments in the previous chapters to answer two questions that are anchored to the very fact that the problem of CΨ has not yet been solved. The first question is: can sophisticated robots develop CΨ? And the second question: why did psychology not develop like the sciences (physics)?

The current book is in fact the closing of a circle of thought on the subject of CΨ that was aroused in me in the first year of my psychology studies, bothered me for years and caused me to publish many articles on the subject. One may wonder on what closing circle I may be talking about, if today I am in the same state of not knowing the answer to the CΨ-problem that I had been at the beginning of my psychology studies. The answer to this question is of course based on the information I offer here, interesting knowledge in my humble opinion, which is related to the problem of CΨ, despite no one knowing how to solve this problem. The information that I present in this book is based on the scientific methodology and philosophical inquiries that have developed over many years mainly in Western culture. Furthermore, I suggest that this methodology and these inquiries are founded on a certain type of culture, which characterizes the human race perhaps more than anything else, a type of culture that I will call the “lonely-mind culture". According to this conception, each person (and probably also each animal) is a world in itself. His/her inner world (sensations, feelings, and thoughts) is accessible only to the individual him/herself and not to any other being. One may learn about the inner world of the other with the aid of different learning methods, such as, understanding his/her behavior under certain conditions (especially by verbal reports), but one cannot communicate directly to the inner world of the other. In my opinion, if humans were able to connect directly to the inner world of the other, current culture as we know it, would be irrevocably changed.

In the first year of my studies at the Hebrew University of Jerusalem, the Psychology department arranged a debate on the question: “is psychology a scientific discipline?” The speaker, who argued for a negative answer, was Professor Yeshayahu Leibowitz, a revered figure not only on the university campus but throughout the state of Israel. Three students: Amos Tversky, Yehoshafat Giveon and Emanuel Donchin argued for a positive answer. At the end of the debate, all members of the Psychology department, lecturers and students, who were at the time influenced by the behaviorist approach, were convinced that Professor Leibowitz had lost. I, however, felt otherwise. In my opinion, no one had countered his argument that none could feel Professor Leibowitz’s toothache except Leibowitz himself. The response to this argument (given by Emanuel Donchin as I recall)—that Leibowitz’s sensation of pain was of no interest to the psychologist. What was important for the science of psychology was the observable behavior that Professor Leibowitz went to the dentist. This answer missed Professor Leibowitz’s argument, since it did not tackle the very problem that the eminent professor had emphasized: a very important part of human behavior simply does not correspond with the methodology of the natural sciences–one inner world. The problem presented by Professor Leibowitz through the toothache case is a well-known and still unresolved problem, the mind/body problem, the consciousness/brain problem. So Emanuel Donchin’s response largely reflected the behaviorist approach, which disregards the individual’s internal, subjective-mental world as an explanatory factor, and concentrates on his behavior that is publicly observable. I propose in section 2 of the book to restore the individual’s inner world as an essential component in psychological explanations, and show that mentalistic explanations (which are based on one’s feelings, motivation, and beliefs) can be part of science’s methodological framework.

This debate had an inerasable effect on me, and since that moment, I have never ceased thinking about it, reading countless books and articles on the mind/body problem, the consciousness-question, and over the years, I have published a large number of articles on that topic. Therefore, the current book can be conceived of as a summary, expansion and further development of the thoughts and ideas on the problem of CΨ, which have been running in my head for many years. Again, I repeat, there has been no solution to this difficult problem, but I hope that this book will inspire the reader with some new ideas (whether they are criticisms of what has been written or whether they are further developments). Moreover, if indeed this is what I achieve, I can pat myself on the shoulder and say that I have contributed something tiny to this difficult problem.

Because the topic of CΨ has been studied in the last decades from different research directions, such as psychology, philosophy, neurophysiology (of the brain) and physics, it seems appropriate that I detail to the reader my scientific-knowledge background, so that he will be able to judge where my strengths and weaknesses are. What I can guarantee is that I will do my maximal effort to present to the reader the complicated issues of the problem of CΨ in the clearest and most readable way. Well, I am an experimental psychologist who did a doctorate on fear and avoidance learning in rats and has moved in the last decades to research in face perception and recognition. During my studies at the University of Jerusalem, I completed (in addition to psychology) a BA in Sociology, two years in Statistics, and introductory courses (including labs) in Physics and Chemistry. Above all, I freely attended dozens philosophy courses in Jerusalem University and in the University of Haifa, especially philosophy of science, including reading a great deal of books and articles related to science. This, then, is my scientific-knowledge-business card.

Now it is appropriate to detail somewhat the scientific approach that I have developed over the years, so that the reader would be able to understand from which point of view I approach the problem of CΨ. I call this approach the "reality comprehension" (or perhaps “the big wondering”) and it is based on two fundamental ideas. On the one hand, I believe as a full-fledged realist that the world exists independent of the existence of man. I believe that the following things, entities, exist in the world independent of any particular human: the galaxies, the stars, the earth, cities, buildings, animals, plants, etc. In addition to this, I believe that all humans have an inner world that contains feelings, emotions, thoughts, curiosity, intentions, and fears, etc.

On the other hand, because the world is indifferent to the very existence of humans, a man has no choice but to create a meaning for the world, a meaning that would allow him/her to lead a more or less reasonable way of life. I believe that man has developed tremendous cultures in order to adapt and understand the world. These cultures include the development of the various languages, logic and mathematics, religion, and scientific methodology.

The fundamental assumption behind the scientific methodology, in my opinion, is that there are unknown true explanations for various phenomena that man is able to observe with the help of his senses and devices that science has developed. Moreover, it seems that the goal of science is about to get closer to the ultimate scientific explanation (a theory, a model, a law that describes/explains the observations). The approach to the ultimate explanation is done by the procedure of eliminating theories that do not meet the following rational criterion, the principle of “empirical-matching”. Accordingly, I believe that the culture of science, developed over hundreds of years, manages to progress and develop, because science is based on the above rational principle. This principle, empirical-matching, is founded on the correspondence between the theoretical/empirical developments and the empirical observations (although these are not free from various theoretical influences). A theory that does not fulfill this principle is eliminated. It is this rational principle that makes it possible to advance the cultural efforts to solve the riddles of nature, among which is the greatest puzzle, the enigma of consciousness that shines with precious light.

Given the above scientific-approach I have adopted, I perceive the problem of CΨ as still unsolved. That is, so far, I have not yet discovered a theory that explains the problem, how the brain produces CΨ. If an answer to this problem is what the reader is looking for, unfortunately he will not find it in this book. However, I hope that he/she will find in it an interesting discussion of this amazing subject. From these respects, I will not deal with literature related to parapsychology (such as, contact with the dead, experiences after death, dead souls reincarnated in living people). This literature tries to argue against materialism and support some sort of spiritualist approach (e.g., Ng, 2023). I read enough material on the subject and remained completely skeptical. In the same vein, I will not address the speculative literature related to religious, moral and legal questions that may arise in the event that robots will indeed develop CΨ. The reason for this, as you may read in the book, lies in the fact that I am very skeptical about this question as well. As things seem to me today, I strongly doubt the possibility that robots, computers, etc. will develop CΨ.

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**Chapter (1) The concept of consciousness**

Pat and Rick drank a lot of beer in ‘our bar’. They were frustrated from their research in the elusive phenomenon of consciousness. Pat said to Rick, "In 'our bar' there is an elusive creature that only I can see." And Rick replied firmly, "Not only you, I see him too." Pat lost in deep thoughts said, "Well, that's only because you drank seven bottles of beer."

**(1.1) The more or less accepted delineation of the consciousness concept:** In recent decades, there has been a great increase in theoretical and empirical research in consciousness (CΨ) that attempted to explain, to solve the CΨ-problem (e.g., Brown et al. 2019; Gennaro, 2012, 2023; Jones & Hunt, 2023; Seth & Bayne, 2022; Van Gulick, 2022). Most researchers have rejected the solutions suggested thus far and as a result, the CΨ-problem continues to trouble them (e.g., Butlin et al., 2023; Carruthers & Gennaro, 2020; Dehaene, Lau & Kouider, 2021; Rakover, 2018, 2021; Uttal, 2005). Hugeefforts have been made to explain how neurophysiological processes in the brain bring about CΨ, but such attempts have failed to offer satisfactory explanations to the classical mind-body problem, the CΨ-brain relation (e.g., Butlin et al., 2023; Gennaro, 2023; Jones & Hunt, 2023; Rakover, 2018, 2021; Seth & Bayne, 2022; Uttal, 2005; Van Gulick, 1995, 2022). In other words, the researchers have not yet succeeded in developing a theory that solves the ‘hard problem’ (Chalmers, 1996), that explains ‘phenomenal consciousness’ (Block, 1995) and that bridges the ‘explanatory gap’ (Levine, 1983). Block (1995) distinguished between ‘phenomenal CΨ’ and ‘access CΨ’. While the first concept refers to the private subjective experiences of each person (qualia), the second refers to mental information, which is accessible to different cognitive processes that can use it for different purposes such as speaking, drawing conclusions, and monitoring behavior. The other concepts of Chalmers' (1996) hard and easy problems and Levine's (1983) explanatory gap are based also on the observations that the subjective experience of each person is very difficult to grasp by scientific methodology. These are discussed further below.

There is still no theoretical explanation of the question how the brain produces CΨ. Frackowiac et al (2004, p. 269) wrote, “We have no idea how consciousness emerges from the physical activity of the brain and we do not know whether consciousness can emerge from non-biological systems, such as computers.”

The concept of CΨ is a controversial (e.g., Dehaene, Lau & Kouider, 2021; Gennaro, 2004; Van Gulick, 2022). Frackowiac et al (2004, p. 269) wrote, “At this point the reader will expect to find a careful and precise definition of consciousness. You will be disappointed. Consciousness has not yet become a scientific term that can be defined in this way. Currently we all use the term consciousness in many different and often ambiguous ways. Precise definitions of different aspects of consciousness will emerge through an iterative process from the kinds of experiments we discuss in this chapter. No doubt some of these definitions will have a rough correspondence to some of the ways we use the term at the moment, but to make precise definitions at this stage is premature.” Moreover, Vimal & Sansthana (2010, p. 93) suggest, “About forty meanings attributed to the term consciousness can be identiﬁed and categorized based on functions and experiences. The prospects for reaching any single, agreed-upon, theory-independent deﬁnition of consciousness appear remote.”

Nevertheless, I do not believe that I would be wrong if I say that most researchers accept the following description of the phenomenon of CΨ (e.g.,  [Searle](https://en.wikipedia.org/wiki/John_Searle%22%20%5Co%20%22John%20Searle), 2005). It is conceived of as a unique subjective experience of a person, who perceives a stimulus in the external world or in his/her internal world. This description is consistent with Nagel’s (1974) famous “What it is like” approach and other views such as that of Gennaro (2012), who has followed Nagel. In a similar way, Chalmers (1996) distinguished between the hard and the easy problems. Accordingly, the ‘hard problem’ of CΨ deals with the question of how humans’ [phenomenal](https://en.wikipedia.org/wiki/Consciousness#Types_of_consciousness) experiences are generated by the brain, where [phenomenal](https://en.wikipedia.org/wiki/Consciousness#Types_of_consciousness) experiences are conceived of in the sense of Nagel’s conception of CΨ – a problem that appears to defy explanation. This is in contrast to the ‘easy problems’ relating to such behaviors as discrimination or integration of information, which can be explained by specifying the processes that execute them. As mentioned above, most researchers distinguish between two kinds of consciousness, one related to subjective experience, which is difficult to grasp with accepted scientific tools, and another that can be expressed and used in different ways (e.g., Block, 1995; Chalmers, 1996; Levine, 1983).

In addition to these conceptions, or qualities, of CΨ discussed in the professional literature, I propose here a new important quality of consciousness: it evokes the fundamental experience of being-alive. Rakover (2021) suggested that CΨ endows life-meaning to mental representations. I distinguished between two types of meaning: innate and acquired life-meaning. The innate-meaning is related to the perception of sensory stimuli, such as sight, hearing, feeling, pleasure, pain and fear. When a person sees, for example, a landscape, he is in a state of CΨ of the landscape including the innate feeling of being-alive, an inherent feeling of aliveness. I call this the “aliveness-feel”. Consciousness is a necessary and sufficient condition for the aliveness-feel. Without CΨ, not only is the person unable to stand on his feet, but the feeling of being-alive disappears. The basic argument is that perceiving sensory stimuli consciously gives the individual a sense of being-alive, an aliveness-feel, which is natural and inborn. (However, note that a person does not say to himself constantly 'how wonderful, I am alive', just as he does not say to himself constantly, ‘how wonderful, I am breathing air’.) The acquired life-meaning refers to customs, values, traditions and norms that society transfers to its members. While sensory perception gives the individual the basic meaning of life: aliveness-feel, being-alive, the acquired meaning offers the individual a way of life that he/she has to follow to be integrated well into the society to which he/she belongs.

**(1.2) The development and evolution of consciousness:** In this section, I would like to emphasize that given the philosophical and scientific attempts to understand CΨ, one must take into account the observations that the conscious brain is a very dynamic system. It seems that the more or less conventional view of CΨ, which is created in an indecipherable way (so far) by neurophysiological systems of the brain, is based on an incorrect fixed and static picture of the brain. It appears that this stationary view is based on the analogy to a computer, where the hardware and software that make up this device are unchangeable, that is, they do not change in their components and the scope of their functions. The hardware remains a fixed system for many years and so does the software (including software capable of learning a certain issue). For example, the program for the inverted-face recognition that I used in my experiments many years ago can be used today safely. But this is not the case related to human brain and consciousness.

Several years ago, I watched a film showing a surgical operation in the human brain. Focusing the camera on a certain area of the brain clearly showed that the brain is buzzing with dynamic activity all the time, for example, it builds and eliminates connections. Kays, Hurley & Taber (2012, p. 119) write, “Until fairly recently, the adult brain was considered largely fixed and stable. Although it was accepted that changes occurred in the context of learning and memory, the general consensus was that major processes essential to normal brain development (e.g., generation of new neurons, neuron migration, pruning) ceased once full development was reached.” But as mentioned above, this conception does not correspond to reality. Moreover, not only is the brain of an adult person changing dynamically, but the brain and CΨ developed throughout the lifetime of the person and throughout the long history of the human race (millions of years). I review briefly these developments, in order to give a more comprehensive picture of topics in the present book.

In a review article of the relevant literature, Fabbro et al. (2019) outlined the development of CΨ over a human life time. It was discovered that already in the fetus condition a distinction between the environment and the fetus itself begins to appear. This distinction, called "a minimal level of consciousness", continues to develop during the first year after birth. From this state onward, higher levels of cognitive functions are added to CΨ up to the level of CΨ characteristic of an adult person. For example, at the age of two, children show an initial level of self-awareness: they recognize themselves in the mirror, and at the age of four to five, they develop a 'theory of the mind' related to the understanding that others also have their own desires and goals.

Research into the evolution of humanity in the very distant past suggests that language was invented approximately 90,000 years ago and writing approximately 5,500 years ago. However, it has been suggested that CΨ as it is comprehended today did not exist prior to 3000 years ago. According to Jaynes (1976) it appears that the ancient Greeks treated their emotions and desires not as we perceive them today (as subjective mental states that belong uniquely to a person) but as the results of the actions of the Greek gods on Olympus. Jaynes’ book *The origin of consciousness in the breakdown of the Bicameral mind*, made a huge impression from the moment it was published and continues to provoke debate to this day. (I cannot review this great bibliographic wealth here. The reader can search “bicameral mentality” in Google and will be flooded immediately with hundreds of books and articles relevant to the subject, e.g., Algom, 1991; Rowe, 2012.) I do, however, present here a very brief summary of the main ideas underlying Jaynes' theoretical approach.

That fundamental idea is that until the days of Plato and Aristotle, humans did not have the concept of CΨ as it is known to us today. Consciousness, which is expressed by subjective states and processes (e.g., desire, belief, anger, joy, worry, etc.), did not exist in humans in Homer's time and before. The Homeric man did not conceive of his actions, desires or emotions as originated in himself (as we do today) but saw himself as driven and operated by the gods who resided on Olympus (according to Greek mythology). The ancient man heard voices in his head, which probably were similar to what we understand in the phenomenon of auditory hallucinations. According to Jaynes, CΨ (mainly mental states that can be introspected) is not an innate process, but a learned one that grew out of the development of language. And because, according to Jaynes, CΨ developed later, around the time of Plato and Aristotle, it follows that the primitive man functioned without CΨ, i.e., he existed on the basis of non-conscious processes. In other words, the primitive man was a kind of zombie (a philosophical thought creature devoid of CΨ who/which does everything exactly like a conscious person). As a certain support for this approach, it is possible to appeal to the research of cognitive psychology, which proposes that a significant part of human behavior is done without awareness. For example, no one is aware of the retrieval processes of information from memory. These processes are very fast, automatic and are not in the domain of CΨ.

The mind of the ancient man was different from a typical modern man. The fundamental difference is related to the development of language that led to the evolution of the mechanism called the "bicameral [two-chambers] mind". This mechanism was established on the communication between the two hemispheres of the brain. Based on the studies of Gazzaniga (1967) on the split-brain (in some patients, surgery was performed that separated the two hemispheres of the brain), Jaynes proposed that the right side of the brain, the visual side, transmitted at the bicameral period hallucinatory voices which, as mentioned above, the primitive man carried out as gods’ commands (and also the voice of the ruling figure such as the king). This mechanism collapsed in about 2000 years BC and in its place developed the mechanism of CΨ as it is known to us today. There were several reasons for the disintegration of the bicameral-mind, mainly they were processes of population growth, building empires, wars and migration of large groups. All of these contributed to the undermining of the influence of the regional gods, to the relying on the hallucinatory voice in the head, and as a result to the rise of the comprehension of the individual psyche, CΨ.

As I mentioned above, Jaynes’ book has sparked much interest and debate (e.g., Rowe, 2012). While Jaynes’ theory is very interesting, I don't think it's true. It is not appropriate for present purposes to summarize the relevant literature and point out the incorrect ideas but I do offer a simpler explanation than Jaynes’, an explanation that stands in contradiction to the theory of the bicameral-mind. Although Rowe (2012, p. 99) tries to explain "... the absence of consciousness in the ancient world" (by using the executive function that includes, memory, inhibition and planning), I find myself belonging to those that Rowe (2012, p. 99) characterized in the following way: “However consciousness is conceived, most people find it difficult to believe the assertion that Bronze Age Greeks and ancient Egyptian pyramid builders did not possess it.”

Contrary to Jaynes, I assume that all humans before, after and during the bicameral-mind period had consciousness (it is inborn and not a product of language). They experienced sensations, feelings, thoughts, inner images and some of them even heard hallucinatory voices in their heads. In other words, I assume that in this respect (CΨ) there is no difference among people over thousands of years. In short, I do not accept the distinction between the human brain before and after the bicameral-mind period. However, I do accept the hypothetical account that the Homeric man might have attributed subjective experiences that were aroused in his head (hallucinatory voices) to commands of the Greek gods. (It is important to emphasize that Jaynes considered the hallucinatory voices a cornerstone in his theory. See e.g., Rowe, 2012, p. 103.) However, the interpretation, which I will call the "faith-interpretation", and which I apply to this account (as it appears in the interpretation of Homer's Iliad) is different.

Accordingly, those people, who heard voices in their heads, attributed these voices to the gods because this attribution fits very well their faith, a complete and total belief in gods. At that time people believed with complete faith that the gods in Olympus manage the actions of people and punish and reward them according to their moral standards. What determined the attribution to the inner voices the commands of the gods is not the bicameral-mind, but the very deep belief in the gods and their reign over humans. (The vocal commands heard in the head are conceived of today in a completely different way.) To strengthen this alternative interpretation, the faith-interpretation, I appeal to two examples from the Bible. The first story is famou: Abraham sacrifices his son Isaac (Genesis, chapter 22(. Abraham heard God commanding him to sacrifice his only son Isaac and he carried out that command. I suppose that Abraham heard the vocal command in his head and attributed it to the voice of God. Earlier, God commanded Abraham to leave his homeland and go to the promised land (Genesis, chapter 12). Once again, it seems that Abraham heard the vocal command in his head. The second story is the revelation of God to Samuel the Prophet (Samuel 1, chapter 3). God called the boy Shmuel several times and only the fourth time, after the old Eli realized that God wanted to talk to Shmuel, the boy answered God. And here again it seems clear to me that voices heard in the head (of Shmuel in this case) are attributed according to the prevailing faith to God’s will.

**(1.3) The evolution of consciousness – animal perspectives:** Given the above, one may see that the activity of the brain, which produces CΨ, is dynamic and the conscious and unconscious cognitive processes of a person continue to develop throughout his/her life. According to the evolutionary theory, the processes responsible for the creation of CΨ in all its degrees are rooted in human distant past. They originated hundreds of millions of years ago in the human race's evolutionary past (e.g., Blackmore, 2013; Fabbro et al. 2019; Jaynes, 1976; Feinberg & Mallatt, 2016).

About 540 million years ago there was a tremendous change in the evolution of animals on Earth, a change called the "Cambrian explosion": most of the types of animals we know appeared at that time. The reasons for this are unknown, but it is speculated that this explosion is related to the increase in oxygen levels and perhaps to the development of animals' visual mechanisms, which split them into two main types, predators and prey. The development of the nervous system and especially the creation of the primary layers of the brain (as a result of natural-selection processes) during the Cambrian period (about 600 million years ago) and after it, were crucial conditions for the creation of the basic, primary, sensory CΨ in all animals, vertebrates, invertebrates, birds, reptiles and mollusks. Sensory CΨ is the individual's subjective awareness of external stimuli. After that period, certain conditions were developed, which allowed the representation of stimuli in the individual brain, and which eventually led to self-awareness, to awareness of consciousness itself, in the human species.

At a conference on consciousness in humans and animals held in Cambridge, England, in 2012, a group of neuroscientists made the following declaration (see Low, 2012):

We declare the following: “The absence of a neocortex does not appear to preclude an organism from experiencing affective states. Convergent evidence indicates that non-human animals have the neuroanatomical, neurochemical, and neurophysiological substrates of conscious states along with the capacity to exhibit intentional behaviors. Consequently, the weight of evidence indicates that humans are not unique in possessing the neurological substrates that generate consciousness. Non-human animals, including all mammals and birds, and many other creatures, including octopuses, also possess these neurological substrates.”

## Similarly, 12 years later, in 2024 at a conference held at New York University on the subject of the science of consciousness in animals, a large group of scientists made the following statement (The New York Declaration on Animal Consciousness, New York University, 19 April 2024):

## Which animals have the capacity for conscious experience? While much uncertainty remains, some points of wide agreement have emerged.

## First, there is strong scientific support for attributions of conscious experience to other mammals and to birds.

## Second, the empirical evidence indicates at least a realistic possibility of conscious experience in all vertebrates (including reptiles, amphibians, and fishes) and many invertebrates (including, at minimum, cephalopod mollusks, decapod crustaceans, and insects).

Third, when there is a realistic possibility of conscious experience in an animal, it is irresponsible to ignore that possibility in decisions affecting that animal. We should consider welfare risks and use the evidence to inform our responses to these risks.

I believe that these two statements from a number of scientists dealing with the issue of CΨ in animals, provides strong support for the hypothesis that all animals are endowed with one degree or another of CΨ (e,g., Allen & Trestman, 2024; Blackmore, 2013). All I can add in this regard are the following natural observations (based on Rakover, 2007, 2019) and the results of several experiments, which I conducted with animals (white laboratory rats and fishes), (based on Rakover, 1975, 1979, 1980). These can be interpreted quite simply as indicating that animals are endowed with a certain level of CΨ (sensory CΨ in particular).

**First observation:** **The Dog and the elevator**. My flat is located in apartment-complex A, situated on a hillside (e.g., Rakover, 2019). Above this complex, there is apartment-complex B, in which the apartment of the dog's owner (called Doggie) is located; Doggie is the protagonist of this observation. Below complex A is a parking lot, from which a corridor leads to an elevator that connects the parking lot level to an exist-level with a small garden, from where one can reach the apartments in both complex A and complex B. The elevator ascends and descends nonstop between the parking lot level and the exist-garden level, so that occupants of the two complexes can benefit from its service.

Doggie customarily lies all day in the parking lot, looking out onto the street from which cars enter the parking lot. One day, after I parked my car and walked toward the corridor that leads to the elevator, Doggie began following me, then running ahead of me, turning its head around from time to time be sure that I was continuing to walk toward the corridor. This behavior continued while I walked in the corridor to the elevator. After some time, the two of us were waiting for the elevator after I had pressed the elevator's descend button. When the elevator doors opened, the Doggie quickly went inside, and I followed behind. I pressed the ascend button and when the elevator arrived at the top floor, the doors opened onto the garden and Doggie ran out and entered apartment complex B.

How may we explain this behavior of Doggie? To propose an explanation, I need to add two important facts. Firstly, this was the first and only time that Doggie and I walked along the corridor and went up in the elevator together. Secondly, Doggie and I were familiar with one another from the many times that it lay down in the parking lot and saw me entering or leaving the corridor. I suggest that the range of Doggie's behavior (overtaking me, running, looking back, waiting for the elevator, etc.) may be conceived of by an appeal to the teleological explanation: Doggie's purpose was to reach his dwelling place, its master's apartment in complex B. To realize this purpose, Doggie utilized my expected behavior, namely ascending in the elevator to the garden. To achieve this, Doggie had to retrieve from his memory the following relevant information. He had to recognize me as a human that lived in the building, habitually walked to the elevator, and travelled in it to the garden-level. (It is reasonable to assume that Doggie had taken the elevator several times with its master and generalized that information to me, as another human inhabiting the building area.) Doggie applied these pieces of information, expressed by means of its behavior. He recognized me, ran and overtook me on my way to the corridor, checked from time to time whether I was walking in the correct direction, entered the elevator, and watched the doors that would open onto the garden (he stood in the elevator with its nose pointing in the direction of the exit).

From this explanation, it emerges that Doggie was endowed with a large number of intelligent abilities. For example, it could store past pieces of information, retrieve them, and use them to guide its behavior. And because Doggie in the present observation recognized me, etc., it is hard to suggest that it was not endowed with information about the past and the future. To be sure, Doggie is not endowed with intellectual abilities like those of a human, but it is endowed with abilities sufficient to contend with challenges such as ascending in an elevator. Furthermore, although we cannot know whether Doggie has the ability to be self-aware, we may assume that he has fairly high levels of recognition of his feelings and desires. Moreover, if he was aware of his own desires, it is possible to offer the hypothesis that he was conscious that these desires are his own, he knew how to plan his actions for the future, and he may have some low level of self-awareness.

I do not think that another explanation based on instinctive processes alone will succeed in fully explaining Doggie's behavior. Likewise, a theory of mechanistic learning would be hard-pressed to explain the behavior of a Dog that fetches the leash for its master, to urge the master to take him for a walk.

**Second observation: The pampered cat**. This observation relates to my Himalayan cat, Max (based on Rakover, 2007). Late one evening, when I was watching TV, Max approached me. With his forepaws, he scratched at the edge of the armchair in which I was sitting, and then remained seated on his rump, looking at me with his blue eyes. We exchanged looks. I leaned towards him, picked him up, settled him on my knees and stroked him. How can this behavior be explained – Max's behavior towards me?

To be able to suggest a teleological explanation for this observation, that Max wants me to pet him so he scratches the edge of the armchair, one has to understand that in the present case scratching had undergone a change. The change is from a natural, adaptive, survival function to a new function: to get my attention to Max with the aim of being petted. The natural scratching is done by thrusting out the claws through stretching the toes of the feet when a cat enters the following situations: defense-attack, hunting, marking the scratched place with the cat's smell, and replacing claws. (Max has a special stand on which he customarily sharpens his claws.) None of these functions were activated in the present observation. Hence the scratching acquired a new function: a means to obtain reinforcements (being petted). A long learning process acquired the new function.

Based on these two observations, it may be suggested that animals (Dogs, cats) have a high level of cognitive processes that make it possible for them to become adapted to their environment by means of learning processes: they remember past events, change their behavior accordingly, and as a result also become used to planning the future. These reactions are intertwined with CΨ. This conclusion arises from the fact that in both observations the animal made rational considerations based on several pieces of information that helped them to perform the right behavior to realize their desire. In view of the above, did Doggie and Max the cat develop a theory of mind? It is hard to propose that, and this is too extreme. I don’t believe that Doggie and Max developed a theory of mind according to which they assumed that I have certain mental states and processes and that my behavior can be predicted on this basis. It is more likely they had some sort of a "behavioral hypothesis" suggesting that under certain conditions I would behave in a certain way and that they could exploit this to achieve their goals. Does this interpretive description support the suggestion that these animals have consciousness? It seems to me that the answer is yes.

Does this level of cognitive development allow the animal to develop self-awareness? (I use here the term ‘self-awareness’ as equivalent to the term ‘self-consciousness’, see for example Smith, 2024. I will come back and address this complicated issue of self-consciousness in Chapter 6.) This is an extremely difficult question. Nevertheless, I tend to give a very cautious and hesitating affirmative answer because the above explanations were based on the animal's inner world. Doggie wanted to get to his master's apartment, and used me as a means of achieving its goal; and Max wanted me to pet him and achieved this by scratching the edge of the armchair on which I sat. These interpretations suggest that the dog and the cat’s behavior indicates that they acted on their own will and belief that took into account the way I am behaving. Despite these speculations, one must take into account that experiments on various animals have shown that dogs and cats do not meet the mirror test that indicates that self-perception signifies self-awareness (see below, and Gallup & Anderson, 2020).

**Two experiments on fear and avoidance.** Rakover (1980) showed that bar-press avoidance learning is affected by the length of the intertrial interval, and Rakover (1979) demonstrated that fish, like rats, learn shuttle-avoidance better than lever-bumping (press) avoidance. These results can be interpreted as indicating that rats and fish are suffering, that they feel pain and fear, because they invest energy, and they worked hard to avoid pain, which is signaled by a stimulus arousing fear (see Dawkins, 1987, who suggested that a good measure of suffering is the effort invested in avoiding suffering). These findings are interesting in particular since several researchers believe that pain does not annoy fishes (see Allen & Trestman, 2024).

 **Measuring fear by pain**. If a dentist caused a sharp pain in the course of treatment, the patient may avoid returning to that dentist or may prefer to postpone the next treatment for a long time. The postponement may worsen the condition of the teeth, so one may propose that the patient is paying with pain for his/her fear. Fear of pain may be seen as suffering in addition to the physical feeling of pain itself. Rakover (1975) attempted to measure fear with pain in laboratory rats. In terms of Dawkins (1987), the experimental question was this: how much pain is a rat willing to endure in order to avoid fear? In other words, the question is as follows: What is the degree of pain that a rat is willing to endure to avoid the situation in which it previously received a high electric shock?

 This question was answered empirically by using the following procedure that was implemented in a device that consists of two boxes, where box A is connected to box B by a lifting door (see Figure 1).

 

**Figure 1.1** describes schematically the experimental device. In the first stage, the rat is in Box A and receives a strong electric shock. In the second stage, the rat is moved to Box B, the door is opened (raised) and it receives an increasing electric shock until the rat moves from Box B to Box A. The small circles on the floor of the device represent bars through which an electric shock was delivered to the rat's legs. The rectangle in the middle marks the small fence between the two boxes.

First, a rat confined in Box A received a strong electric shock (in milliamps [mA]) and as a result, box A arouses strong fear in the rat. Then the rat is transferred to box B in which it received a very weak electric shock that steadily increases. This situation raises the following question: What level of pain in box B (caused by the increasing electric shock) is a rat ready to suffer in order *not* to enter box A, which arouses a strong fear? The results showed that the degree of pain that the rat was willing to endure in box B to avoid entering the fearful box A increased as a linear function of the intensity of the electric shock that the rat received previously in box A. Quite roughly, it is found that FearmA = .23xPainmA. For example, if PainmA = 2mA, then FearmA = .46mA.

 This result indicates two interesting things. First, the rat was afraid to enter the box where it received a strong electric shock, because it was willing to pay in suffering, in pain, for the fear.

 Second, it appears that the rat's behavior in the present experiment was rational, where a rational behavior can be defined as behavior that is between the following two limits.

 *Lower limit*: if the rat enters box A, which arouses strong fear, without even feeling a minor pain in box B, one may say that its behavior is not rational, because it has learned nothing from its past experience (the pain it suffered previously in box A).

 *Upper limit*: if for non-entry into box A, the rat in box B suffers pain that is greater than the pain it suffered previously in box A, one may suggest that its behavior is not rational. The rat pays for avoiding the fear with pain that is greater than the pain it suffered previously in box A.

 The fact that the rat's suffering was between the lower and upper limits shows that his behavior was rational. It is interesting to note that in many cases human behavior is not necessarily rational. People are willing to pay more than the upper limit, for example, when they reject medical treatment due to fear and worsen their health condition; or when they risk their lives in bloody wars for the sake of dubious glory.

 The observations and the results of the experiments that I have described above are all based on behavior that are interpreted with a reasonable degree of certainty as indicating that animals (Dogs, cats and fish in the above examples) are endowed with a certain (sensory) level of CΨ. However, behavior as indices of CΨ in humans and animals arouse vigorous debate related to their validity (e.g., Irvine, 2013a, b). Furthermore, Irvine (2013b) suggested in her book on the concept of CΨ that, in light of many severe methodological problems that the measurement of CΨ encounters, one should raise doubts about the validity of these measurements and propose that the concept of CΨ should be eliminated from scientific research. I do not accept this approach, which seems to me too extreme. In light of the examples discussed above (the observations and experiments) and of the declarations of the groups of researchers in England and the USA that animals do possess CΨ, I reject Irvine’s approach of “scientific eliminativism”. (Later I present additional arguments against the approach of Churchland's, 1988, “Eliminative Materialism”.)

 I am well aware of the methodological problems associated with the attribution of CΨ to animals and even to other humans, also referred to as the “other-minds problem” (e.g., Allen, and Trestman, 2024; Avramides, 2023; Rakover, 2007). Given this, it is possible to propose that since CΨ is a subjective and private phenomenon, it is not amenable to objective research. However, if one accepts, as I do, the assumption that CΨ, like all other phenomena in the kingdom of life, developed in an evolutionary manner and therefore is not epiphenomenal, one would be able to justify scientific research in CΨ (see discussion in Allen, and Trestman, 2024). On this basis, as we will see later, I developed a mentalistic model of explanation (based on the inner world of the individual) to account for the public behavior of the individual.

**(1.4) Evaluating consciousness by experiments.** A fundamental question is how can one know if a certain behavior indicates a state of CΨ? How a behavioral index may indicate whether an individual is in a state of CΨ or not? These are important questions to all people who judge whether other’s behavior signifies CΨ. Why? Simply because only the individual him/her-self knows if s/he is in a state of CΨ. However, even the individual himself is not always aware of all the stimuli in his field of perception. For example, are you aware of what is happening in the periphery of your field of perception? You are certainly aware of the stimulus on which you are concentrating. However, are you conscious of the stimuli around the center, in the corners of the eyes? Further, consider extreme situations in which a doctor wants to know if the patient in a coma may be at a certain level of CΨ; and if a patient, who is in a vegetative state, shows any signs of CΨ. These are questions of life or death.

 Large efforts have been made in research of certain behavioral phenomena that are associated with changes in CΨ, such as the phenomenon of ‘Blindsight’ and the ‘Binocular rivalry’. (The first refer to people who respond correctly to visual stimuli, which they do not consciously perceive because of [lesions](https://en.wikipedia.org/wiki/Lesion) in the [visual cortex](https://en.wikipedia.org/wiki/Visual_cortex#Primary_visual_cortex_(V1)). The second refer to people who perceive alternating two different images instead of one superimposed image when two different images are presented to each [eye](https://en.wikipedia.org/wiki/Human_eye). For a review of other behavioral phenomena indicative of CΨ see Kim & Blake, 2005.) The indicators of these behaviors relating to CΨ, can be divided into two main categories: subjective (verbal reports) and objective (behavior, neurophysiological activity in the brain) (e.g., Blackmore, 2013; Hunt, Ericson & Schooler, 2022; Irvine, 2013a; Seth et al. 2008). However, as it turn out, appropriate statistical and theoretical analyses have shown that none of the subjective or objective indexes is immune to serious flaws. For example, Persuh (2018) suggests that objective indexes specifies the individual's behavioral performance rather than his/her CΨ. To elaborate a bit on the criticisms of objective measures for consciousness, I will focus on the following two behaviors, one related to humans and the other to animals (for criticisms directed against subjective measures, see the articles above).

 The *binocular rivalry* observation can be used to discover the neural correlates of consciousness (NCC) of this phenomenon (e.g., Blake, Brascamp & Heeger, 2014; Miller, 2015). In everyday vision, the individual perceives the same stimulus with two eyes, when each eye views the same stimulus in a slightly different way. The brain creates a coherent union of these stimuli and thus one perceives a stable uniform image (a three dimensions one). However, when each eye is presented with a different image (e.g., the right eye is presented with a face and the left eye with a house) instead of perceiving a superimposition of these two different stimuli, one experiences the phenomenon of binocular rivalry. The perception is alternating between these two visual stimuli: one stimulus is seen for few seconds, then the other, in a random order. The phenomenon of binocular rivalry makes it possible to discover the changes in the neurophysiological processes in the brain that correlate with the changes in the awareness of the two different stimuli that are presented separately to each eye. As one might expect, the idea of ​​a connection between brain activity and CΨ has been criticized. In my opinion, the brain activity can be interpreted as an effort to process the information of the presented stimuli and not necessarily as a process that generates CΨ. Blake, Brascamp & Heeger (2014) and Miller (2015) put forward a number of interesting reasons to doubt the hypothesis that indeed the NCC discovered in the experiments on binocular rivalry are the neural correlates of CΨ. While Blake, Brascamp & Heeger’s article concentrates mainly on certain conceptual issues, Miller's paper emphasizes methodological issues. The main problem pointed out by Miller (2015) is that research in CΨ should focus on the attempts to discover in the brain not the neurophysiological *correlates* of CΨ, but the neural *constitution* of CΨ. However, an acute methodological problem arises here, according to which there is no empirical strategy capable of distinguishing between *correlates* and the *constitution* of CΨ. The detailed analysis of this distinction ultimately leads Miller to a new proposal for the way science of CΨ should be conducted.

 The *Mirror Self-Recognition* (MSR) test is one of the most important and well-known tests for determining CΨ in animals (e.g., Allen & Trestman, 2024; Blackmore, 2013; Gallup, 1970, 1998; Povinelli, 1998). When chimpanzees stand in front of a mirror for the first time, they react to the figure in the mirror as another chimpanzee. Over time their behavior changes and can be interpreted as if they see themselves in the mirror (e.g., they examined inside their own mouths). To rule out the interpretation according to which the chimpanzees are just intrigued by the figure in the mirror (for example, Max the cat showed interest in the figure in the mirror until the moment he tried to smell it, see Rakover, 2007), Gallup conducted the following experimental manipulation. He anesthetized the chimpanzees, drew two red dots on their foreheads, and placed them in front of the mirror after they woke up from the anesthesia. The result was that the chimpanzees showed great interest in these dots (touching and rubbing them). The interpretation is that they remembered themselves without the dots and wanted to know what the dots that appeared on their forehead were.

 The broad research that has been aroused following the invention of the MSR test, revealed that certain types of animals (such as orangutans, baboons) passed the MSR test, but other animals did not recognize themselves in the mirror (e.g., cats). Gallup and Anderson (2020) proposes after a rigorous examination of the experimental evidence, that only chimpanzees, orangutans and humans passed convincingly the mirror test. The great interest that the test has aroused included also substantial questions about to the relationship between the findings of the test and the attribution of CΨ to animals. Here is not the place to review the rich literature on the subject. However, it seems to me that the following commentary may be of interest. In my view the MSR test can be interpreted in many different ways. While Gallup believes that its finding indicates self-recognition that points to self-awareness, that is, CΨ, other researchers offer interpretations that contradict Gallup's view. In my opinion, one may conceive of the experiment of MSR as a conundrum that the animal has to cope with. The animal may refer to the figure in the mirror from several points of view, such as, (1) a strange and intriguing shape; (2) a figure whose movements are related to my movements; (3) Who is this animal? I have never seen it around. (4) What a strange and terrifying creature. It has a familiar shape and it is in a familiar environment; But, it doesn't smell, it doesn't make a sound, and it has a strange and scary gaze. (5) Hey, I can see inside the mouth of this creature, what does it have there? Etc. etc. These possible interpretations may indicate that the MSR test does not decide whether CΨ exists in animals, but rather it uncovers different cognitive abilities (attributes), such as curiosity and apprehension that the figure in the mirror arouses in animals. It should be added here that different degrees of a cognitive attribute (such as intelligence) have no correlation with CΨ, because, for example, the cowardly and the brave humans are blessed with the same level of CΨ and so are the foolish and the wise. In other words, the same level of CΨ applies to people who are very different from each other (for similar ideas see Koch, 2019).

 In view of these criticisms, the following question raises once again: Are all animals endowed with CΨ similar to humans. This question may exacerbate the “other-mind problem" that was mentioned above. According to this problem, an individual cannot justify his/her confidence that another person has CΨ similar to his/her own, because one can only observe his/her unique inner world (e.g., Avramides, 2023; Fabbro et al., 2019). Usually, in everyday life, we tend to accept the other's verbal report as reliable evidence for his state of mind. We accept the situation according to which the other has a subjective inner world similar to ours, without disputing this approach. However, because animals are not gifted with the ability to learn and use language like humans, the problem of the other-mind is exacerbated with them. We have no other choice but to rely on observations of their behavior and neurophysiology (Koch, 2019 offers an overall positive answer based on the IIT, a theory of CΨ that I will discuss in the next chapter). Nevertheless, given all the arguments for and against CΨ in animals and considering the approach, which is accepted by me, that CΨ has been developed in an evolutionary way, I am inclined to propose that the answer is 'yes', animals do have a certain level of CΨ similar to that of man – sensory CΨ.

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