UNIT 2 PHILOSOPHICAL IMPLICATIONS

Contents

2.0 OBJECTIVES

In this unit, an attempt will be made to understand the philosophical presuppositions of artificial intelligence; especially, the nature of mind as presupposed by artificial intelligence. Artificial intelligence as a programme in cognitive science is based on many theoretical presuppositions like the distinction between natural and artificial intelligence, the information-processing character of mental representations, the idea of mind as a computer, and so on. The nature of cognition is a complex process which needs to be studied for understanding the nature of artificial intelligence.

2.1 INTRODUCTION

Cognition involves issues how we acquire, store, retrieve, and use knowledge. If we use cognition every time and acquire a bit of information, place it in, or use that information in some way, then cognition must include a wide range of mental processes. Cognition, generally, is a process in which information is encoded in the brain by receiving signals from the outer world through the sense organs. It seems that human cognition is largely different from that of other animals because of the enormous richness of the human cognitive process.

2.2 THE NATURE OF COGNITION IN MACHINES

There are different models of understanding cognition such as the neuro-scientific, psychological, representational, connectionist and computational model. These six approaches explain cognition from different standpoints. Neuroanatomy is the study of the nervous system's structure, and is concerned with identifying the parts of the nervous system and describing how the parts are connected to each other. Neuroanatomy can be made at many descriptive levels. According to neuroscientists, investigation can be made at two levels. Firstly, gross neuroanatomy is about general structures and connections, whereas fine neuroanatomy is the main task that describes the components of individual neurons. Secondly, histology is the study of tissue through dissection. The primary concern of neuroanatomy is to ideally connect the patterns of connectivity in the nervous system, and to layout the mechanism that allows information to get from one place to another. For neuroscientists, this neuroanatomy is the analogy of cognition.

While explaining neuro-scientific approach to cognition, Francis Crick, a famous neuro-scientist observes that the brain does not make a distinction between hardware and software, as a computer does. Theories [of thought] have made this distinction are unfortunate. Crick argues for theories of cognition that are strictly tied to biology, which implicitly force him to argue for the study of simple cognitive acts, such as visual word detection, rather than the complex acts such as paragraph comprehension, etc. For neuroscientists, mental action depends on the psycho-neurological factors underlying in it. No mental action is without these factors which determine the mental history of an agent. Although Crick's general discussion is on the concept of conscious thought; virtually all the specific studies he cites deal with visual cognition. For him, it might be most profitable to deal with vision entirely within the field of neuro-science, while dealing with language comprehension in terms of psychological machines has no known neural basis. Cognition is a multi-dimensional process which needs a many-sided approach.

The psychological approach to cognition is defined as the psychology of understanding and knowing. It is also the study of mental processes. It is concerned with the way we take in information from the outside world, and how we make sense of that information, and what use we make of it. According to Groome, there have been three main approaches to the study of cognitive psychology, namely, experimental psychology, computer modelling, and cognitive neuropsychology. Firstly, experimental psychology involves the use of psychological experiments on human subjects to investigate the ways in which we perceive, learn, remember or think. Secondly, cognitive psychology is the use of computer modelling of cognitive processes. This approach involves the simulation of some aspects of human cognitive function by writing computer programs, in order to test out models of possible brain function. Lastly, cognitive neuropsychology is concerned with the activities of the human brain during cognitive processing. These three approaches of cognitive psychology explain the psychological levels of cognitions.

The representational theory of cognition tries to show how our knowledge of the world is represented in the mind. When human knowledge is represented in an abstract format, we call it propositions. Thus all knowledge representations take place in language. The representational theory studies the mental representation in a formal language called language of thought by Jerry Fodor. A representation is something that stands for something else. For example, the words of any human language are forms of a representation because they stand for objects, events, and ideas; words are an abstract representation because the relation between a word and the object signified or the idea it represents is arbitrary; words in other language can refer to the same objects and ideas, and in few cases the referent of a word cannot be predicted from its auditory form. But in the case of mental representations, mind preserves information about objects or events in the world. For example, when we have a mental representation of table and this representation preserves locations of objects in the space, it supports a number of abilities, including imaging the place, estimating distance from memory, and so on. This mental representation is necessary because human behaviour cannot be explained without specifying how individuals represent the world to themselves.

According to cognitive scientists, all cognitive processes are computational processes, and all computational processes require internal representations as the medium of computation. And then the nature of this medium is such that the internal representations are symbols. The symbol-system facilitates the computational processes. Computational modelling in cognitive science and artificial intelligence has profoundly affected how human cognition is viewed and studied. Computational levels of cognitions show that the mind is a computer, which is based on symbolic computation. In symbolic computation, the abstractions provided are symbols and rules. But according to the classical computational theory of mind, mental representations are symbolic structures, and the mental processes consist in the manipulation of these representations according to symbolic algorithms as computation is based on symbolic rules.

Herbert Simon, one of the founders of Computer Science, discusses the nature of cognition while constructing models of human mental activity. According to him, cognition is a mental process based on mechanisms of the brain. The brain mechanisms can be studied by neurophysiology. Further, he argues that human brain functions like a computer so that the human cognitive processes are computational in nature. Therefore, if we manage to programme a computer to play chess, we may well have discovered how human thought proceeds. Thus, Simon argues for a sharp distinction between the brain as a physical system and the programs the brain executes; and therefore, he urges us to concentrate our attention on the program. A great deal of the modern study of cognition depends on the insight that representational level and neural level events can be linked through the development of intermediate, computational theories of thought. Newell and Simon point out that this insight is based upon a rather sophisticated notion, both of thinking and computation as activities that are carried out by physical symbol systems.

As we know, a machine or computer is a physical device that manipulates electrical signals that stand for the symbols in the equation. The physical systems translate signal system into a symbol system. Computers and engineer-paper-pencil devices are general computing systems in the sense that they can, in principle, compute any computable function that is defined by a symbol system. In order to actually compute something, the physical device must be given a set of instructions which are stated in terms of symbols. Thus computing systems operate systems of symbols to arrive at results. We have to note that the algorithm is not stated in terms of the physical machine, because the physical operations that achieve the primitive function such as writing down, multiplying, and subtracting have not been specified.

According to Newell, a physical symbol system has the necessary and sufficient means for general intelligent action. By ‘necessary’ we mean that any system that exhibits general intelligence will prove upon analysis to be a physical symbol system. By ‘sufficient’ we mean that any physical symbol system of sufficient size can be organized further to exhibit general intelligence. Lastly, by ‘general intelligent action’ we wish to indicate the same scope of intelligence as we see in human action. Thus physical symbol systems as discussed above give rise to intelligent actions because of the presence of symbol manipulations according to rules.

The physical symbol system hypothesis plays an important role in showing computational levels of cognition because the symbol system hypothesis implies that the symbolic behaviour of humans arise because he or she has the characteristics of a physical symbol system. Hence, the success in modelling human behaviour on the symbol systems becomes an important part of the evidence for the hypothesis. The hypothesis helps research in cognitive psychology. Research in information processing psychology involves two main kinds of empirical activity. Firstly, it conducts observations and experiments on human behaviour in tasks requiring intelligence. Secondly, it formulates the hypothesis about the symbolic processes found in the human system. Not only are psychological experiments required to test the veridicality of the human behaviour, but also out of experiments come new ideas for the design and construction of physical symbol systems.

According to Newell, Rosenbloom, and Laird, human beings can be described at different levels of the system. For him, at the top is the knowledge level which describes the persons having goals and knowledge about the world, where knowledge is used in the service of attaining goals. The person can operate at the knowledge level because that involves a symbol system, which is a system that operates in terms of representations and information processing operations on this representation. They says that the symbol level must also be realized in terms of some substrate, that the architecture is that substrate defined in an appropriate descriptive language. For computers this turns out to be the register-transfer level, in which bit-rectors are transported from one functional unit (such as an adder) to another, subject to gating by control bits. For human beings it is neural circuit level, which currently seems well described as highly parallel interconnected networks of inhibitory and exlitatory connections that process a medium of continuous signals.

Thus according to Newell, Rosenbloom, and Laird, the role of architecture in cognitive science is to be the central element in a theory of human cognition. The fixed structure provides the frame within which cognitive processing in the mind takes place. This structure is called architecture. The central function of architecture is to support a system capable of universal computations. Symbols do provide an internal representation function, but representation of the external world is a function of the computational system as a whole so that the architecture supports such representation. It is not the sole or even the predominant determinant of the behaviour of a person, but it is determinant of what makes human behaviour psychological. For him, to have a theory of cognition is to have a theory of the architecture.

The model of the brain, on the other hand, is a technique for analyzing the anatomy and physiology of the brain. This view suggests that the brain consists of a network of simple electrical processing units, which simulate and inhibit one another. This style of explanation of the brain, in cognitive science, is generally considered as the brain-style computation. Now, the question is: Why should there be a brain-style computation? The basic assumption is that we seek explanation at the program or functional level rather than the implementational level. Thus it is often pointed out that we can learn very little about what kind of program a particular computer may be running by looking at the electronics with which it is made. In fact, we do not care much about the details of the computer at all. All we care about it is the particular program that is running. If we know the program, we will know how the system will behave in any situation. It does not matter whether we use vacuum tubes or transistors, the essential characteristics are the same. It is true for computers because they are all essentially the same. Whether we make them out of vacuum tubes or transistors, we invariably use computers of the same design. But when we look essentially at a difficult architecture, we see that the architecture makes a good deal of difference. It is the architecture that determines what kind of algorithms are most easily carried out on the machine in question. It is the architecture of the machines that determine the essential nature of the program itself[12]. Thus, it is reasonable that we should begin by asking what we know about the architecture of the brain and how it might shape the algorithms underlying the biological intelligence and human mental life.

Rumelhart says that the basic strategy of the connectionist approach is to take the neuron as its fundamental processing unit. Computation is carried out through simple interactions among such processing units. Essentially, the idea is that these processing elements communicate by sending numbers along the lines that connect the processing elements. This identification already provides some interesting constraints on the kinds of algorithms that might underlie the identifications of human intelligence. A question may arise here: How does the replacement of the computer metaphor as model of mind affect our thinking? Rumelhart says that this change in orientation leads us to a number of considerations that further inform and constrain our model building efforts. Neurons are remarkably relative to the components in modern computers. These neurons operate in the time scale of milliseconds, whereas computer components operate in the time scale of nanoseconds- a vector of 10^6 time faster. This means that the human brain process that receives the order in a second or less can involve only a hundred or so times steps. Because, most of the computational processes like perception, memory retrieval, etc take about a second to function. That is, we seek explanations for these mental phenomena that do not require more than about a hundredth elementary sequential operations.

The human brain contains billions of such processing elements. As the computer organizes computation with many serial steps, similarly the brain can deploy many processing elements in cooperation and in parallel to carry out its activities. Thus, the use of brain style computational system offers not only a hope that we can characterize how brains actually carry out certain information processing tasks but also offers solution to computational problems that seem difficult to solve in more traditional computational framework. The connectionist systems are capable of exploiting and mimicking brain-style computation like artificial intelligence. Connectionism operates both as a system and a process. The connectionist systems are very important because they provide good solutions to a number of difficult computational problems that seem to arise often in models of cognition. Connectionism as a processing mechanism is carried out by a number of processing elements. These elements, called nodes or units, have a dynamics, which is roughly an analogue to simple neurons. Each node receives input from some number of the nodes and responds to that input according to a simple activation function, and in turn excites or inhibits other nodes to which it is connected.

All the levels of cognition, which we have discussed, are not universally accepted. There are levels of cognition which are better explained in the connectionist model. The connectionist approach refers to the functions of the neurons. According to Crick, the ‘astonishing hypothesis’ is that consciousness and all the thinking that goes with it are the product of neurons, and therefore, the primary business of the scientific study of thought has to be the reduction of cognitive psychology to neurology. He says that one may conclude, then, that to understand the various forms of consciousness, we need to know their neural correlates.

Crick is not opposed to the study of the computational level of cognition when they are linked to the physiological investigations of the brain. But, advocates of computational level models are careful to dissociate themselves from the idea that the computer, as a physical device, is being used as a model for the brain. According to David Chalmers, a computational basis for cognition can be challenged in two ways. First, it can be argued that computation cannot do what cognition does: that a computational simulation cannot reproduce a human cognition, because the causal structure in human cognition goes beyond what a computational description can do. Second, computation might capture the human capacities, but something more is required to replace the human capacity. The human cognition can be applied to what is known as memory attention, pattern recognition, language, problem solving etc. The most intriguing aspect of the human mind is the selection of information for further processing and storage. The information available during each moment, except sleep and unusual occasions, is vast and complex; we are constantly bombarded by our senses. All the external senses give us information which the mind deals with at different stages. Cognition is the output produced after a long process of getting the inputs.

2.3 THE COMPUTATIONAL MODEL OF MIND

As we have already seen, artificial intelligence is the discipline that aims to understand the nature of human intelligence through the construction of computer programs that imitate intelligent behavior. It also emphasizes the functions of the human brain and the analogical functioning of the digital computer. According to one extreme view, the human brain is just a digital computer and the mind is a computer program. This view, as John Searle calls it is strong artificial intelligence. According to strong artificial intelligence, the appropriately programmed computer with the right inputs and outputs literally has a mind in exactly the same sense that you and I do. This tells that not only the devices would just referred to indeed be intelligent and have minds, etc. but mental qualities of a sort can be attributed to teleological functioning of any computational device, even the very simplest mechanical ones such as a thermostat. Here, the idea is that mental activity is simply the carrying out of some well-defined operations, frequently referred as an algorithm. We may ask here as to what an algorithm actually is. It will be adequate to define an algorithm simply as a calculation procedure of some kind. But in the case of thermostat, the algorithm is extremely simple: the device registers whether the temperature is greater or smaller than the setting, and then, it arranges for the circuit to be disconnected in the former case and to remain connected in the latter. For understanding any significant kind of mental activity of a human brain, a very complex set of algorithms has to be designed to capture the complexity of the human mental activities. The digital computers are approximations to the complex human brain.

The strong artificial intelligence view is that the differences between the essential functioning of a human being (including all its conscious manifestations) and that of a computer lies only in the much greater complication in the case of brain. All mental qualities such as thinking, feeling, intelligence, etc. are to be regarded, according to this view, merely as aspects of this complicated functioning of the brain; that is to say that they are the features of the algorithm being carried out by the brain. The brain functions like a digital computer according to this view. The supporters of strong AI hold that the human brain functions like a Turing machine which carries out all sets of complicated computations. The brain is naturally designed like a computing machine to think, calculate and carry out algorithmic activities. To strong AI supporters, the activities of the brain are simply algorithmic activities which give rise to all mental phenomena like thinking, feeling, willing, etc.

David Chalmers, mentions that the field of artificial intelligence is devoted in large part to the goal of reproducing mentality in computational machines. The supporters of strong AI argue that we have every reason to believe that eventually computers will truly have minds. Winston says that intelligent robots must sense, move and reason. Accordingly, intelligent behaviour is interpreted as giving rise to abstract automation. That is to say that an artificial, non-biological system could thus be the sort of thing that could give rise to conscious experience. For the supporters of strong AI, humans are indeed machines, and in particular, our mental behaviour is finally the result of the mechanical activities of the brain.

John Searle, in his *Is the Brain a digital computer*? mentions that the basic idea of the computer model of the mind is that the mind is the software and the brain is the hardware of a computational system. The slogan is that the mind is to the program, the brain is to the hardware. For strong AI, there is no distinction between brain processes and mental processes. Because the process which is a happening in the brain is a computational process, the mind is the alternative name of the brain which is a machine.

According to David Chalmers, the theory of computation deals wholly with abstract objects such as Turing machine, Pascal program, finite state automation and so on. These abstract objects are formal structures which are implemented in formal systems. However, the notion of implementation is the relation between abstract computational objects and physical systems. Computations are often implemented in synthetic silicon based computers.

Whereas the computational systems are abstract objects with a formal structure determined by their states and state transition relations, the physical systems are concrete objects with a causal structure determined by their internal states and the causal relations between the states. It may be pointed out that a physical system implements a computation when the casual structure of the system mirrors the formal structure of the computation. The system implements the computation, if there is a way of mapping states of the system onto states of the computations so that the physical states which are causally related map onto the formal stares that are correspondingly formally related. The fact is that there is rich causal dynamics inside computers, as there is in the brain. There is real causation going on between various units of brain activity precisely mirroring patterns of causation between the neurons. For each neuron, there is a specific causal link with other neurons. It is the causal patterns among the neurons in the brain that are responsible for any conscious experiences that may arise.

The brain, as Marvin Minsky says that happens to be a meat machine. He points out that the brain is an electrical and chemical mechanism, whose organization is enormously complex, whose evaluation is barely understood and which produces complex behavior in response to even more complex environment. Artificial intelligence understands the nature of human intelligence in terms of the computational model of the brain.

2.4 ARTIFICIAL INTELLIGENCE & THE FUNCTIONALIST THEORY OF MIND

Functionalism arose as a result of the phenomenal rise of interest in computing machines and artificial intelligence. The functionalists say that mental processes are computational processes realized in a machine. Functionalism is a theory that explains mental phenomenona in terms of the external input and the observable output. It explains the mind as a machine. Functionalism as a conception of mind explains the reality of the mental phenomena in terms of the mechanical phenomena. Mind is not just a part of the physical organism but is itself characterized as the physical organism called the brain. The brain is further characterized as a complex physical system working like a computing machine. Functionalism explains the mechanical behaviour of the brain/mind. Functionalism as a theory of mind is supported by various scientific theories like those of artificial intelligence, cognitive science, and neuroscience, etc., Artificial intelligence advocates a computational theory of mind which argues in favour of the functional similarity between the computation states of the artificial system and the neurophysiological states of the brain.

The hypothesis of artificial intelligence that "machine can think" became very popular after Alan Turing's "C*omputing Machine and Intelligence.*" Turing's hypothesis is that machines think intelligently like human beings. Putnam says that probabilistic automation has been generalized to allow for 'sensory inputs', and 'motor outputs', -that is, the Machine Table specifies, for every possible combination of 'state' and a complete state of 'sensory inputs' an 'instruction' which determines the probability of the next 'state' and also probabilities of the 'motor out puts'. The following are the steps which explain how a machine functions in general:

i) The description of the sequence of states (procedure)

ii) Description of rules

iii) The explanation of the rationale of the entire procedure.

The computing machine is thus a system constructed out of different subsystems that function inside it to process the inputs and to produce the output once the input is simulated in the machine. It tries to match the simulating state with the states already computed and mapped in the system. This mapping order follows certain syntax or rules. The syntax is responsible for the correlation of total cognitive states. Thus, the entire process of simulation can be called an intelligent process. This simulation process takes place between the functions of the two functionally isomorphic systems. As Putnam defines that two systems are functionally isomorphic if there is a correspondence between states of one and the states of the other that preserves the functional relation.

There is functional isomorphism, according to Putnam, between the brain/mind and a machine. This functional isomorphism holds due to the causal capacity of the functional states of the machine. For example, when I have a pain, there is a neurophysiological process corresponding to the mental state because of the firing of the C-fiber. The brain/mind identity follows as there is functional identity between the two. Thus, identity between the mental states and the physical processes of the brain is established from the functional point of view. That is, in functional terms, the brain state is isomorphic with the mental state. That is, there is identity between software that constitutes the program and the hardware of the machine, which helps the software to be realized in the machine.

There can be indefinitely many different physical properties, which constitute the realizations of the same functional property. However, it is also true that the same physical state can realize different functional properties at different times or in different circumstances or in different creatures. The functional states are 'multiply realizable' in the sense that a functional state cannot be identical to any particular physical realization of it. For example, someone could write a program using two completely different types of computer, which use different sorts of hardware to run the same program. In this sense, the program is said to be 'multiply realizable' in that any number of computers may be used to realize the same program. Functionalism takes states of mind and mental properties to be functional states and properties. Mental properties are realizable by, but not identical with, material properties. For example, the same mental property, the property of being in pain, may be realized by one property in a human being and to a certain extent by another property in an invertebrate. For the functionalist, if someone has now a particular pain, then he/she can imagine that this pain is realized through a particular neural state. That neural state has an identifiable material structure, and this may be studied by a lower-level hardware science like neurobiology. Therefore, for functionalism, what makes the state a realization of pain, is not its material constitution but it's occupying a particular kind of causal role within our nervous system. Multiple realizability thus implies that there is a higher-level functional description of physical states in terms of their causal role, which abstracts from their lower-level physical constitution. It is with such functional properties that mental properties can be identified.

In his essay "*Mad Pain and Martian Pain*", David Lewis discusses two kinds of beings, which experience pain differently than normal humans. In the case of mad pain, the subject experiences pain when doing moderate exercise in an empty stomach; further, it improves his concentration for mathematical reasoning. On the other hand, Martian pain takes place in a Martian organism constructed of hydraulic hardware rather than neurons. Here the point is that pain is associated only contingently with either its causes (as in mad pain) or its physical realization (as in Martian pain). We cannot specify *a priori* its causal role or physical

Daniel Dennett has suggested a multiple-draft-model, approach to the nature of mind. According to this model, there is similarity between the functions of the human mind and those of the computer. The brain system functions in relation to different sub-systems. So there are multiple drafts, which operate within an artificial system. Such an analogy is beneficial because it analyses consciousness from the point of view of language processing. This is given importance precisely in the sense that a linguistic or language speaking being is considered not only as a conscious being but also a rational being. Even the robots as information processing systems can also be characterized as intelligent systems. According Dennett, we are machines! we are just very, very complicated, evolved machines made of organizes molecules instead of metal and silicon, and we are conscious, so there can be conscious machines – us. So the human thought process and language processing in the artificial systems are analogous to each other. In the case of the conscious thought process, we are aware of our thoughts, at the same time, there is physico-chemical process, which goes on in our brain.

Dennett's functional analysis of consciousness is divided into two parts. There are the sub-personal view of consciousness and the multiple draft-model of consciousness respectively. The sub-personal model explains consciousness and other mental activities through the help of neurological states and processes of the organism, whereas the multiple-draft-model discusses how an artificial system behaves intelligently. Thus Dennett provides a functional explanation of consciousness at the sub-personal level. According to him, sub-personal theories proceed by analyzing a person into an organization of subsystems (organs, routines, nerves, faculties, components-even atoms) and attempting to explain the behaviour of the whole person as the outcome of the interaction of these subsystems. Thus in the present instance the short-coming emerged because the two access notions introduced computational access *simpliciter* and the computational access of a print-out faculty, were defined at the sub-personal level; if introduced into a psychological theory they would characterize relations not between a person and a body, or a person and a state of affairs or a person and anything at all, but rather, at best relations between parts of person (or there bodies) and other things.

Therefore, the sub-personal level of explanation of consciousness tries to explain not only how the human beings are systems of organism but also how the system is being constituted and how the various functions involved in different physiological parts of the organism function together. And that functional structure would help us in defining the capacity involved in causing consciousness or what we call conscious behaviour. A state of consciousness is simply one which exhibits a certain characteristic pattern of causal relations to other states, both mental and physical.

We know that human beings perform various activities; they learn language; acquire various knowledge states or belief states, and there are changes in their belief states, and so on. All these activities are independent biological activities of human life. Dennett anticipates that there would be a system whose programs would be such that it would be self-dependent in all its functions. That would be able to replace or stand parallel to human intelligence. Further, the functions of the artificial system help us in explaining the various mysterious features that are ascribed the human life. Thus, the strong notion of functionalism advocates the identity between the mental states and the brain processes. It also explains the different basic features of human beings such as consciousness, intentionality and subjectivity, etc, by bringing the feature of the functional isomorphism into account.

Functionalism holds that the mental states are abstract, functional states, characterized solely in terms of their casual relationships to each other, to input, and to outoput.[37] Human purposive behaviour is then explained in terms of how this hypothesized system of states take the organism from sensory input to behaviour. Because functionalism insists upon a network of mental states, it insists upon the holism of the mental upon the way in which mental states operate together to explain behaviour. It accepts structure of mental states in which each is necessarily connected with the other. The mental states do not function in isolation; rather they function within the causal co-relationship with other mental states. The function of mental states also takes into account the effect of the environment in which the subject or agent is placed with the system that must be well equipped to receive the input from the environment and to produce the output.

The functionalist program has been strongly influenced by analogies drawn from computer science and AI, both in its general outlook and in several of its specific applications to problems about the nature of mind. Because a functional state is like a computational state of a computer. A computer program can be described as a functional organization of the hardware. As already discussed, the functionalists argue that mental states are like the 'information processing' states of a computer. Accordingly, for computer functionalism or artificial intelligence, the brain is a computer, and the mind is a computer program implemented in the brain. Thus artificial intelligence is strongly founded on a functionalist conception of mind. It is dependent on the idea that human functions like a digital computer with multifunction computational abilities.

2.5 LET US SUM UP

In this unit an attempt is made to understand the philosophical presuppositions of artificial intelligence; especially the nature of mind as presupposed by artificial intelligence. Artificial intelligence as a programme in cognitive science is based on many theoretical presuppositions like the distinction between natural and artificial intelligence, the information-processing character of mental representations, the idea of mind as a computer, and so on. The nature of cognition is a complex process which needs to be studied in order to understanding the nature of artificial intelligence. In this way, we have explored mental representations like beliefs and thoughts which constitute the broad domain of cognitive science. These representations explain how cognition takes place in the human mind. Cognitive science (including cognitive linguistics and cognitive psychology) has brought about a cognitive revolution in the study of mind.

2.6 KEY WORDS

Artificial intelligence, functionalism, cognitions & computational theory of mind

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