Chapter 1
Representing the World

ABSTRACT

Chapter 1 describes how specifically organized, hierarchical structures of a neural network can create neural representations of perceived reality. The authors describe how, as a result of categorization and generalization, memory traces created in subsequent layers can represent the perceived world in all its complexity. Starting from the representation of direct sensual impressions in the lowest layers, closely connected to the sensors of individual senses, to the representation of increasingly complex objects, the feelings and knowledge about the observed world are built. They postulate that to achieve this goal imaginary natural and artificial brains must contain such semihierarchical structures capable of creating new connections and information transmission paths. By associating large areas of brain fields in multiple layers, it is possible to create representations of complex reality. The dominant mechanism of self-learning is correlation learning, during which simultaneous, synchronous arousal of different senses creates mutually correlated features of the observed object. Perceived objects excite neuronal stimulation patterns that allow the system to identify the object in the future. The re-stimulation of the memory structures from the top layers to the sensory fields, causes the recall and creation of sensations similar to those felt during the original experiences. By comparing new sensual impressions with those stored in memory, the perceived objects are recognized. Frequent, simultaneous co-occurrence of stimulations of mental representations results in associations of memory cells and synapses, and thus associations of mental facts. Order and sequences of their occurrence is the basis of episodic memory. Imagined neural network memory cells, like natural brain neurons, do not limit their role to just remembering the information that they receive. They actively process this information and change the structure of their connections. We put forward the thesis that the described memory cells, artificial neurons, can create brains with features such as natural brains. It is this semihierarchical structure of neurons, which arise from categorization, generalization and association processes that can create neural representations of perceived reality. Learning through life experiences allows us to give them the characteristics of psychological sensations and thus they also become mental correlates of perceptions. The knowledge that these structures represent is as hierarchical they are. This hierarchy starts from the representation of the simplest direct sensual features, to complex models of the environment and abstract concepts that can be defined by symbolic language. The presented model describes the creation of knowledge in the mind, pattern recognition, remembering and imagining objects and events, planning, and making decisions. The systems thus created yield minds with cognitive, intentional, and propositional awareness. Unfortunately, they are devoid of phenomenal awareness, which we write about in the following chapters.

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The prolegomena introduced us to various aspects of human and animal consciousness. Most of the mentioned attributes of consciousness are associated with the processing of well-defined information reaching the brain by means of the senses receiving signals from the outside world. What we perceive must cause some changes in the brain, because we know that we can remember our sensations and perceptions. These changes in brain states are our memory. We can therefore call them neuronal representations of the perceived and felt world. Perhaps the explanation of the mystery of consciousness is very simple. If only we knew the shape of these representations and the means of their stimulation and mutual interaction, then perhaps we would understand how consciousness is created. The process of remembering perceptions is quite well understood and described. We seem to understand how perceived objects are recognized and how sets of objects can create a picture of a scene in front of our eyes and other senses. Representations of objects, phenomena, and the perceived world are part of cognitive consciousness. Because this type of consciousness has access to all other ways of processing knowledge in the mind, it is called access consciousness. Representations of reality have the objective nature of changes in the memory cells and brain fields created by these cells. Therefore, they can be studied, analyzed, viewed using modern methods of imaging the brain, and described objectively from a third-person perspective. Their structure and functioning can be very complex, but we can hope that we will deal with this issue and discover how the shape of these representations results from biophysical or microphysical facts related to information processing in the brain. We will try to describe this in the next chapters.

Bigger problems are our feelings related to what we perceive, what we think, and what we experience. We know that almost all mental processes evoke subjective impressions that generate emotional states of pleasure, aversion, sadness, joy, and a whole range of feelings well known to psychology, which we will write about in more detail. They are strictly subjective, and no third party has insight into how we experience love and hatred. What's worse, even the impression caused by touching a slippery object, seeing the flash of a colorful firework, or sensing a significant concentration of wine mercaptans is completely subjective and impossible to pass on to other people. We have access to these impressions only from a first-person perspective. We can't accurately describe the disgust we feel when we touch rotting, decaying debris, the pleasure of tasting a favorite wine, the happiness of stroking the fluffy fur of a favorite kitty, or the delight at the colorful plumage of an exotic parrot. We cannot report on how we feel our presence in the mundane world and how we perceive the proximity of other people and objects. We have a sense of consciousness, but we have no way to pass this feeling on to others. We can only do this with people who understand our language and who have sufficient confidence in what we are saying. But if we claimed that these things were felt by snakes, octopuses, sharks, or beings from an alien planet? How would we know that this is not a false anthropomorphism? Yet we are sure that we are conscious and aware. Even if we temporarily lose consciousness, we know perfectly well when we recover it. This kind of consciousness is phenomenal consciousness. Our problem is that no one has discovered the neural representations of these subjective impressions. No one has indicated what effects they can have on neurons and synaptic connections. No one even has an idea how they result from the microphysical, biophysical, or neural processes that occur in our brains. Distinguishing what is mental from phenomenal can be so-called intentionality. It reveals itself in mental states with propositional content. Can intentionality be presented in functionalist categories? Until now, the nature of qualia seemed to be the main obstacle.

Unfortunately, philosophers pointed to a more fundamental obstacle. If the microphysical domain is causally closed, the impact of the macrophysical sphere is irrelevant. No properties resulting from specific sciences can be causally effective against their underlying lower-order properties. By analogy it