

**PAUL M. CHURCHLAND'S ELIMINATIVE
MATERIALISM AS A THEORY OF MIND**

*Thesis submitted to the fulfillment of
Doctor of Philosophy (Ph.D) in Philosophy*

by

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DECLARATION

I, Baiju E. B., hereby declare that this thesis titled '**Paul M. Churchland's Eliminative Materialism as a Theory of Mind**' has not previously formed the basis for the award of any Degree, Diploma, Associate Fellowship or other similar title or recognition.

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PREFACE

The present thesis is an enquiry into one of the most scientifically advanced cognitive modeling of the brain. Still, even today, the model continues to be developed by Paul M. Churchland and many others. It is called the Neural Network Theory of Mind, which is presented as a form of scientific realism. It defines mind in terms of information carried across parallel distributed neural network. Eliminative materialism is an important lemma in this network that is derived from the high watermark of connectionist research. Eliminative materialism is a doctrine that is presented as an advanced variant of functionalist theory of mind. As a form of contemporary materialism, it extends the representational-computational notion of mind in specific directions in which mind is thought to be reducible to its neurobiological correlates. It is claimed that if mind is reduced to its neurobiological correlates, it can eliminate commonsense conception of mind (folk psychology). Eliminativism claims that it can eliminate folk psychology as a theory in favour of scientific psychology. Eliminativist arguments originate in Quine and found in many others like Churchland and Stephen Stich. If the credentials of eliminativism are proved wrong, the very possibility of the neuro-computational perspective is threatenend. Hence, this is taken to be a hypothesis *to be* examined in the thesis. Churchlands thesis stands on two pillars: one is his non-linguistic view and the other is the key argument which reduces reductionistic procedures, understand in an inter-theoretic way, into a philosophy of science. My efforts lie in the direction of showing some of the major weakness of his theoretical perspective in the course of my thesis.

The whole thesis consists of five Chapters and in each of them definite purposes are being made. First Chapter tries to locate and introduce Churchland's theory is a major contribution in this field. As a follower of functionalist theory, we discussed it to some extent with other classical default theories, which are all reductionistic except dualism. Along with this, an introduction to cognitive science is also given since we can locate Churchland's theory within the framework. We saw two important paradigms in cognitive science, which gave impetus for the second Chapter. It is about these two modellings in cognitive science namely classical computational theory and neuro-scientific connectionist theory. This is also about the first pillar of Churchland's theory, i.e., non-linguistic feature in which we found that his non-linguistic feature is not free from a semantics and it is state space semantics. His critique of all reductionistic theories gave rise to his inter-theoretic reductionistic programme in which we found in the fourth Chapter. It is the realism and anti-realism of folk psychology which makes a serious debates in cognitive science and those who made compatibilist positions even threatens the credentials of Churchland's theory. It is this what we searched in fifth Chapter which gives a summary and evaluation. So with the criticisms and defences Churchland's theory seems to be still fascinating for its neural network constitution and weakened at the question on realism. Whatever it may be, Churchland's theory represents the high water mark of connectionist researches in recent literatures.

CONTENTS

Chapter	Page No.
1. INTRODUCING PAUL CHURCHLAND'S NEURAL NETWORK THEORY OF MIND	1 - 53
1.1 The Programme called Neurophilosophy	
1.2 The Classical Default Theories in the Philosophy of Mind	
1.3 The Glory and Fall of Functionalism	
1.4 Neural Network Theory/Eliminative Materialism – An Offshoot of Functionalism	
1.5 The Controversy between Folk Psychology and Scientific Psychology	
1.6 The Claims of Neural Network Modelling of Mind	
2. THE MAJOR THRUST OF CONNECTIONIST NEURAL NETWORK	54 - 104
2.1 Paradigms in Cognitive Science	
2.2 Model I: J. Fodor's Computational Representational Understanding of Mind	
2.3 Model II: Churchland's Connectionist Neural Network Modelling of the Brain	
2.4 Neural Network Connectionism as Eliminative Materialism	
2.5 Eliminative Materialism and Folk Psychology	
2.6 Propositional Attitude Psychology	
2.7 Paul M. Churchland's 'Eliminativism Now'	
2.8 Stich's Elimination in Prospect	
3. EVALUATING NEUROCOMPUTATIONAL PERSPECTIVE AS A THEORY OF MIND	105 - 156
3.1 Major Features of Neurocomputational Perspective: A Review	
3.2 Parallel Distributed Processing	
3.3 Does PDP Explain the Plasticity of Human Nature ?	
3.4 Intertheoretic Model of Reduction	
3.5 The Rationale of Intertheoretic Reduction	

3.6 Prototype Activation Vectors: The Basis of all Knowledge

3.7 State Space Semantics Vs Mentalese Semantics

3.8 Can PDP Explain the Status of Consciousness ?

3.9 The Hard Problem and the Explanatory Gap

3.10 The Reconstruction of Consciousness

**4. AN ESTIMATE OF NEUROCOMPUTATIONAL
PERSPECTIVE AS A THEORY OF MIND**

157 - 207

4.1 Connectionism and it's Aftermath

4.2 Churchland Vs Churchland

4.3 Churchland Vs Dennett

4.4 Churchland Vs Penrose

4.5 Churchland Vs Searle

5. SUMMARY AND EVALUATION

208 - 238

5.1 Churchland's Defence against His Critics

5.2 Postures and Counter-postures

5.3 Structuration of Eliminativist Argument in Churchland

5.4 Structuration of Eliminativist Argument in Stich

5.5 Does Eliminative Materialism Really Entail Realism ?

BIBLIOGRAPHY

9.

CHAPTER I

INTRODUCING PAUL CHURCHLAND'S NEURAL NETWORK THEORY OF MIND

*“There is nothing supra-physical,
nothing beyond the bounds of physical science here”*

1.1 The Programme called Neurophilosophy

In a fair assessment of the contributions of Paul M. Churchland, Patricia Churchland and their most interesting challenge to orthodoxy, Robert N. McCauley writes: *“The influence of Patricia and Paul Churchland’s work in contemporary philosophy (of mind) is unmistakable”*¹ (emphasis added).

The thesis therefore has a definite objective. It is to examine the credentials of Paul Churchland’s account of Scientific Realism/Eliminative Materialism/Non-reductive Reductionism in what he calls as the neuro-computational perspective of the mind. The rich philosophical significance of Churchland’s major contribution lies in the new programme they have introduced under the name of Neurophilosophy. Churchland’s oeuvre consists of major and minor works. While his **Matter and Consciousness**² is devoted to an exploration into neurological basis of consciousness, his later book on **Scientific Realism and the Plasticity of Mind**³ and **The Neuro-**

Computational Perspective⁴ provide new vistas into the methodological background of his works and hence complementary to each other. As later book, **The Engine of Reason, The Seat of the Soul**⁵ is a succinct summary of his earlier views on mind, brain and consciousness, while the last **On the Contrary**⁶ is a stout defence of his views against the critics in **The Churchlands and their Critics**⁷, which provides a glimpse of the way he interacted with many strands of criticisms. The objective of my thesis is to explore how best Churchland sustains an outlook on scientific realism, while at the same time defending a functionalistic stance and what he calls eliminativist option, along with Stephen Stich. Churchland's neuro-computational cognitive modelling stands on two pillars; one is his non-linguistic view that throws a challenge to the intentional realism which posits a language for the mind and the other is the key argument which reduces reductionistic procedures understands in an inter-theoretic way, into a philosophy of science. My efforts lie in the direction of showing some of the major weakness of his theoretical perspectives in the course of my thesis.

There are two forms of eliminative materialism to consider both of which have their ancestry in Quine's eliminativism of propositional attitude psychology.⁸ Later Quine introduced more interesting notion like empathy to explain the nature of propositional attitudes. Be that as it may, the two versions may be called Churchland's eliminativism as an inter-theoretic reduction to a species of philosophy of Science of the Kuhn-Feyerabendian type; and Stich's eliminative materialism⁹ as a species of deconstructionism with its corollary of socio-political consideration, that is claimed to

converge on a strong scientific realism of the Papineau-type of philosophy of science. While this is being so, the realistic credentials of Churchland remains can be understood only if we counterpose many other cognitive modellings towards the end before finally evaluating the full impact of Churchland's eliminativism.

Over the centuries, philosophers and psychologists have used a variety of explanations for the mind such as comparing it to a black sheet or hydraulic engine, etc. But, studying the mind is not easy because we cannot just pop one open to see how the mind works. Plato thought that the knowledge about the values etc., came from mind and not from sense experience. Rationalist philosophers believed that knowledge can only be gained by thinking and reasoning (Descartes, Leibniz). But philosophers like Aristotle, Locke, Hume, etc., emphasized the importance of experience. Immanuel Kant attempted to reconcile these two fashions by arguing that human knowledge depends on both innate capacities of the mind and sense experience.

Until the development of experimental psychology, mind was a special province for discussion to philosophers. Developmental psychology provides only a glimpse of the very notion of mind. In the two decades, brain studies succeeded to map the various parts of the brain with reference to their functions. But the exact location of mind is problematic also today itself. Much of the discussion about mind was in progress also in philosophy of mind. Many theories such as reductionism of mind to brain has failed as a project were developed, and most of them were

rejected because of their defects. Dualism, behaviourism, identity theory, functionalism etc., are some of the main theories.

With the rise of cognitive science, the status of mind has moved more onto the scientific point of view. It is the duty of cognitive science to explain how people accomplish those various kinds of thinking. Paul M. Churchland himself also contributes much to the body of cognitive science through his neuro-biological explanations. The term Neurophilosophy was introduced by Patricia Smith Churchland. She launched the new discipline through her works **Neurophilosophy**¹⁰ and **The Computational Brain**¹¹. It was believed that the solution of mind-body relation, which is a philosophical problem since the line of Descartes, can be effected via empirical sciences. It was the thought that neuro-science can contribute to the philosophy in its mind-brain programme really resulted in this new sub-discipline. This claim is known as Contribution Thesis, which is at the heart of Neurophilosophy. She later introduces psycho-realism into ethics, which follows her central thesis and holds that the direct study of brain will be fruitful in advancing the understanding of cognition and emotions (*Sine qua non*-Thesis). This states that neuro-science is more essential. Her third thesis is stronger than the contribution thesis which states that neuro-science is the most important in understanding those areas of mentality of interest to philosophy than other disciplines such as linguistics or cognitive psychology (Stronger *sine qua non*-Thesis).

Churchland's unique argument appeals to parallel distributed processing models of visual cognition. In Patricia Kitcher's words, "*PDP made very rapid advances and changes in these years, changes that affect the role that it can play in the argument for Neurophilosophy*".¹² The chief argument for Neurophilosophy goes as follows (from Patricia Kitcher, who made these observations from Churchland and Sejnowski).

1. Many problems of PR Mentality depend on exploiting relations of similarity and analogy.
2. Hence, a theory that illuminates how similarity relations are exploited would be valuable in explaining PR Mentality.
3. The nodes in a PDP network can easily be regarded as dimensions in a similarity space. By using vector coding, one automatically creates a similarity space.
4. Hence, in computing similarity relations via a PDP network, the similarity relations among the objects represented will be a reflection of the positions in activation space of the process that did the computation.
5. Hence, given this model, we have some understanding of how similarity judgements come out as they do.
6. Moreover, if this is how actual systems of neurons process information, then we would have some understanding of how actual similarity judgements come out as they do.

7. Further, although not all vector-coding can be regarded as coding micro-features features, some can.

Hence, from all these points above, Patricia Kitcher concludes that contemporary neuroscience can make significant contributions to philosophy, because the development of the notion of representation as vector-coding in PDP Network by compu-neuro-science appears to be a promising means of approaching central problems in PR (Philosophy-Related) Mentality. We shall read the cardinal features after a brief review of cognitive science within which his contribution can be located.

The following quote reveals the collective or synthetic nature of the new discipline called cognitive science: *“The mind will not yield its secrets to any single discipline, i.e., not to psychology, linguistics, anthropology, artificial intelligence, neuro-physiology or philosophy alone but to a collective or synthetic approach of all these disciplines”*.¹³

Inquiries about mind began with human history itself and various informations were given in various times. But an answer which is agreeable to all never came. As we know, the problem of mind-body relation is paradigmatic within the cognitive science revolution. It is in the wake of this that the question about cognitive modelling of the mind, with the help of technological designs became prominent. Previously, we have examined Carruthers’s case for weak dualism (M.Phil Thesis). It is doubtful whether the problems remain the same. If we closely consider the arguments put

forward by Searle¹⁴ for the irreducibility of consciousness or Roger Penrose's¹⁵ defence of quantum-scientific account of consciousness, we are left with an impression that some form of dualism or double aspect theory is still in the air. But we must juxtapose Churchland's continuing defence of the neuro-computational account of the brain that is quite consistent with the latest account of philosophical accounts of scientific method in order to highlight its importance. Cognitive science is a multi-disciplinary study of mind and intelligence. It brings forth the many disciplines such as philosophy, psychology, artificial intelligence, neuro-science, linguistics and anthropology under a single title. Such a multi-pronged attack on the notion of mind can never show that mind is a substance or a property, but it can only show that there are various modes of understanding the mental function.

The important factors that affected the emergence of cognitive science were many-sided. Firstly, the researchers in many disciplines have engaged on a certain central problems and explanatory ideas of their respective fields; especially biology and physics. Together they gave rise to what Stich¹⁶ calls the descriptive philosophy of cognitive psychology. Secondly, the invention of mathematico-logical theory of computation and the programmable digital computer. The primary question that was raised in this connection was '*Is mind a digital computer ?*'. Research in artificial intelligence gave way to various engineering designs of mind called cognitive modelling. Besides these, the revolts from various sides against the positivistic and behaviouristic restrictions against the systematic study of mind and consciousness had

also played an important role in this emergence. The philosophical problems and arguments were thought to throw light on cognitive psychology. But the nub is on the other side, the philosophical argumentation themselves are problematic. One interesting way this impasse has come to be overcome is to collect data from experimental work in cognitive psychology. It is only from some such considerations that Stich was led to map the three different ways of interaction between philosophy and cognitive science.

It is this that gave an impetus to the new wave philosophical psychology. Earlier, it dealt with problems relating to higher mental processes of reasoning, decision-making, problem-solving, language-processing and higher-level visual processing. With the paradigm shift, it began to ramify into several directions. In the direction of descriptive philosophy of cognitive psychology, it took the idea of representation as a key to resolve question concerning mental representation itself. The second direction philosophical argumentation was thought to throw light on questions related to intentional phenomena and it is here that semantics makes many inroads into cognitive psychology. Yet the third direction was to fuse psycholinguistics, especially the variety that came after the work of Chomsky's¹⁷ generative grammar, to develop an epistemological outlook that will address itself to the notion of rationality.

On Stich's account, it is the second account that culminated in a strong critique of traditional theories of mind as well as the critique of classical cognitivism. The principal contention of Searle¹⁸ is that none of these theories have succeeded to

explain the mind, rather than left it out of the picture. This includes the account of strong artificial intelligence, that which took seriously the analogy between mind and machine (mental states are Turing Machine States). Such an analogy was recognizably a weak one (called sometimes as weak artificial intelligence). The emergence of cognitive science demands a collective approach of the various methodologies and ideas. The fusion between artificial intelligence (mind is a hardware) and strong functionalistic theory of mind that gave rise to the research cluster called cognitive science. The idea behind the new wave materialism was to examine the question whether our brain implements hardware programme ? How to programme a computer that will enable it to pass the Turing Test ? Or, how to simulate the brain in the way we do with computers ? On Searle's view, it is one of the fundamental assumptions of mainstream cognitive science that the brain states as Turing-computable. Its intuitive appeal is so great that it was laid at the foundation of cognitivism. The main source debates dates back to one of early papers of Alan Turing¹⁸, which relied on two results in mathematical logic. The Church-Turing thesis states that for any algorithm there is some Turing Machine that can implement that programme. The second result is that there is Universal Turing Machine that can simulate any Turing Machine. If we put these two results together, we get the result that a Universal Turing Machine can implement any algorithm. After all, programmes are syntactical, and hence, their semantics depends on another logical-mathematical thesis on proof theory. Semantics is a relation between propositions and hence, they are mirrored by syntactic relations.

So, it is Searle who fought at two fronts, one on the traditional theories of mind and another on this computer functionalism. They are termed as critique of unlikely (default) theories of mind and the critique of cognitive reason respectively. A combinatorial account, he thought, is thought to pave way for what he christens as the biological naturalism according to which mental events and processes are as much part of our biological natural history as digestion, etc.

Paul Thagard¹⁹ examines the emergence of cognitive science as a continuing enquiry on mind and intelligence which began from Greek philosophy. Plato and Aristotle thought knowledge as *a priori* and *a posteriori* respectively. The Rationalists, Descartes and Leibniz, believed that knowledge can be gained by thinking and reasoning, while the empiricists, Locke and Hume, thought it as arising from experience. Immanuel Kant came to the scene with a synthesis of these two positions saying that human knowledge depends both on *a priori* and *a posteriori* knowledge.

Until the development of psychology in nineteenth century, the study of mind remained the special province of philosophy. Within the field of developmental psychology, the growth of behaviourism was vigorous and it dominated the field with a view that virtually denied the existence of mind. To behaviourists, psychology should restrict itself to examine the relation between observable stimuli and observable behavioural responses. Throughout 1950's, this view dominated the scene.

Thagard characterises six thinkers as the founders of cognitive science. George Miller²⁰ is the first among them who made numerous studies on the human capacity of thinking and memory and proposed that memory limitations can be overcome by recording information into chunks, mental representations that require mental procedures for encoding and decoding the information. Others in the field of artificial intelligence were also doing their investigations at this time. They were John McCarthy, Marvin Minsky, Allen Newell and Herbert Simon. Noam Chomsky's rejection of behaviouristic explanations and his own explanation of people's ability to understand language in terms of mental grammars consisting of rules, was also an eye-opener in several aspects.

Among these scholars McCarthy²¹ became one of the artificial intelligence leader through his works based on formal logic. Newell²² and Simon showed the power of rules to account for aspects of human intelligence while Minsky²³ proposed that concept like frames are the central form of knowledge representations. The increased interest in the mental imagery, experimental and computational research concerned analogical thinking and the rise of connectionist theories of mental representation and processing models on neural networks in the brain are the important features of this inquiry.

Even though the above scholars revolutionised cognitive science, it was David Marr²⁴, in 1982, through his computational theory of brain, vigorously came to the scene and his visual processing considered as paradigmatic in cognitive science.

The importance of Marr lies in the fact that his identification at the three levels, at which a cognitive system has to be examined. The three levels are as follows:

1. The task analysis leads to a computational theory of what the system does and why it does it.
2. Details of algorithm and representations used to make the computations specified by the computational theory should be analysed.
3. The neural implementation be specified, the details of the machinery on which the computations are carried out.

The question whether Churchland's Neurophilosophy can be situated within cognitive science can best be answered after briefly reviewing the various methods of cognitive science.

1.1.1 Methods in Cognitive Science

As cognitive science is a multi-faceted project, it has diversity in its outlook and method. Researchers from various fields bring their study of mind and intelligence which give diversity, but the name cognitive science gives them a unity. A sketch of the different approaches on various aspects of cognitive science includes the following:

Psychologists: Cognitive psychologists often engage in theorising and computational modelling but their primary method is experimentation with human subjects. Because of our conclusions about how the mind works are based more than '*commonsense*',

introspection can give only a misleading picture of mental operations. But, many of these operations are consciously inaccessible. Psychological experiments which carefully approach mental operations from diverse directions are, therefore, crucial for making cognitive science scientific.

Artificial Intelligence Researchers: Theory without experiment is empty, experiment without theory is blind. Each of them have the equal status. So to address the crucial questions about the nature of mind, the psychological experiments need to be interpretable within a theoretical framework. This theoretical framework should postulate mental representations and procedures. One of the best ways of developing theoretical frameworks is, by forming and testing computational models intended to be analogous to mental operations. Researchers in psychology have developed computational models that simulate human performance. Concept formation, mental imagery, and analogical problem-solving are needed to complement psychological experiments on deductive reasoning. So, the artificial intelligence researchers supplement their method of designing, building and experimenting with computational models. Psychology and artificial intelligence go hand in hand in cognitive science.

Linguists: Linguists do psychological experiments or develop computational models. For linguists (Chomskyan tradition), the main theoretical task is to identify grammatical principles that provide the basic structure of human languages. This identification takes place by noticing subtle differences between grammatical and ungrammatical utterances.

Neuro-scientists: Neuro-scientists perform controlled experiments like psychologists. Since they are concerned directly with the nature of brain, their observations are different. In recent years, we use magnetic and positronic scanning devices to observe what is happening in different parts of the brain, while people are doing various mental tasks. Additional evidence about brain functioning is gathered by observing the performance of people whose brains have been damaged in identifiable ways. E.g., a stroke in a part of the brain dedicated to language can produce deficits such as the inability to utter sentences. Neuro-science is theoretical as well as experimental and theory development is frequently aided by computational models of the behaviour of sets of neurons.

Anthropologists : Anthropologists examine the human thinking in consideration with how thought works in different cultural settings. The study of mind should consider possible differences in modes of thinking across cultures. The cultural anthropologist's method is ethnography, which requires living and interacting with members of a culture to a sufficient extent that their social and cognitive systems become apparent.

Philosophers : Generally, philosophers do not perform systematic empirical observations or construct computational models. The importance of philosophy to cognitive science is that it deals with fundamental topics that underlie the experimental and computational approaches to mind. The issues on the nature of representation and computation are abstract which can not be addressed in the everyday practice of psychology or artificial intelligence. These issues inevitably arise when the researchers

think deeply about what they are doing. Philosophy deals with methodological issues such as the relation of mind and body as well as descriptive questions about how people do think and normative questions about how they should think.

As a convergence of these above disciplines, its work becomes more interesting when there is theoretical and experimental convergence on conclusions about the nature of mind. Thus, theoretically, it is the most fertile approach to understand the mind in terms of representation and computation. Since the study of mind requires insights both from theoretical and practical sides and also it requires various methodologies developed by many fields, cognitive science become a cluster of disciplines under a single name. This interdisciplinary study of mind has a core with it, i.e., thinking is the result of mental representations and computational processes that operate on those representations.

1.1.2 Role of Churchland's Theory in Cognitive Science

Most cognitive scientists agree that the knowledge in the mind consists of mental representations. So, the nature of mental representations is important among cognitive scientists. Although cognitive science is in a flourishing state, we still can not fully comprehend the nature of mind or the mental. Paul M. Churchland's neuro-biological approaches to the nature of mind is the most advanced one. His co-work with the neuro-scientist, Patricia Churchland, gives the impetus for his work and motivation for a naturalistic account of the mind. The scientific character of his approach to mind gave

additional support to his naturalism. He uses the method of science and philosophy for developing a naturalistic standpoint. However, his view of mind is known as eliminative materialism, in which he advocates that mind is nothing but the neuro-biological processings in the brain. Mind never exists, i.e., there is not an organ named mind to which we can postulate the mental functions. It is really the neurons in the brain, i.e., the activation of neurons gives us the mental functions. He says that there is nothing supra-physical or above the physical. In his view, everything is physical and they are bound to the knowledge of physical sciences.

The present thesis is an inquiry into Paul M. Churchland's cognitive modelling of the brain. It is called the Neural Network Theory of Mind, which defined mind in terms of information carried across the parallel function of neurons. It is called Parallel Distributed Processing. The inquiry is intended to find out to what extent his neuro-computational perspective will answer the following questions.

1. **Reductionism:** What is the role of reductive strategies in solving the mind-body problem? Is Churchland's perspective also reductive? If so, in what sense?
2. **Eliminativism:** Does Neural Network really eliminate folk/commonsense psychology?
3. **Scientific Realism:** To what extent his inter-theoretic reductive methodology operates to ensure a scientific status to his programme?

4. **Functionalism:** What is the status of mind and consciousness in his connectionist Neural Network Theory of Mind ?
5. **Micro-Cognition:** What is the status of language in his state-space semantics ?

The objective of this work is to study the many cardinal features of PDP research as developed and used by Churchland, while advancing a neuro-computational account of mind. His connectionist account of mind (PDP) gives the following features, i.e., the character of one's perception, cognition and behaviour is determined by the particular configuration of weights within the interconnected network which consists in one's basic cognitive apparatus. These weights determine what features in the world one responds to, which concepts one uses to process them, which values one embraces and which range of behaviour, one commands. Thus, the connection of neurons causes our response to the outer world. In Churchland's view, the connections of neurons in our brains are parallel which means that sensory inputs are processed simultaneously and not step by step, and hence it is called Parallel Distributed Processing (PDP).

In cognitive science, the approach of Churchland to mind is better known as eliminative materialism. It is eliminative because, it wanted to eliminate the folk psychological conception of mind. Folk psychology is our everyday talk about the mind and mental functions of ourselves and others. The postulates of this theory are the propositional attitudes, such as beliefs, attitudes, etc. In his view, these beliefs, etc., do not exist and so a theory, built on the edifice of non-existential postulates, should be

eliminated. Eliminative materialism gets strong support from neuro-scientific connectionism. In neuro-scientific connectionism, mind and mental functions are nothing but the activation of neurons in the brain. If this becomes correct, then eliminativism would get strong support. It is in this context that the unidentifiable relation between eliminative materialism and neuro-scientific connectionism becomes prominent. It is for this reason that we have chosen the name eliminative materialism as the topic of research. This eliminating nature is an important feature of his philosophy and so folk psychology and elimination are discussed in detail in the subsequent Chapter.

Churchland rejects all the classical reductive programmes within the philosophy of mind and advocated on inter-theoretic reduction. Reductionism was used as a common scientific strategy used early by Nagel and others. In Churchland's view, the reductive programmes such as behaviourism, identity theory, functionalism etc., are not correct. Behaviourist theories reduced mind into behavioural outputs, while identity theory reduces mind to brain. To them, mind is identical with brain. It is a sort of physicalism like Churchland's. Functionalism reduced human minds to the functional states of brain. But they also said that, mental functions are not physical ones. In Churchland's view, all these strategies are incorrect because inter-theoretic reduction does not go smoothly in these, i.e., in the case of behaviourism, a one-to-one correspondence between mind and behaviour is not possible.

Even though Churchland criticises all other reductive strategies, we can say that his approach is also a reductive one in yet another sense. He reduces mind into the neuro-biological (neuro-computation) processing of the brain. So, we have to analyse whether inter-theoretic reduction goes smoothly in his strategy. Here his stand is very much scientific. He followed the lines of Paul Feyerabend²⁵ and somewhat a Quinean. R. N. McCauley : “*Churchland’s neuro-computationalism reconsiders and reformulate Quine’s naturalized epistemology. Kuhn’s account of scientific revolutions, Sellar’s attack on the myth of the given and Feyerabend’s discussion of theory incommensurability and eliminative materialism in the light of the most up-to-date advances in the cognitive and neuro-sciences*”.²⁶ Even though Churchland refutes Quinean²⁷ conception of translation (indeterminacy of translation), he accepts that the relation between two theories is a species of translation. McCauley : “*Churchland’s semantics of natural language dates back to his scientific realism and philosophy of mind (1979) and discusses their bearing on the problem of translation*”.²⁸ We can see an urge for naturalizing the things in Churchland’s philosophy along the lines of Quine.

The methodology of this project is to study the many cardinal features of Parallel Distributed Processing as developed and used by Churchland. His theory of eliminative materialism is a hypothesis that needs a closer understanding. As said earlier, eliminativism is a theory which stated that, our common sensical conception of mind – folk psychology – is a fundamentally defective theory that both the principles and ontology of the theory will be displaced (or reduced ?) by completed neuro-science.

When discussing about eliminativism, we will compare this with the eliminativism of Stich also. In Carruthers's terminology, the eliminativism of Churchland and Stich can be termed as '*Eliminativism Now*' and '*Elimination in Prospect*' respectively.

What eliminativism of Churchland says on consciousness or what is the notion of consciousness that is originating from his connectionist theory? Critics point out that no notion of consciousness is emerging from the connectionist research. Churchland's position is really eliminating the necessity of personal conscious experience. But we cannot reduce conscious phenomena into something physical because the experience varies from person-to-person. Since personal experience is personal consciousness, Churchland's stand appears to be questionable from a traditional point of view. But when he says about personal, causal connections that no one else has, it does not mean that there is something non-physical about the states. We can know what it is like to be a bat, but we can not know it in the way the bat does. Before entering to the nuances of Churchland's account of scientific realism, we have to examine the earlier theories of mind. They are all classified as '*default theories*', according to John Searle.²⁹

1.2 The Classical Default Theories in the Philosophy of Mind

Inquiries about mind were seen in pre-Socratic and in ancient Greek philosophers. Rationalists and Empiricists were also given their standpoints about mind. It was Kant who worked for a synthesis of both rationalism and empiricism by

stating that human knowledge depends both on sense experience and the innate capacities of mind.

Here, we shall briefly review some of the most important classical theories in the philosophy of mind. All these theories are reductionistic except dualism. Dualist theory of mind is the most widely accepted theory among the common people. By this theory, a normal human being is a duality that consists of two ultimate entities, mind and body. Bodies are purely physical, spatial, etc., while minds are purely spiritual and radically non-spatial. The attribute of body is extension and of mind is consciousness. Body and mind interact causally. Bodily happenings cause sensations, experiences and thoughts in one's own mind and mental activity leads to action and speech causing the physical motion. Mind survives the decay of the body. Dualists identified the person with the soul. In short, dualism can be written through the following three assertions:

1. There is a physical realm, which is fundamental to every person.
2. There is a mental realm, which is also fundamental to every person.
3. These two realms are ontologically separate, but casually interact.

Often the dualist theories are understood in terms of the two varieties namely, Substance Dualism and Property Dualism. In Substance Dualism or Cartesian dualism, reality is divided into two basic kinds of substances in which, one is ordinary matter and the other is non-physical thinking substance. It is the decision and desires of this non-physical thinking substance makes our body our own and not some one else's. The idea

underlying the theory of property dualism is that there is no substance to deal with beyond the physical brain, the brain has a special set of properties possessed by no other kind of physical object. This special property is non-physical. This version of dualism is really an emergent version of epiphenomenalism. The other version of dualism is called Property Dualism. This conveys the idea that a person is literally '*a ghost in a machine*', where the machine is the human body and the ghost is the mind. By this theory, minds are held to be inside the bodies and are in intimate contact with the brain.

Dualism gets strong support, from many quarters such as from introspection, from religions, from parapsychology and from the irreducibility principle. When examining these points, we get the impression that what supports dualism is the non-physical or epi-physical quality of the mind. The irreducible nature of qualia and intentional states are the important points which stand still in the same position. Even though, researches in cognitive science made many problems about the brain clear, the intentional qualities are not revealed so clearly. The most puzzling thing about qualia (i.e., the qualitative characteristic of intentional terms like feelings) in its relation to physical world. A complete physical comprehension of qualia is not found to be possible. Above all, physical explanations there will be something about the qualia. So, there appears a gap between qualia and its physical explanation. This is what really meant by the explanatory gap. A physical explanation of these qualities are not found to be completely possible.

Because of their division of human beings into two and the way it is endorsed on a non-physical mind, dualists were very much criticized by materialists. Materialists, in turn are very much criticised by dualists. By Ockham's Principle³⁰, their postulation of two basic substances is wrong. There is also another criticism about the causal interaction of the ontologically separate entities. How such things can causally interact ? Materialists also criticised dualists for the explanatory impotence of their theory. They argued that dualists have nothing to say about the internal stuff of the mind when compared with neuro-science and neurology. There is also another criticism from evolutionary history, i.e., the human species and its features are the physical outcome of purely physical process. We have a nervous system that permits the discriminative guidance of behaviour. This opposition is in tune with the Theory of Neural Network. Our nervous system is complex and powerful. Our inner nature differs from simpler creatures only in degree and not in kind. If this view is correct, then there seems to be neither the need for any non-physical substances or properties to be admitted into our theoretical account of ourselves. We are creatures of matter and we should learn to live with this fact. This is the strong materialist sword raised against both forms of dualism.

Even though we have many criticisms and drawbacks, dualism is poised to survive at least in a weaker form until the emergence of philosophical behaviourism, as the outcome of logical positivism. From Churchland's point of view, it is the irreducibility of mental properties that characterizes a dualist position. He distinguishes

interactionist Property Dualism from elemental property dualism and prefers the second for developing his neuro-computational perspective. But in recent literature, Searle defends each variety of dualism as, "*Those who think of themselves as materialist's typically deny the existence of any special irreducible mental phenomena and those who think themselves as property dualists think that we must recognise the existence of some non-physical phenomena in the world*".³¹ Searle says that both of these are true and hence the notions 'mental' and 'physical' must be modified suitably. Whether Searle is a substance or property dualist is much debated in recent literature. John Foster, who also makes a defence of the Cartesian dualistic position opines that dualism about the mind is an approach rather than a definite thesis. He says, "*We can envisage positions which give a dualist account of certain categories of mental phenomena and a non-dualist account of others, and such positions can't be naturally classified as straightforwardly dualist or straightforwardly non-dualist*".³²

But Churchland is strongly against any form of dualism, while endorsing a neuro-computational connectionism (Eliminative Materialism). In his words, the professional community moved to embrace some form of neuro-biological realism or materialism, in consistent with a scientific realist point of view.

Again, philosophical behaviourism came into the scene as a reaction against the dualist theories. Logical positivist's verification principle and the emergence of analytic philosophy also motivated philosophical behaviourism. Philosophical behaviourism is a version of behaviourist theories of which psychological behaviourism is yet another

version. As a semantic thesis, philosophical behaviourism is about the meaning of mentalistic expression. The thesis can be written as: "*Statements containing mentalistic expressions have the same meaning and are translatable into some sort of publicly verifiable statements describing the behavioural and bodily processes*".³³ That is, the mentalistic terms signify dispositions to behave in characteristic ways, but these dispositions have the form of hypothetical conditionals unlike the genuine categorical statements. In short, the obvious verification conditions or tests for mental ascriptions are behavioural. To them, most mental states are multi-tracked dispositions and so, there is no point in worrying about the relation between mind and body. They held that mind-body problem is a pseudo-problem.

It is said that philosophical behaviourism gives a third-person account of mental states. Jerome A. Shaffer supports this special feature by saying that this third-person account would be naturally suited to the analysis of the mental states and so, this would furnish an appropriate analysis. Behaviourism is understood to solve the methodological problem of inter-subjective verification and in one way, thus avoiding all the objections raised against the dualistic theory. An important fact is that behaviourism is consistent with materialist conception of human beings. Material objects can have dispositional properties and so there is a chance for behavioural disposition. It also provides a solution for the problem of other minds.

As any other materialist theories of mind, behaviourism also faces the problem of inner aspects of mental states. The total refutation of the inner, private, subjective aspects of mental states is problematic and leaving something important. In this connection, Churchland comments, “*Any theory of mind that ignores or denies intrinsic nature of inner state (qualia) is simply derelict in its duty*”.³⁴ But it does not necessarily mean that one must have recourse to dualistic theories.

Churchland notices a further flaw in behaviourist accounts with respect to their attempt to specify in detail the multi-tracked dispositions said to constitute any given mental state. But defining the mental solely in terms of publicly observable circumstances and behaviour is not correct. John Searle’s critique of behaviourism concentrates on the following three points:

1. The behaviourist never succeeded in making the notion of a ‘*disposition*’ fully clear.
2. There seemed to be a problem about a certain form of circularity in the analysis that beliefs have to be analysed in terms of desires and desires in terms of beliefs.
3. It leaves out the causal relations between mental states and behaviour from these points; he concludes that the absurdity of behaviourism lies in the fact that it denies the existence of any inner states in addition to external behaviour.

Behaviourist theories are clearly reductionistic, but the reduction of mind to something, external is not agreeable to every one. So, the reduction of mind to behavioural disposition is not a complete reduction and still there exists the explanatory gap.

Peter Carruthers³⁵ distinguishes two forms of behaviourism – reductive and holistic. In his view, the former does not succeed, while the latter does. This is what underlies his defence of weak dualism. While weak dualists face the self-consciousness problem as a hard-problem, the advantage of holistic explanation is that it obviates the need for a vicious circle.

A holistic explanation becomes a rallying point in psychological explanation. Thus, a behaviouristic analysis of belief requires clauses referring to hypothetical designs, but when we analyse its design, it will turn to clauses referring to various hypothetical beliefs. Thus, one is forced to move in circles which are not vicious. Hence, the impending doubt that there is circularity may be set aside. As a result of the holistic interrelation of beliefs, designs and other conscious states, behaviourists are forced to give up the search for reductive analysis. It is important to note that when behaviourism seemed to be the only alternative to dualism, philosophers were prepared to struggle even with its flaws. But when other materialist accounts of mind flourished, the interest to it is diminished.

Among the materialist theories of mind, identity theory or reductive materialism is said to be the most straightforward one. This theory is said to be something intermediary between dualism and behaviourism. In their view, dualists are right in maintaining that mental terms are inner and wrong in thinking that they are non-physical; while behaviourists are right in what they affirm (materialistic outlook) and wrong in what they deny (denial of the existence of inner mental events).

As a strong version of materialism, identity theory holds that all mental states and events are in fact physical, i.e., mental states are identifiable with physical states of brain or central nervous system. To them, minds are brains, and to have a mind is to have a brain.

Mental state = df. physical (brain) states

Because of the conclusion that the correct account of human behaviour and the cause must reside in the physical neuro-science, there have been many arguments to support identity theory. It avoids many drawbacks of dualism and accommodates what behaviourists cannot. The problem of '*inverted spectrum*' becomes explicable within the theoretical boundary of this theory. In identity theory, the purely physical origins and ostensible physical constitution of each individual are taken as co-ordinates. The result of this progress would be purely physical, whose behaviour arises from the internal operations and the interactions with the rest of the physical world. Since the evolutionary theory provides the only serious explanation for the controlling of the

capacities of behaviour of the brain and central nervous system, this theory is given due recognition. And so, there are many points, in favour of this theory in which each of this is directed at the conclusion that the correct account of human behaviour and its causes must reside in the physical neuro-science. The argument from genetic endowment and growth, the argument from evolutionary theory, the argument from neural dependence and the argument from the recent advance of neuro-science are examples.

Even though it looks like the strongest materialist theory, the identity theory itself faces problems, since its version of identity is something problematic. Saul A. Kripke³⁶ attacks identity theorists' concern of identity, i.e., identity between mental and physical events is contingent that the identity statements are not conceptual truths. This opens the question, whether such identities would be necessarily true on other construals of necessity? Kripke has argued that such identities would have to be necessarily true if they were true at all. He maintains that the term '*pain*' determine the states that refer to different things. Kripke argues that pain cannot be necessarily identical with any brain state, since the tie between pains and brain states seems contingent. So, they cannot be identical at all. A further and a more rigorous argument is due to Paul M. Churchland. In his view, Leibniz's Law of Identity (identical things have identical properties) goes against the identity theory as the following argument shows. Leibniz's Law of Identity states that, $(x = y) \equiv (Fx = Fy)$, (If x is identical with y , then anything true of x must be true of y also).

1. My mental states are knowable by introspection.
2. My brain states are not knowable by introspection. Therefore, by Leibniz's Law.
3. Mental states are not identical with my brain states.

Other formulations and arguments are also evident within Churchland's writings. The burden of the above argument is borne out by the identity thesis. It is surprising to note that identity theories have similar frameworks like inter-theoretic reduction. In brief, what it conveys is a meta-identity thesis, and hence, it is more about the statement of identity. However, the chance of its becoming linguistic is not ruled out by the tenor of the above argument. Identity theorists' notion of identity is criticised by functionalists with their multiple realizability thesis which we will discuss later.

Functionalism theory is the widely accepted theory among philosophers, cognitive psychologists and artificial intelligence researchers. This theory holds the view that mental states and events are causally mediating between subject's sensory input and ensuing behaviour, i.e., the essential feature of any type of mental state is the set of causal relations it bears to environmental effects on the body, other types of mental states and bodily behaviour, i.e., mental states really are the functions of the brain.

E. J. Lowe³⁷ comments on functionalism as a thesis which characterises mental states by indirect reference to behaviour, i.e., in terms of the causal roles in behaviour in different circumstances. In his view, three kinds of causal relationship can be involved such as:

1. Characteristic ways in which states of a subject's environment causes that subject to have a certain type of mental state. E.g., injury in one's body causes one to feel pain.
2. Characteristic ways in which a certain type of mental state can interact causally with other mental states of the same subject. E.g., feeling of pain causes one to believe that his body has been injured.
3. Characteristic ways in which a certain type of mental state can contribute causally to the bodily behaviour of its subject. E.g., when a belief that one's leg has been injured together with a desire to relieve pain can cause one to rub the affected part of the body.

Functionalism is committed to regarding mental states as really existing states of subjects which can be referred to in causal explanations of the overt behaviour of the persons whose states they are. In Lowe's view, functionalist characterizes mental states as the '*software*' states of a computer. It is really a fact that the computational model gives the main impetus for functionalism, and that is why functionalism is considered to be the glory of cognitive science.

1.3 The Glory and Fall of Functionalism

Here, we shall discuss functionalism, as the theory which paved the way for neural network theory of mind. The computational modelling of brain by functionalists was really the starting point of cognitive science, e.g., Turing Machine. In functionalists view, mind can be functionally characterised without any commitment to any physical story, and brain can be thought of as a land of engineering implementation of the functional account. To them, mind is the functional description of brain.

We can see two themes go together in this theory. One is the old common sensical description of mind and the other is a scientific one. They showed that both these doctrines are insightful. While recognising the causal role of a mental state, they accept the physical or physiological state of that causal state occupier, (We know that their central thesis is this; the essential feature of any mental state is its causal role), i.e., a physical state realises the functional state. So, the crucial attention functionalism deserves as theory of mind is that it reconciles physicalism with folk psychology. We cannot ignore it as an ordinary physicalism or identity theory, since we can trace the origin of cognitive science in this theory it self. So we can take functionalism as a bridge from folk psychology to cognitive science. Now, we shall turn to the most important features of functionalism. They are:

1. In functionalism, the theory of mind is relatively independent of the theory of the brain, even though brain states realize mental states.
2. The relationship between functional kinds and their physical realisations is complex, i.e., psychological kinds can be multiply-realised.

The fundamental claim of functionalism is that questions about the mind should be approached by something like functional deconstruction. When this takes place, two suggestions must be carefully fulfilled. They are stated as:

1. The current functional account will emerge only as the result of empirical work on human subjects.
2. All that the materialist needed for a functional account are already contained in the folk psychology itself.

The functionalist aims to '*coalesce*' (a term Samuel Guttenplan³⁸ introduces) mind into brain by a layer of functional description is an input-output model, where these inputs and outputs include other mental states. In this pursuit of '*coalescence*', there are two stages to be distinguished, such as:

1. Proving the functional characterisation of human mental features.
2. An account of how the functional aspect comes to be embodied in neuro-physiological theory.

1.3.1 Functionalism : Analytic and Psychological

How can bring them into coalescence ? Both the analytical and psychological functionalists agree on the fact that mind is a functional description of the brain. Psychological functionalism takes cognitive science as sitting in between folk psychology and physical theory.

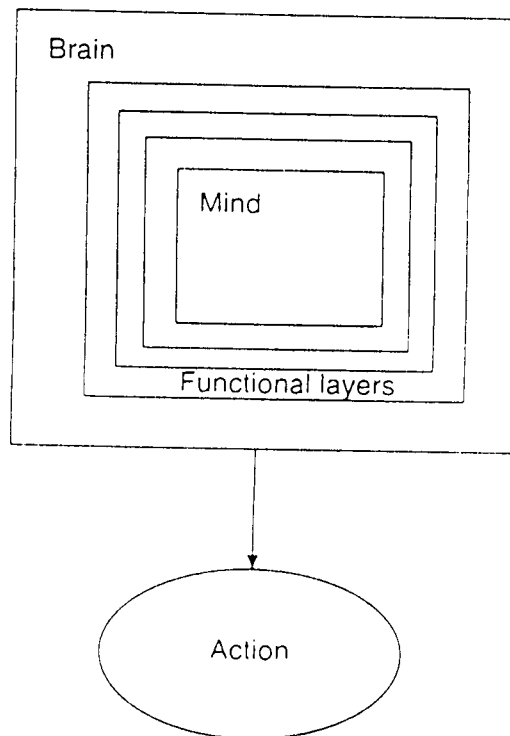


Figure 1³⁹

In this picture, the mental accomplishments of an organism at one cognitive level are broken down into component abilities which are themselves accomplished by various sub-systems. These sub-systems are broken into component abilities which are then accomplished by various sub-systems. Here is a sketch of what governs is the empirical methodology of cognitive science.

Psycho-functionalists also take another model of problem-solving. This model leads to the elimination of mind from the picture, i.e., they think that the problems of the roles between mind – brain – functional layers would go away by dropping the mind from the picture. Psycho-functionalists who adopt this will insist that what is being dropped is merely a deeply problematic folk psychological account. In this elimination, we can trace both the characteristics of Churchland's eliminative materialism such as the elimination of both the mind and folk psychology.

We already took for granted that functionalism is a bridge between folk psychology and cognitive science. Analytical functionalism answers the problem of mind – brain – functional layer with the help of simple analytical reflection on folk psychology. The term mind and its functional characterisation always go smoothly, i.e., this gives the guarantee that mind and functional description can never come apart. Against analytic functionalists, it is said that the folks are upto in their explanatory practices, i.e., many find that the folk psychological picture, as a tacitly known set of explanatory generalities is just implausible. Samuel Guttenplan opines saying that, *“Psychological functionalism creates what look like just the right space for the serious research now going on in cognitive science”*.⁴⁰ But in this there is equally the possibility for the vindication of folk psychology rather than elimination.

With regard to the functionalists' attempt of coalescence, we can simply think of it as a mind-brain identity. But it consists in our thought about functionalists, i.e., whether they are taking a non-physical account or physical account of mind. When functionalists say that mind is the functional states of brain, this functional specification is tied to brain. This gives an identity forms such as,

$$\text{Mind} \xrightarrow{\text{Is}} \text{functional states of} \xrightarrow{(\text{Is})} \text{brain,}$$

i.e., Mind is brain

Now, there is an initial sameness in both of the theories. We know that identity theorists' account of mind is purely physical. But, when functionalists think about mind as non-physical, then there occurs a dispute between them. But functionalists can not reject the identity theorist's identity because in functionalism also some such identity relation is to be posited. Specifically, the analytic functionalists' notion of identity is more or less the same as that of identity theorists.

The psycho-functionalists' attempt to integrate mind and functional level does not bring the full integration of mind and brain. With the help of cognitive science, psycho-functionalists are trying to characterise the relation in terms of the following three possibilities. They are stated as follows: (the order is of increasing optimism)

1. The first one is a disappearance or an eliminativist point, i.e., there is no systematic relationship because the '*Mind*' box just disappears. Here, the implication is that functionalists started their journey for exploring mind by the route of folk psychology and when the route is changed to cognitive science, they realised that the folk psychological route is bad or confused for solving the problem. This is what the eliminativists said about mind, but their strong point was not started from folk psychology.
2. The second possibility is that the relation is one of vindication (not elimination). Here, the suggestion is for the vindication of folk psychological notions by holding that the functional levels will reflect the folk notions, which will justify the folk psychology. This results in the notion of '*modularity of mind*' that defends folk-psychological realism.
3. The third possibility is one of identity. Here, the implication is that the concepts, used in folk psychological explanation, will turn out to be features of the functionalist account. This will vindicate folk psychology in a more robust way than the second.

From all these, we can state that the functionalists who stick to analytic functionalism are really imitating an identity theory. It is because the analytic version of functionalism is not coming from experiments, but from the very analysis of the mental. It is the identical theorisation of mental to physical, which is an important feature of

mind-brain theories. In theories which granted physical reduction of mind we can see that theory would go in tune with identity theory in this respect. E.g., behaviourism, functionalism, eliminativism, etc., has a favouring to physical properties such as behavioural outputs, functional states of the brain, the neuronal activity of brain, etc. So, it is a fact that if identity theory goes by default, then the theories which got support from identity theory also would also go wrong.

Whatever it may be, the central idea of functionalism was introduced in contrast to physicalism. The functionalist approach to the mind-functional state-brain relations differs from identity theory. The working strategy of functionalist approach to the mind-functional state-brain relations differs from identity theory. The working strategy of functionalists is called coalescence, i.e., functionalism is viewed as setting out to solve the over-determination problem by integrating mind and brain. Samuel Guttenplan, through his examination of functionalism, argues that the above assumption leads to the following foremost important consequences such as:

1. It turns out that at least one version of the identity view must be counted as a kind of functionalism.
2. Psycho-functionalists open up a gap between folk psychological mental characterisation and functional characterisation in cognitive science. There is no guarantee for a vindication.

3. Functionalism does not give a correct answer on the question, what is exactly the relation between mind and body ?
4. Functionalist does not give a correct account of the coalescence strategy that concerns the relationship of functional characterisation to the physical.

1.3.2 Multiple Realisability and Identity Theory

Earlier, we have seen that there are two important features to functionalism. We have already taken the first. Now, the second one is dealt with. It is the feature of functionalists that they take the relationship between functional kinds and their physical realisations as complex, i.e., two different people can be in the same mental state. They can both believe the same thing, but their psychological kinds can be multiply realised.

This multiple realisation is the most severe criticism raised against the identity theorists' notion of identity. To identity theorists, pain (mental state) should have been identified with C-fibre firing (physical state). It implies that, whenever there is a pain, there should be C-fibre firing. But in lower kind of animals, in which brain is not as developed as ours, it is not so. Even though they are having pain, there is not C-fibre firing in them. Because of the absence of C-fibre firing, we can not say that they do not have pain.

Humans and other animals can be in the same psychological state despite the difference between their respective brains. If so, the one mental state might have varied physical realisations. But this multiple realisability is not an obscure idea of psychology. Some electronic devices realise the same function even though they have different forms. This multiple realisability is a valuable point from functionalists. Now, we can turn towards the fall of functionalism.

It is in Putnam⁴¹ who subscribed to functionalism during his early period, before turning to anti-functionalism and post-functionalism, we can see many of the internal objections faced by functionalism. There are many objections from outside based on qualia but here we only take into account Putnam's criticism. Putnam was a machine functionalist and later, he attacks his own notion of machine functionality in **Representation and Reality**⁴². He cuts down the functionalist argument that they can give adequate account of the content of propositional attitudes. He says that functionalism does not tell us what the nature of mental state is. He objects to his own idea of mind as a machine and mental states as programs or machine states. His reason is that physically possible systems may be in the same mental state while having unlike programmes. That is, the multiple realisable problems threaten them. Another problem is about meaning and reference. Putnam says that meaning and reference can not be understood within the functionalist framework. He says that an average speaker's sense of a language is in the sense of being able to use a word in a discourse. This follows that two people could be in the same computational state and have different

propositional attitudes, i.e., one towards Water and other towards Twin Earth '*Water*'. It also follows that two people may have the same propositional attitude towards water and the computational roles of their use of the term '*water*' may differ because of the differences in their knowledge about water. Hence, if propositional attitudes are internal to the person, then they cannot straightforwardly identical with computational states.

1.4 Neural Network Theory/Eliminative Materialism – An Offshoot of Functionalism

We have seen that, on Guttenplan's understanding, there is a possibility of elimination in a functionalist attempt of characterising mind-brain relation (even though it is the least possibility). Hence, let us consider Churchland's theory as a more sophisticated variant of functionalism. Functionalist attempts to characterise the mind-brain relation results in elimination both of mind and propositional attitudes. There is no chance for the vindication of propositional attitudes. Seen thus, the major features of Churchland's philosophy of mind, would be stated as follows:

- 1. Against Folk Psychology:** Churchland's eliminativism is a theory that our folk psychological phenomenon constitutes a radically false theory. That is, a fundamentally defective theory that both the principles and ontology of the theory will be displaced or reduced by completed neuro-science.

2. Mental can be reduced to physical and against the '*mental*' hence mind does not exist at all. Mind is nothing but the neuronal structures of the brain. The Parallel Distributed Processing of the neurons is mental functions and so, there never exists an entity namely mind.
3. If folk psychology can be reduced to neuro-science, then it can not be sustained. But, because of its irreducibility, it should be eliminated. Here, inter-theoretic reduction does not go in a smooth manner. So it might be called non-reductive reductionism.
4. **Against International Realism:** Non-sentential representations reduced the basic unit of human understanding is the activation of vectors and not sentences.
5. **Naturalism:** Against epi-physicalism there is nothing supra-physical about the mind, minds are as natural as human beings are natural.
6. **Against LOT (Propositional Attitude Psychology):** He is against language-of-thought hypotheses, i.e., thoughts occur in a private language, mentalese. He argued for the thoughts, which occur in images.

The most important features of Churchland's elimination theory are, first, its anti-linguistic nature and second its inter-theoretic reductive nature. They are taken to be the two main pillars of the entire edifice of Churchland's theory of eliminativism. He rejects the contentfulness of propositional attitudes, because they contain initially sentences. To him, sentences have nothing to do with cognition. Mental representation

is not linguistic, but it is imagistic. To him, the basis of all human knowledge is activation vectors or prototype activation which really is in contrast with propositional attitudes. Inter-theoretic reduction is a scientific tool used by Churchland in his mind-brain reduction. With this strategy, he says that propositional attitudes cannot be reduced to neuro-science. It is because the inter-theoretic reduction will not occur between propositional attitudes and activation vectors. The basic notion of folk psychology, i.e., belief, attitude, etc., will not find a consecutive place in the neuro-biological programme of brain. So, a one-to-one correspondence between folk psychology and neuro-science is impossible. For this reason, Churchland wants to eliminate folk psychology from the landscape of the mental. But folk psychology has its roots in commonsense understanding and so he cannot do his job easily. These topics are to be considered in detail in another Chapter and so let me conclude the discussion here with saying some thing about the controversy that exists between folk psychology and scientific psychology.

1.5 The Controversy Between Folk Psychology and Scientific Psychology

As we all know, we all have a notion of psychology of ourselves and others. It was not founded by any scientific experiment but only from the commonsense understanding. The propositional attitudes like belief, attitude, etc., help us to build such a form. We simply consider one's belief in a particular notion or attitude towards a particular event and infer that person's mentality. Here, the standard is one's own

mind. This is what is folk psychology. There is nothing experimental in it, but much is *priori*. Folk psychology is concerned with is the explanation of folk concepts like belief, desire, pain, pleasure, love, hate, joy, fear, suspicion, memory, recognition, anger, sympathy, and intention. As such, it is a sort of Proto-Science. Churchland's eliminativist option is thought to be exercise as of now on the status of Proto-Science.

Because of this nature, scientific community does not want to co-operate with folk psychology. But some of the thinkers (most of) wanted to retain folk psychology. Some of them are eliminativists, who thought that folk psychology is a stagnant programme and there is no possibility for scientific research. So, they want to eliminate it by superior theories. This eliminativist option was exercised both by Churchlands as well as by Stephen Stich. In cognitive science, these two options are characterised as elimination now (Churchland) and elimination in prospect (Stich). The main objections Churchland's eliminativism raised to folk psychology are as follows:

1. Folk psychology fails to explain a considerable variety of central psychology phenomena.
2. Folk psychology is a stagnant research programme. It has not significantly progressed in at least 2500 years.
3. Folk psychology shows no sign of being smoothly integrable (reducible) to other mature sciences.

Even though the computational understanding of mind warrants elimination, Fodor wants to preserve folk psychology. In his **Modularity of Mind**⁴³ he took mind as different modules. His notion of mental representation is a language-of-thought, i.e., mentalese. He took mental representation as linguistic. He wants to retain folk psychology and thought folk psychology as contentful. Following Fodor, Carruthers's also finds an integrated view of consciousness which accommodates folk psychology.

The initial controversy between folk psychology and scientific psychology is one of integration. But eliminativists say that, the notion of folk psychology stand magnificently alone which has no prospect of future. The computational, connectionist and neuro-connectionist theories gave much impetus to scientific psychology. Now, we are in a position to think of an artificial mind or a constructed mind. In such a situation, a theory like folk psychology will be posing a problem. But, if it can be reduced to a better theory, then it should be rewarding both to folk psychology and to scientific psychology. The elimination and vindication of folk psychology are taken in detail later.

1.6 The Claims of the Neural Network Modelling of Mind

We can see that the Neural Network Theory is the basis of his claim about eliminative materialism. The neural network is a scientific tool used by Churchland to eliminate the irreducible nature of mind and the propositional attitudes which is the

basis of folk psychology. The main objections to Churchland's eliminativism were raised by many thinkers. Churchland characterises the objections as follows:

1. The '*functional kinds*' objection is due to Putnam⁴⁴ and Searle⁴⁵. They argue that the taxonomy to psychological kinds embedded in folk psychology is most accurately construed as a taxonomy of functional kinds rather than natural kinds. If so, then folk psychology has nothing to worry about the failure on an inter-theoretic reduction because the ontological integrity of functional kinds is not contingent. Thus, the principle, '*Reduce, or be eliminated*' on which eliminative materialism is said to rest, is unacceptable.
2. The '*self-defeating*' objection to eliminative materialism is from Rudder-Baker⁴⁶, who is one among the critics. He argues that eliminative materialism is incoherent in arguing, stating or embracing its case for it must presuppose the integrity of the very framework it proposes to eliminate, i.e., there is evident conflict between eliminative materialism's '*belief*' that folk psychology is false, and its claim that there are no beliefs.
3. A further objection is from Wiles⁴⁷ who claims that the conceptual framework of folk psychology is used for a vast range of non-scientific purposes beyond the prototypically theoretical purposes, i.e., folk psychology is deployed in pursuit of different goals which is different from a scientific theory. This objection is

against the eliminative materialist claim that folk psychology in utter failure in explaining psychological phenomena.

4. Another objection is from Hannan which Churchland calls the, '*No Existing Alternatives*' objection in which she conveys the idea that we have no possible way to reject rationality and propositional attitude concepts until replacement concepts are suggested. To quote here, "*... in the absence of plausible replacements for these concepts, or even the limit that such replacements might be on the horizon, don't we have ample reason to bet against the eliminativist ?*".⁴⁸

Churchland counters these objections in his computational neuro-science and connectionist artificial intelligence, which conveys the following ideas.

The character of one's perception, cognition and behaviour is determined by the particular configuration of weights within the inter-connected network which consists in one's basic cognitive apparatus. These weights determine what features in the world one responds to, which concepts one uses to process them, which values one embraces and which range of behaviour one commands, i.e., the connection of neurons causes our response to outer world. In Churchland's view, the connections of neurons in our brain are parallel which means that the sensory inputs are processed simultaneously and not step-by-step and hence, it is called Parallel Distributed Processing (PDP). Through this,

he hopes to make available a conceptual framework which is able to reconceive at least some of our mental life in terms of neuro-computation.

Here, I have only introduced some of the most important features of Neural Network Theory. We shall single out two of the features namely, the anti-linguistic paradigm, and inter-theoretic reduction as the two main pillars of his programme of Neurophilosophy.

The first feature counterposes Churchland's neuro-computational/neuro-biological/neuro-philosophical scientific realism to intentional realism, proposed by Jerry Fodor and backed up by the language-of-thought hypothesis. Language-of-thought hypothesis has a sentential kinematics. It is the idea that all of our thoughts consists of sentences, i.e., thoughts occur in languages which is private and personal. This LOT hypothesis is closely connected with his modularity thesis, which is computational representational. This is taken as Model I in the next Chapter. Churchland's non-sentential/imagistic/representational model is taken as Model II in which vector-to-vector transformation or prototype activation vectors is taken as the basic unit of understanding. In brief, we shall counterpose the view that mind as number-crunching to the view that mind involves number-crunching kinematics.

The second feature counterposes the continuum theory of commensurability to the classical reductionistic paradigm. His treatment of inner-theoretic relations have improved upon the discussions on traditional theory reduction inspired by Ernest

Nagel's⁴⁹ work. His inter-theoretic model leaves room for a wide range of intermediate cases of approximate reduction. The coherence between inter-theoretic reduction and scientific revolution construed in the endpoints on a single continuum of theory commensurability. This continuum mode supercedes to a co-evolution model by detailed examination of experimental design, technique, apparatus, sources of evidence and theoretical and conceptual resources. This model of co-evolution and proliferation of theories shall be discussed later in third Chapter.

Robert N. McCauley⁵⁰ distinguished three philosophical models of inter-theoretic relations in science. The first model is the classical, the Nagelian or the positivistic model which was deeply-rooted in logical empiricism and the second was rooted in a model of theory change which is emerged largely in reaction to the classical positivistic model. The classical model conceives theory as a special case of deductive-nomological explanation that as a special case because the explanandum is rather a law of the reduced theory. The use of Bridge Laws is important in this reduction and because of this the reduction reflects an asymmetry between the reduced and reducing theories. An example to this type of reduction is the reduction of classical thermodynamics laws into the principles of statistical mechanics. In such reductions, a lower-level theory and its ontology reduce to a higher-level theory and its ontology and so it is called micro-reductionism.

The second type of post-positivistic inter-theoretic relations of reductionism can be seen in Feyerabend and Kuhn. Their main discussions were against the logical

empiricist reductionist programme and its reductionist blueprint for scientific progress. This type is emerged from theory succession and theory progress in which conflicts may involve between incommensurable theories.

The third model is from Churchlands. Their account of inter-theoretic reduction is in terms of a continuum model of commensurability. What they pointed out was that the different cases of inter-theoretic relations vary considerably with respect to the commensurability of the theories involved. At one end, this model is radical incommensurability while at the other end is the most rigorous models of theory reduction. The initial sketch of this model can be seen in Churchland (1979)⁵¹ and its subsequent development in 1986⁵² and 1990⁵³ works. The Churchlands have enlarged this continuum model. Paul Churchland has enlarged this continuum model with his prototype-activation model of explanatory understanding that which includes the understanding arises from reductive explanation. He insists that prototype-activation vector increases rather than diminishes information and this account of explanatory understanding implies that reductive explanations amplify our knowledge, i.e., in short, the approximate character of inter-theoretic reduction is a function of conceptual redeployment, but it is neither the old one's destruction nor new one's generation.

Within Patricia Churchland's framework, McCauley located three scenarios of co-evolution, which he calls co-evolution_m, co-evolution_s, and co-evolution_p. In this, co-evolution_m is approximate to micro-reduction which is in the reduction of all psychological phenomena to neuro-biological and neuro-computational phenomena.

The second model co-evolution is in the opposite direction to co-evolution_m . This model is famous because it underlies the eliminative materialist position. This co-evolution producing the eliminations of theories characteristic of scientific revolutions, i.e., the theoretical perspectives of two neighbouring sciences are so disparate that eventually the theoretical commitments of one must go in the face of the other's success. The third one, namely co-evolution_p is closely related to co-evolution_m . It is co-evolution as explanatory pluralism. This model is opted by pragmatically oriented philosophers and Churchland's eliminativism and their preference for co-evolution_p indicate the influence of pragmatic currents in their thought. The following Figure illustrates the three notions of co-evolution situated on the Churchland's continuum model.

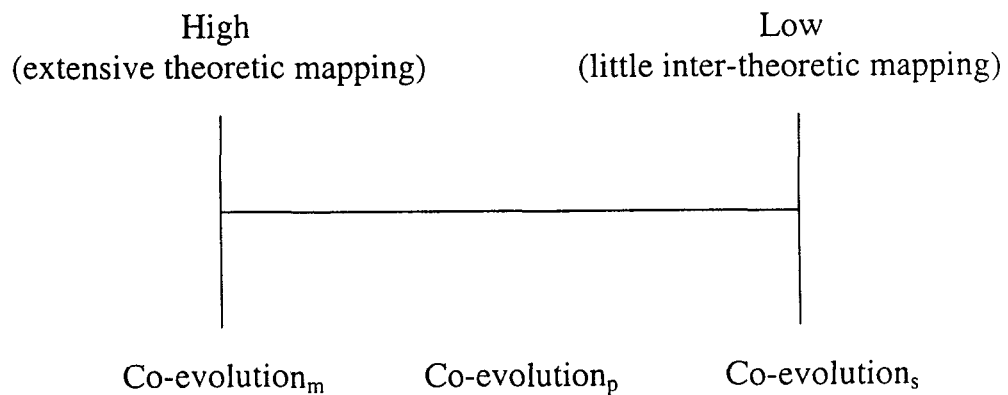


Figure 2⁵⁴

Here, when we take these three models in the context of intra-level and inter-level, co-evolution finds no home for incommensurability. So this model is being debunked. Intra-level contexts involve much incommensurability and the mappings between

theories are reasonably good because the new theory explains its predecessor. But changes are evolutionary only when they preserve a fair measure of intensional and extensional overlap with their predecessors. The revolutionary or the evolutionary progress within science eventually eliminates features of earlier theories. Inter-level relations concern theories at different levels of analysis while inter-level concerned with successive theories at the same level. In Churchland's characterisation, we can see both levels in the following map showed the degree of inter-theoretic continuity onto intra-level and inter-level contexts.

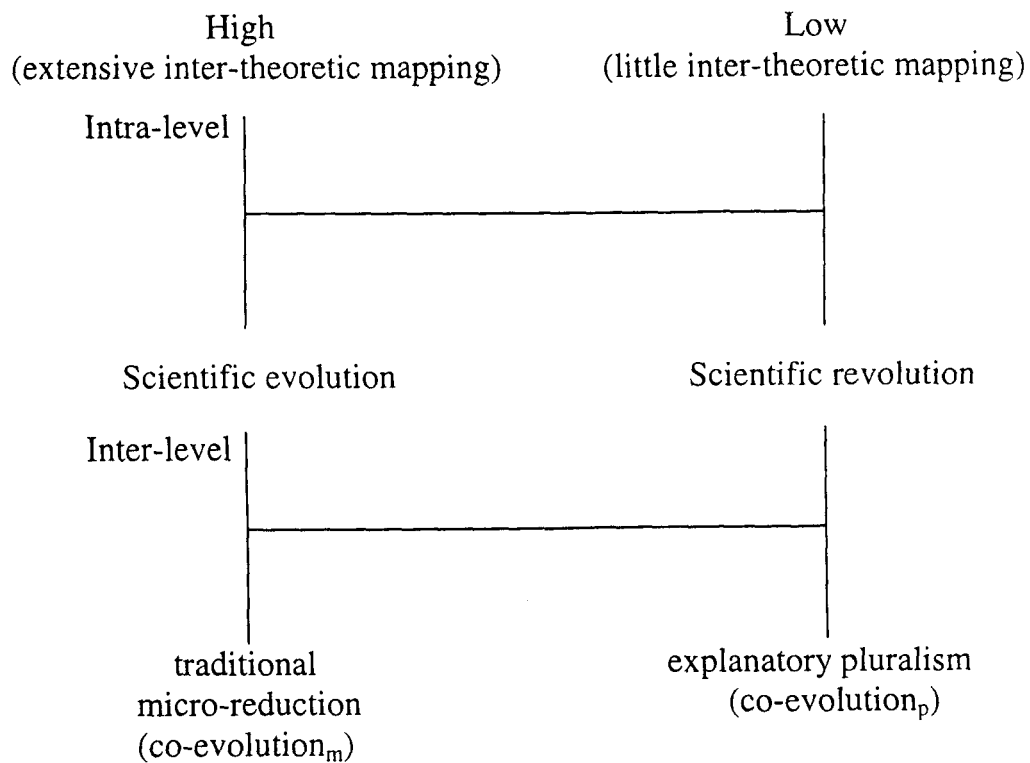


Figure 3⁵⁵

This map accommodates co-evolution_m and co-evolution_p, but co-evolution_s find no place. So the point is that the interaction of psychology and neuro-science is a case of inter-level relations. Here co-evolution makes a category mistake because it conflates the dynamics of the co-evolution of theories at different levels of analysis with scientific revolutions which are intra-level processes.

This co-evolution model and proliferation of theories are the benchmarks of Churchland's neuro-philosophical paradigm.

Meanwhile, we shall elaborate on the first two models in the subsequent Chapter.

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CHAPTER II

THE MAJOR THRUST OF CONNECTIONIST NEURAL NETWORK

2.1 Paradigms in Cognitive Science

Within cognitive science, we can see different types of cognitive modellings. A cognitive model is really meant to be a device for an engineering design. Terence Horgan¹ distinguished three such important - models such as, the classical, the computational conception, the non-sentential computationalism and the dynamical cognitive connectionism. His real intention is to defend folk psychology from a connectionist point of view, but he dismissed all the three conceptions with saying that they are '*just-so-stories*' about the mind.

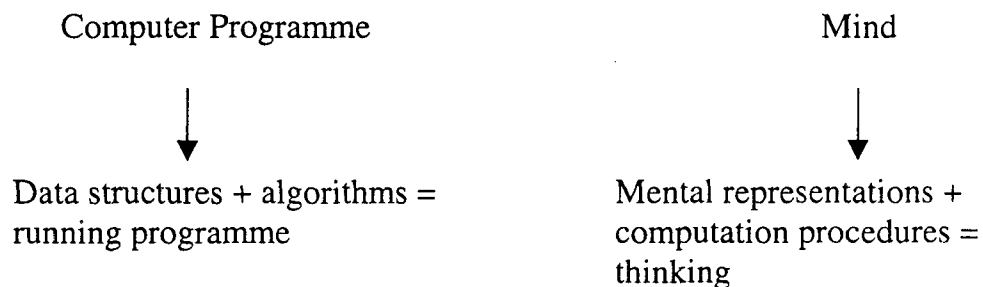
We can also reclassify these models into a matrix of oppositions. Thus we can see the opposition to consists in their being linear or non-linear, dynamic or static, linguistic or non-linguistic, and sentential or non-sentential paradigms in these modellings. We know that linear is opposed to non-linear, dynamic to static, linguistic to non-linguistic, sentential to non-sentential. In those above modellings, the classical computationalism can be said to be linear, linguistic and sentential (Mentalese sentence), while connectionist is said to be non-linear, dynamic, non-linguistic and non-sentential.

Dr. A. Kanthamani² distinguishes four different paradigms in cognitive modelling namely, the classical cognitivism, the neuro-scientific connectionism, the non-classical implementational connectionism, and the unified implementational connectionism. In this Chapter, we can take the first two of them, i.e., the classical cognitivism (Model I) and neuro-scientific connectionism (Model II) so as to counterpose each other, and learn about the other pairs. They are opposing paradigms in cognitive science.

The classical cognitivism is sentence-oriented in which neuron-like structures are given an identifiable interpretation in terms of specifiable concepts or propositions, i.e., our mental states have a syntactic structure as well as a semantic content which is representational, computational, sequential, linear programmable and causal-explanatory. The neuro-scientific connectionism is non-sentential, non-linear, dynamic and chaotic in its orientation taking the mental states as neuronally representational (neural nets) with activation vectors (excitatory, inhibitory) and vector transformation of the weights of the synapses. The non-classical implementational connectionism (Terence Horgan) stands on the strength of alternative syntax, but it is called approximationist in that it approximates to an alternative syntax to the connectionist nets. It is non-algorithmic at least in implementational level. The unified connectionism (Smolensky) is approximationist while it tries to explain implementation by means of a mathematical formation. Its most important feature is that it is also

externalist in its orientation since it expands the programme so as to cover expert knowledge of science.

As the most important modelling, the connectionist model bears the brunt of attacks on all the cognitive modellings. Churchland's Neural Network Theory is also a species of connectionism. The model of connectionism, as a neuro-scientific programme, wants to reduce mind or consciousness to its neuro-biological correlates. Churchland is very optimistic enough to hope that future investigations should help us to place the notion of mind and consciousness within the neuronal connections of brain itself. Classical cognitivism is considered with special reference to Jerry Fodor³ to which Churchland's is to be opposed. Thagard⁴ calls the former as the Computational and Representational Understanding of Mind (CRUM). The success of this hypothesis (CRUM) has been due to the fact that it employs a fertile analogy derived from the development of computers. CRUM assumes that mind has mental representations analogous to data structures and computational procedures similar to algorithms. It can schematically be shown as,



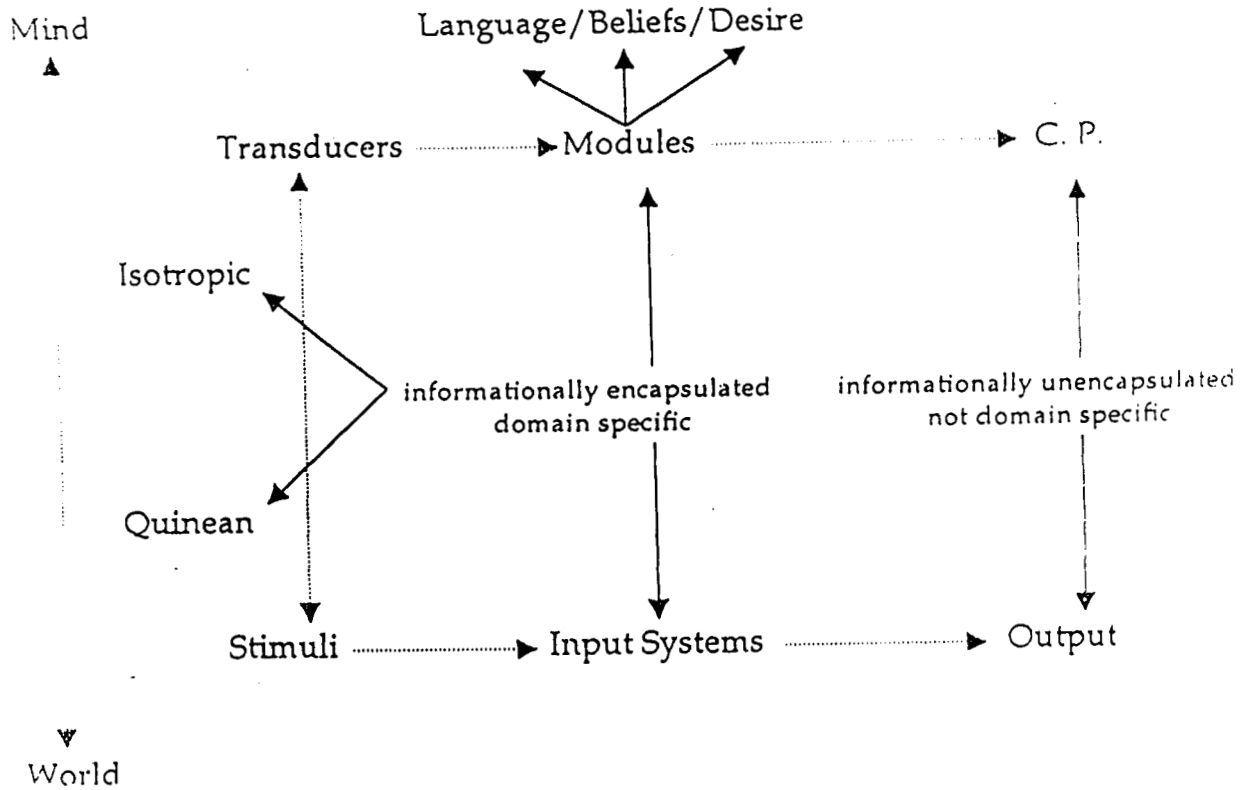
The classical symbolic computational theory of mind asserted that mental representations are symbolic structures and mental processes consist in the manipulations of these representations in accordance with symbolic algorithms based on symbolic rules. The dictum that calls mind as '*a sentence-crunching machine*' represents the high watermark of this. It is fully articulated in Jerry Fodor's intentional realism. Within this modelling, it is assumed that on the theoretical level, we can attempt a symbolic computation model in order to model human thought processes, using symbols which required only rules to manipulate them. With this theory, it was further assumed that they would transform and manipulate symbols and thereby simulate the human thought processes. But, this symbol manipulation model reached its impasse known as multiple-realizability, which is acutely problematic. The new researches about human cognition have revolutionised our basic concepts about intelligence, consciousness, knowledge, mind, etc. The classical paradigm namely symbolic computation approach (sentence-crunching model) was in debate with a new paradigm namely neural network approach – connectionist (number-crunching) model.

In contrast to the first model of digital computer that can be used to manipulate symbols, the second was the view that brain consists of a network of simple electrical processing units which stimulated and inhibited each other. Connectionism explored the usefulness of networks in more perceptually-oriented tasks. This biologically-inspired neural network is also known as '*Neural Network Theory*' and '*Parallel Distributed Processing*' (PDP). According to connectionists, human behavioural

features are the results of the connectionist architecture of the human brain. However, we must incidentally note that the structural and architectural level of the brain is fundamentally different from the basic form and functions of a digital computer. So, in connectionist model, neural network is not programmed in the manner of a digital computer and the basic difference is its ability to learn from internal representations. In fact, the connectionist model suggests an important rethinking about many basic assumptions in cognitive science. ✓

2.2 Model 1: J. Fodor's Computational Representational Understanding of Mind

The symbolic computational account of Fodor can be taken as an example of the classical computational paradigm. In his account of modularity of mind, mind is decomposed into several modules and these modules are monitored by a central unit. The main claim of the modularity thesis is that the human cognitive system processes a number of important subsystems that are modular: domain specific, mandatory, limited in their access to other parts of the larger cognitive system, fast, and informationally encapsulated. Fodor argues that there is good evidence for the fact that they have input system that exhibits modularity. Modularity can schematically be shown as:

Figure 1⁵

2.2.1 Informationally Unencapsulated Central Processor

From the above Figure, we can see that the Central Processor (CP) or central module is informationally unencapsulated. The central module can take input, output from various modules and so it is easy to believe that it might be able to make use of things known to some other parts of the cognitive system, i.e., in virtue of their centrality, central modules will not be informationally isolated as peripheral modules.

Fodor's contention is that the central cognitive system is unencapsulated. A peripheral module is encapsulated if, it processes its inputs in a way which is independent of the background beliefs of the subject, perhaps every one will be inclined to agree that central process are not encapsulated. Here Carruthers⁶ warns that, "*This should not lead us to conclude that central processes are unencapsulated of course*"

2.2.2 'Mentalese' - The Basis of Sentential Paradigm

The '*language-of-thought*' or mentalese is central to the classical computational approach of Fodor. Mental representations are linguistic expressions within a language of thought. This is what sententialism postulates. To the advocates of this '*LOT*' hypothesis, such as Fodor, sententialism is a strong thesis. The main reasons for this are that '*mentalese*' have the following traits such as, (1) Semantics and Reasoning, (2) Systematicity and Productivity, and, (3) Opacity.

2.2.3 A Variant of Intentionalist Semantics

Having contents, thoughts possess semantic properties which they appear to denote and attribute, i.e., denotation and attribution are the semantic properties of thought. For example, take the problem of John's thinking that '*Pegasus is winged*'. When thinking of this, John deploys an actual mentalese name for its non-existence. If John's thinking of Pegasus is his mentally naming it, then his thinking of Pegasus as winged would be his concatenating the mentalese-adjective meaning '*Winged*' with '*Pegasus*' mentalese-name. The mentalese sentence '*Pegasus is Winged*' has to bring

Pegasus to mind and to portray this as winged. At this time, John would be ignorant about the other characteristics of Pegasus including colour. But when symbolization (pictorial) will serve this purpose, it cannot avoid the colour of the Pegasus. So, sententialists say that thoughts are precise in just the way the sentences are, but picture are not as precise as sentences. From this, they conclude that if thoughts denote and attribute precisely, sententialism may be best positioned to explain how this is possible.

In reasoning, belief plays a central role. The beliefs may be true or false. If beliefs are relations to mental representation, then the beliefs must be relations to representation that have truth-values among their semantic properties. (Sentences are the representations having truth-values capable of denoting and attributing). Beliefs serve a purpose within the mental economy, and so, they contribute to the control of behaviour. Reasoning is a process in which we attempt to obtain new true belief by exploiting old true beliefs. Thus, reasoning becomes a process defined over mental representations and sententialism tells us that the representation takes place in reasoning is sentential.

E.g., Take John's beliefs as follows (in a syllogistic manner)

P₁ Elios is Ashen.

P₂ If Elios in Ashen, then she is ill.

C. Elios is ill.

Sententialists gave this example to make us understand the relation between new and old beliefs. Sententialists say that these three beliefs consist of sentences (mental sentences). In reasoning, mental representations stand to one another just as public sentences do in valid formal derivations. Thus, the sententialists claim that reasoning would be able to preserve the truth of belief by being the manipulation of truth-valued sentential representations. This is done smoothly because the rules of sentential representation are so sensitive to the syntactic properties of the mental representation and also protecting and preserving the semantic properties. Thus, we can formulate the sententialist hypothesis as follows: "*Reasoning is formal inference, it is a process that tuned primarily to the structures of mental sentence. Reasoners, then are things very much like classically programmed computers*".⁷ The traits are discussed one-by-one.

Systematicity: Thinking is said to be systematic and productive. The act that John can have some thoughts entails that he can also have certain other thoughts which are semantically related. Sententialists say that his systematicity is possible because mental sentences as complex mental representations result from process ultimately defined on mentalese words and expression. E.g., if John can produce, '*WILLIAM IS TALLER THAN ROSCELIN*', he must have access to '*WILLIAM*', '*ROSCELIN*' and '*IS TALLER THAN*'. Because of these simple mental representations he is capable of producing '*WILLIAM IS TALLER THAN ROSCELIN*'. Sententialism postulates that mental representations are linguistically complex representations whose semantic properties are determined by the semantic properties of their constituents.

Productivity: Productivity of thought is closely related to the systematicity of thought. We appear to have a good competence to think ever more complex novel thoughts having certain clear semantic ties to their less complex predecessors. This is called the productivity of thought. The productivity of thoughts goes on until the physical resources of the brain are exhausted. Mental representation systems exhibit the productivity as spoken languages. By identifying the productive system of mental representation with a language-of-thought, sententialism accommodates the productivity of mental representations. In this, the language-of-thought is subject to a productive grammar.

Opacity: The opaque nature of thought also justifies sententialism. Thought respects some semantic relations among mental representation, but it can be utterly blind to others. E.g., take the belief of John that '*ELIOS IS ASHEN*'. Even if when believing Elios is ashen, he is ignorant of the other facts about Elios, i.e., Elios is the most literate woman in Paris or so on. Thus, John's thought about Elios is opaque in Elios's own facts. This is the opacity of thought. But sententialists justify this clearly and it becomes a support to sententialism. Their answer is that, these two facts about Elios, '*ELIOS IS ASHEN*', and '*ELIOS IS THE MOST LITERATE WOMAN IN PARIS*' represent different mental sentences even though it is about Elios (Ashen). Sententialists take thinking as same as quoting. To quote a sentence in a language is to issue a token of a sentence in that language type. As quoting, thought may be the same process. If to think is to token a sentence in the language-of-thought, the sheer tokening

of one mental sentence need not insure the tokening of another equivalent. Hence, thought is opaque in nature.

As E. J. Lowe⁸ argues in his **Introduction to the Philosophy of Mind**, postulating the existence of a language-of-thought would enable us to model human thought processes on the way in which a digital electronic computer operates. He also argues that if the human brain is an information processing device, then it may be reasonable to hypothesise that it operates in the same way as an electronic computer does. Mentalese might be seen as a naturally evolved brain code analogous to the machine code of a computer. In Kim Sterenly's reading, Fodor's this proposal is at least coherent, theoretically motivated and experimentally productive. At some level of description, brain processes are syntactical. They are sentences in the head. There is a language-of-thought. Such a language is the language of the mentalese or *lingua mentis*. Like any sentences, they have a syntactical structure and a semantics or meaning. It is very difficult to know where the exact relationship between syntax and semantics obtains. The problem of semantics is: How do these sentences in the head get their meanings ? A general answer is given by holding that the brain works as a digital computer performing computational operations over the syntactical structure of the sentences in the head. The view that all there is to having a mind is having a programme is central to strong AI. The view that brain processes can be simulated computationally is central to weak AI. Both these are limbs of the view of cognitivism, which holds that brain is a digital computer. The most important counter to the strong

AI is that the computational model of mind left out the crucial things about the mind, such as consciousness and intentionality. Neither of them is reducible to matter. We have no silicon brains.

2.3 Model II: Churchland's Connectionist Neural Network Modelling of the Brain

*“An individual's overall theory of the world is not a large collection or a long list of stored symbolic items. Rather, it is a specific point in that individual's synaptic weight space. It is a configuration of connection weights, a configuration that partitions the system's activation-vector spaces into useful divisions and subdivisions relative to the inputs typically fed the system”.*⁹

It is the discovery that brain consists of discrete cells (neurones) and these neurones signal each other through contacts at specialised points called synapses, pave the way for connectionism. Its emphasis on the importance of connections among simple neuron-like structures gave it the name connectionism. The human brain has about 100 billion neurones many of which connect to thousands of other neurons forming neural networks. The main constituent of a human brain is neurone. This neurone consists of a nucleus with many dendrites attached to it. It is through the dendrites that the neurone receives information from other neurones. The other end is a single axon, which transmits information from one neurone to other neurones. All these axons, at its end are joined to a part called synapse (electrical relay junction). When an electric impulse is created inside a neuron, it is transmitted through axon.

The neuro-transmitters cross the synaptical junction and reaches to a dendrite of another neuron attached to it. So, information from a single axon may be transmitted through many other dendrites of other neurones. There are two kinds of neuro-transmitters namely, excitatory and inhibitory. The combinatory values of neuro-transmitter influences the dendrites of a neurone and this decides whether the neurones have to be fixed or not. If firing takes place, the neurons transmit its own current through the axon.

An important assumption of Churchland's scientific realism demands that the central nervous system is a very complex parallel system. In this system, the information bits are processed and collected as a whole. The important fact is that the processing elements of human brain, i.e., neurons are very simple. Connectionists believe that the cognitive and thinking process in human beings are basically computational. Hence, this can be explained in terms of higher level computational systems like the human brain. Connectionists offer a novel kind of parallel processing and modelling which clearly is a shift from the present paradigm. To them, this is the only remedial strategy to the disadvantages of the classical computational model. The connectionists argue that there is a fundamental difference between the classical information processing methods of the brain. Connectionists adopt a method that is totally distinct from the classical method, which failed in solving many of the problems of commonsense and of natural language. The peculiar features of neural networks are efficient to make rapid memory than highly-accurate computational process.

The central processing unit of the connectionist model is a tiny processor, which has the ability to sum up several input values and output functions of that sum. Such tiny processors are neural cells or neurones and this can be considered as a very simple form of an independent computer. These cells together consist of an idealised body of '*neurones*'. Each of these neurones has an arbitrary number of input, which are all different and a number of outputs. These cells are mutually connected (weighed link) and they receive input and pass output to other cells. The output of previous node or cell is the input of the next node. The weight specifies the relative influence of the value carried by all the links to the unit to which they are connected. The function of each neurone is to receive processed information from other neurones and perform processing with combining all the inputs and to pass the resulting output to other neurones. A layer includes a number of cells that can perform some type of common function. But no cell is connected to another cell in the same layer. In these layers, the first one is input-layer and the last one is output-layer. The layer between input-layer and output-layer is called the hidden-layer. In such a system, the second-layer of a three-layer network receives input from the units in the first-layer and passes output to the third-layer. In this model, the first-layer corresponds to sensory inputs and third-layer to motor inputs. The middle and hidden-layer allows development of the internal representations capable of subserving the wanted input-output model. In these layers, each one makes self-computations and passes the overall result to the next layers. The process continues, finally, a layer determines the output from the network.

The important feature of this neural network is that each of these processing elements makes its computation based upon the weighted sum of inputs. This weighted connection between individual units propagates the overall activity. The weights modulate the effects of the signals produced by individual processing units. The weights modulate the effects of the signals produced by individual processing units. The weights can be positive or negative and the passing signals are determined by the size and the polarity of the weighted inputs.

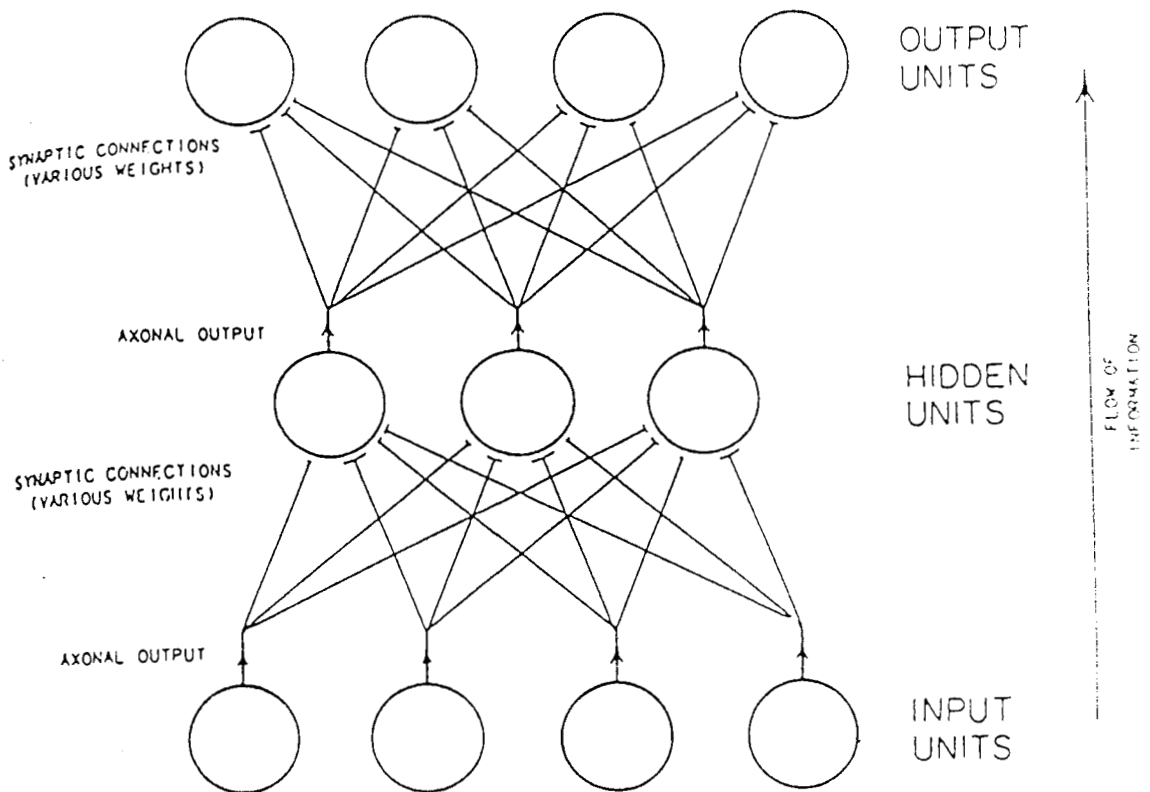


Figure 2¹⁰

The main characteristic of neural nets is the factor of speed. Each of the neural nodes processes information separately and the speed of the system is great. The overall speed of the network depends upon the total number of '*neurones*' and the layers of the system. Of those four, mentioned in the beginning, the first two can be simply called as localist representation and distributed representational respectively. The second type (distributed) can learn how to represent concepts or propositions in more complex ways that distribute meaning over complexes of neuron-like structures. Generally, the connectionist architecture is the sum total of the following points:

1. The theory that mental computations are carried out by connectionist networks.
2. Mental computation is identifiable with the computations of the brain, which cause and explain our mental states and processes.
3. Connectionist network is a system of interconnected neuron-like computing units.
4. Each unit has a number of input or output connections.
5. Excitatory or inhibitory activation can be sent along with these connections.
6. The output of a unit = a function of the sum total amount of input it receives from all the input connections.
7. The amount of input receives by a unit along a connection is equal to the weight of the connection the output from the other unit along this connection.

8. A connectionist network can be trained to perform certain tasks by adjusting the weights of the connection to improve its performance.

Connectionism has brought major changes in the way many cognitive scientists conceive of cognition. The properties of the connectionist model which the eliminativists argued for are given as follows:

1. The encoding of information in the connection weights and in the biases on units is widely distributed rather than being localist.
2. Individual hidden units in the network have no comfortable symbolic interpretation, and they are sub-symbolic.
3. The models are intended as cognitive models, not merely as implementations of cognitive models.

Some connectionist models are said to be compatible with the propositional modularity of folk psychology. They are to be called compatibilist models.

Much of the allure of the connectionist approach is that many connectionist networks programme themselves, i.e., they have autonomous procedures for turning their weights to eventually perform some specific computation. These learning procedures often depend on training in which the network is presented with sample input/output pairs from the function it is supposed to compute. In learning, networks

with hidden units will perform; since these units represent neither input nor output, they are never told what their values should be, even during training.

In many cognitive models (non-connectionist), it is easy to locate a functionally distinct part of the model encoding each proposition or state of affairs represented in the system. According to Fodor and Pylyshyn, "*Conventional (computational) architecture requires that there be distinct symbolic expressions for each state of affairs that it can represent*".¹¹ In connectionist models, an analogous sort of functional localisation is possible not only for the input and output units but the hidden units as well.

In some units, there may be model's symbols for the properties or features in question. In models, where the weights and biases have been tuned by learning algorithms, it is not the case that any single unit or any small collection of units will end-up representing a specific feature of the environment in straight way. It is also often plausible to view such networks as collectively or holistically encoding set of propositions although none of the hidden units, weights or biases are comfortably viewed as symbols. Hence, it should be called sub-symbolic.

The clearest way to introduce the notion of explanatory level is to place it against the familiar functionalist theses that psychological theories are analogous to programme that can be implemented on a variety of very different sort of computer. If one accepts this, then it makes sense to ask, whether a particular connectionist model is intended as a model at the psychological level or at the level of underlying neural implementation.

Because of their obvious similarity to neural architectures, it is tempting to view connectionist models of the implementation of psychological processes. So it is viewed that connectionist models are not psychological or cognitive models at all. A very different view that connectionist model builders can do is to take their models at the psychological level, not at the level of implementation. So, the models are in competition with other psychological models of the same phenomena. Thus, a connectionist model of word recognition would be an alternative to a non-connectionist model of word recognition and so. Smolensky suggests that connectionist models stand in relation to traditional cognitive models in the same way that quantum mechanics stand in relation to classical mechanics.

The analogy between connectionist models and quantum mechanics is thought to beg an important question, for although quantum mechanics is conceded to be a better theory than classical mechanics, a plausible case could be made that the shift from classical to quantum mechanics was an ontologically conservative theory change. But it is not clear that the change was ontologically radical. Connectionists argued that the explanatory level of the caloric theories and kinetic theories are same though the shift from one to other was ontologically radical. They assume that *“if their conception of connectionism is correct, then the relation between connectionist models and traditional cognitive models is the same as caloric and kinetic theories just said above”*.

The connectionist models, that are the models at the cognitive level and in which the encoding of information is widely distributed and sub-symbolic, are incompatible

with the propositional modularity in folk psychology. There are no discrete, semantically interpretable states that play a causal role in some cognitive models. So, in these models, nothing with which the propositional attitudes on commonsense psychology can plausibly be identified, if these models turn out to be the best accounts of human belief and memory, we shall be confronting an ontologically radical theory change - the sort of theory change that will sustain the conclusion that propositional attitudes do not exist.

This provides an important support towards eliminativism. If connectionist conception of mind becomes correct, then the eliminativism of mind also be correct. In these connectionist models, nothing can be done with sentences, as Fodor and others claim.

2.3.1 The Poverty of Sentential Paradigm

It is the poverty of sentential epistemologies that made Churchland to follow on connectionist architecture. He points out that these failures of sentential epistemology can be overcome by the connectionist approach. In his view, this novel approach also provides positive accounts to the central notions of philosophy of science, such as simplicity, theory-ladenness of observation and paradigm. He says that the theoretical developments and experimental results within connectionist framework provided us a powerful and fertile framework with which to address problems of cognition.

Churchland identifies the failure of classical sentential paradigm mainly as the following types. They are:

1. The classical explanation of theories involve from the deduction of laws. Churchland argues that people cannot often articulate the laws on which their explanatory understanding is supposed to rest. So explanation does not seem to require sententially stated laws. Churchland have questions both on the need for laws and the appeal to logic as the way of relating laws to the explained phenomena in the deductive-nomological model of explanation. He says that people arrive at an understanding of phenomena for which, they seek an explanation in much less time than it would be likely to take them to perform a deduction.
2. The next objection to classical sentential framework is that it offers no account of learning to use the propositional system itself. Living subjects have to learn to make the complex perceptual discriminations that make perpetual judgements possible. This pre-supposes antecedent possession of a determinate propositional system and a capacity for determinate perpetual judgement. This is prior to extensive learning which the human infant's lack. So, the classical sentential theory cannot possibly account for all cases of learning. There must exist a type of learning that is prior to the process of sentence manipulation. But, in non-human animals, the problem of learning and cognition has not got the benefit of language (either internal or external) but, all of them engage in

cognition. Their cognition proceeds entirely without benefit of any system for processing sentence-like representations.

3. A third problem with sentential learning is that it cannot account for the learning of skills which is as important as learning the facts of a discipline. From a connectionist point of view, skills are accounted in the same manner as all other learning through the adjustment of weights within the network.
4. A fourth objection is that the sentential model cannot explain how we retrieve relevant information in the process of reasoning about theories. From a connectionist perspective, all stored knowledge is stored in the weights through which processing will occur. This stored knowledge brought into play whenever relevant.
5. A fifth objection is that sentential perspectives cannot explain the progress of science.

While overcoming these failures, Churchland advances connectionism. Connectionism provides a radical advance in philosophy of science, i.e., by understanding theories in terms of weights in a network and explanations in terms of prototypical responses of a network. This network, he thinks, can overcome the failures of classical approach which took theories to be sets of propositions and explanations to involve derivations from theories or laws.

Besides, a connectionist approach, in Churchland's terms, provides an account of simplicity as a cognitive virtue. He construes simplicity in terms of the number of hidden units in a network and points out that the ability of networks to generalise depends upon their utilising the minimum number of hidden units needed for a particular problem (An explanation of their will be added later). He argues that the preference for simplicity can be understood from a connectionist perspective as an important epistemic virtue. Churchland links the virtue of simplicity with the virtue of explanatory unity. He proposes that explanatory unity arises not from arranging theories in a deductive hierarchy but from finding one set of weights that enables a single network to solve a multitude of problems.

He also contends that connectionist framework can explain features of science, i.e., the theory-ladenness of observation and the role of paradigms in science. Since all processing in a network is determined by the weights, it follows that any processing of inputs by a network will be governed by its theory. The notion of paradigms was central to Kuhn's account. For Kuhn, normal research is directed by the paradigm with the goal of filling in the general perspective on phenomena encoded in the paradigm. Kuhn's notion is vague and this vagueness paves way for severe criticisms, according to Churchland. Here Churchland contends that connectionism provides a way both to make the notion more specific and to explain why paradigms often seem vague. To quote Churchland: "*For a brain to command a paradigm is for it to have settled into a weight configuration that produces some well-structured similarity space whose central*

hyper volume locates the prototypical application(s). And it is only to be expected that even the most reflective person will be incompletely articulate on what dimensions constitute this highly complex and abstract space and even less articulate on what metric distributes examples along each dimension. A complete answer to these questions would require a microscopic examination of the person's brain".¹³

According to Churchland, connectionism provides a radical advance in the philosophy of science. He claims that with this approach (connectionist), we can overcome the limitations of classical approach. Here, Churchland rejects the sentential or propositional attitudes as the most important form of representation (thus folk psychology) used by cognitive creatures. He emphasised on the necessity of empirical and theoretical research into brain function in order to answer the question of what are the most important forms of representation and computation within cognitive creatures.

2.3.2 The '*Back-Propagation Algorithm*'

In an artificial network, training proceeds by entering a sample input vector (lower-level) letting it propagate upward through the network, noting the vector this produces at the topmost (output) layer, calculating the difference between the actual and desired output and then feeding the error measure into a special rule called the generalised delta rule. This rule dictates a small adjustment in the antecedent configuration of all of the synaptic weights in the network. This procedure is the '*Back-Propagation Algorithm*'. Repeating the procedures many times forces the

network to slide down an error gradient in the possible synaptic weights. The adjustments continue until the network has finally assumed a configuration of weights that does yield the appropriate outputs for all of the inputs in the training set. Such a network is called recurrent as opposed to feed-forward networks.

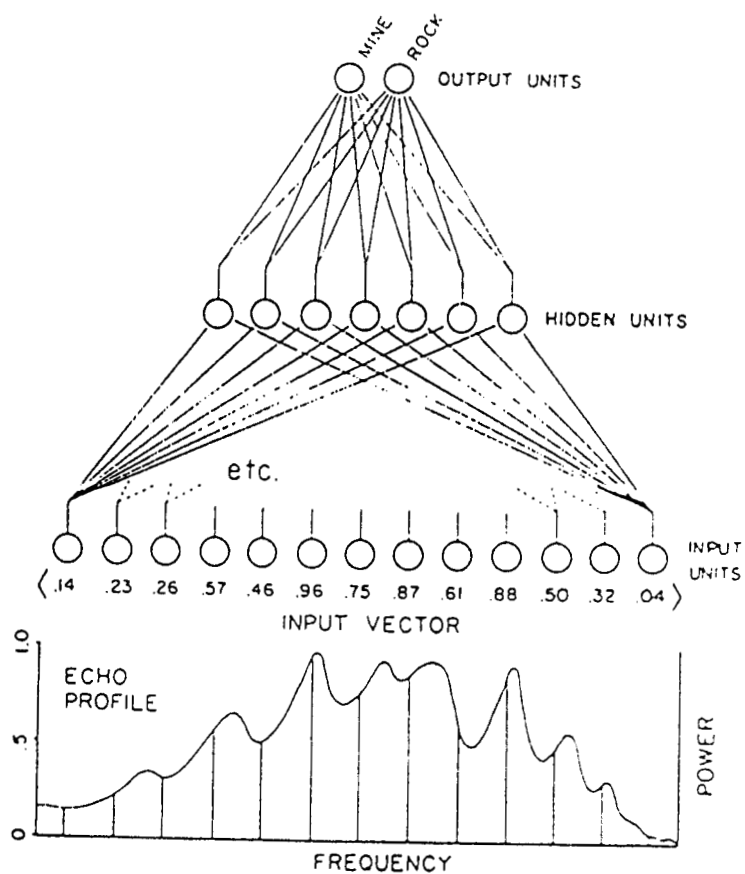


Figure 3¹⁴

This can be illustrated with the picture (see **Figure 3**). Let us take a network by which we want to discriminate sonar-echoes such as explosive mines and rocks. The discrimination poses two types of difficulties. First echoes from both objects sound indistinguishable to the normal human ear, and second, echoes from each type show wide variation in itself in sonic characters. This network begins with recording fifty different mine-echoes and rock-echoes. Then, digitalize the power profile of each echo with a frequency analyser and feed the resulting vector into the output units.

The network's initial verdicts are confused and meaningless, since its synaptic weights were set at random values. Under the pressure of weight-nudging algorithm, it gradually learns to make the designed distinction among the initial examples. Its output behaviour progressively approximates to the correct output vectors. After it has mastered the echoes in the training set, it will generalise, that is, it will reliably identify mine and rock echoes from outside its training set. Mine-echoes are united by some features. So, also the rock-echoes.

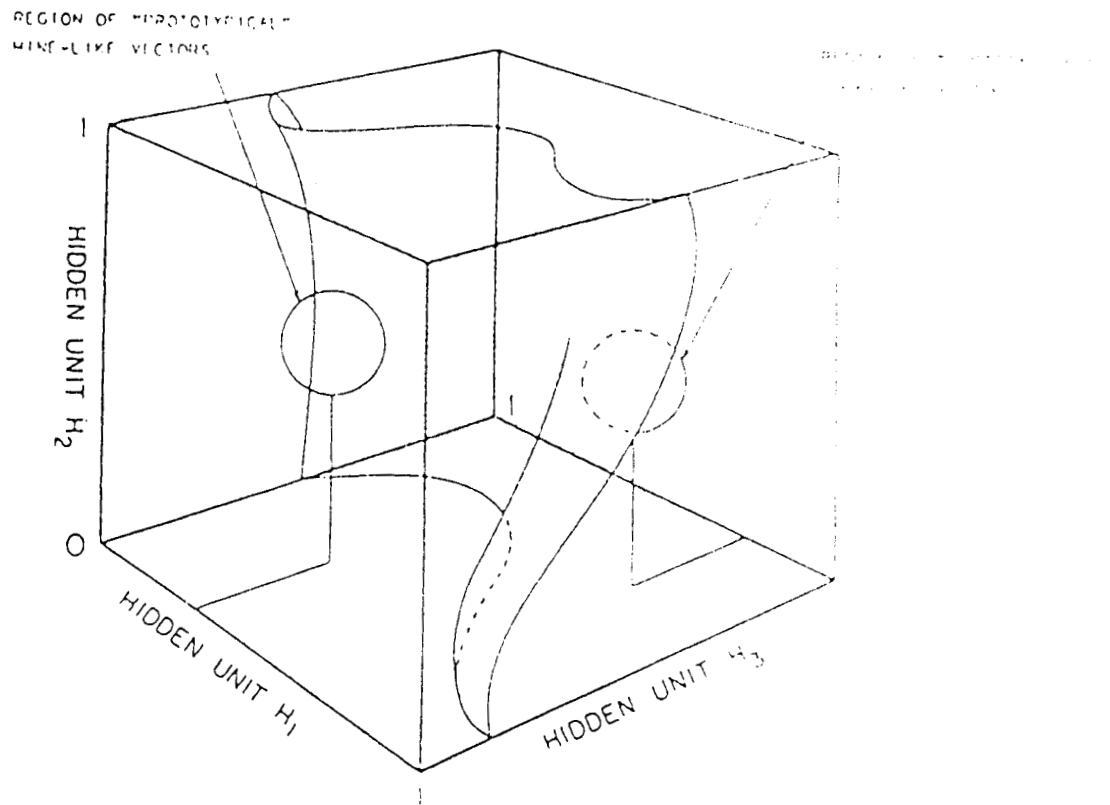


Figure 4¹⁵ Learned partition on hidden-unit activation vector-space

Thus, the system learns to discriminate the hard-to-define perceptual features and be sensitive to similarities of a comparably diffuse but highly relevant character. Once the network is trained up, the recognition task takes only a split of a second because the system processes the input stimulus in parallel. Finally, it gives us a discriminatory system that performs like a living creature, in speed and overall character.

2.3.3 Neural Networks – In Contrast with the Classical

The contrast between the neural networks with the classical AI approach is brought out as follows:

1. Classical AI's approach is symbolic serial processing like programmable computers but the neural networks are never governed by any rules, i.e., they do not achieve their result by following any rules.
2. The speed of neural network processing is very high than the classical AI processing. It is because, in neural networks, processing is done through Parallel Distributed Processing and not serial.
3. There is also a contrast between neural network and classical AI processing in the manner of information storage, i.e., in neural networks, acquired knowledge is stored in a distributed fashion. The very high-dimensional representations employed by neural nets namely, activation vectors across large cell populations, can be exquisitely sensitive to subtle similarities among their perpetual inputs.
4. Neural nets can learn a designed function and generate a categorical system adequate to compute it. All it needs are sufficient examples of the relevant function.

The connectionist model is against the classical sentential representation, which is the basis of propositional attitudes. Being an eliminativist, he is strictly against any kind of

supra-physical status of mind. This approach of connectionism is really against the folk psychological conception of mind. It is said that, if connectionism turns to be right, then eliminativism (about folk psychology) also be correct. So this may be the strongest reason. But there are philosophers like Andy Clark¹⁶, who defend folk psychology from a connectionist point of view, there is also other reasons such as connectionism unites the Feyerabendian kind of science. Churchland makes use of Feyerabend's thesis in many places. To quote Churchland, "*A connectionist model of cognitive activity successfully reduces to a Feyerabendian philosophy of science*"¹⁷ (An elaborate discussion about this is included in the next Chapter). Moreover, this can also be considered as his interest for making '*mental*' completely a matter of science (physical and natural). The objections are raised about this which will be discussed later.

2.4 Neural Network Connectionism as Eliminative Materialism

"If connectionist hypotheses of the sort we shall sketch turn out to be right so too will eliminativism about propositional attitudes".¹⁸

The above sentence itself reveals the mutual dependence of these two theses. The three main pillars of eliminative materialism are stated as follows:

1. Mental functions are nothing but the neuro-logical functions of the brain. Mental can be reduced to neuro-logical (physical). Hence, mind does not exist at all and hence, mind is eliminated.

2. Folk psychology, i.e., our everyday non-scientific way of talking about ourselves and our mental lives in terms of beliefs, desires, hopes, etc., is wrong because there is nothing in neurology to correspond with the basic factors of folk psychology (belief, desire, etc.). So, folk psychology does not exist.
3. The basic unit of animal and human understanding is the activation of neurones in the brain.

Many others such as Joseph Garon, William Ramsey and Stephen Stich endorse the above and exercise the eliminativist option in their writings. They also give importance to scientific revolutions, taking seriously connectionist architecture (if it is right) as revolutionary.

2.5 Eliminativism and Folk Psychology

There is a natural transition to folk psychology on Carruthers's¹⁹ understanding. Accordingly, it is defined to be a network, which includes a wider canvas of beliefs about the mind. Folk psychology is our everyday conceptual scheme for accounting for our own and others actions in terms of beliefs, desire, emotions (propositional attitudes) etc. It denotes the pre-scientific commonsense framework that we all normally socialised human being deploy in order to comprehend, explain, predict and manipulate the behaviour of our '*own and others*'. According to this theory, human beings are conscious rational agents. We live in a physical and social world of experiences and as a result, we have hopes, fears, expectations, etc. Our actions reflect our mental facts.

Being a reflective creature human beings continually engage in cognitive practices, i.e., they attempt to understand, explain and predict the psychological states of their own and others by making use of ordinary psychological notions.

During 1950s and 1980s, the interest on intentional psychology was less. The main debate of the time was about mind-brain identity theory. Philosophers were mostly concerned with the question of whether the qualitative aspects of sensations could be reduced into brain states. It was the reductionistic approach. But the revolution within cognitive psychology has continued to grow into the multi-disciplinary '*research cluster*' that is called cognitive science which took seriously the intentional phenomena. A key factor played here is taking minds as information processing systems. A powerful tool for this development was the study of artificial intelligence in computers by providing a theoretical model of human cognition in terms of internally processed programs. With this development, contemporary philosophy of mind has shifted from sensational phenomena (e.g., Pain and sense data) to intentional psychological phenomena (beliefs and desires). Mind-brain identity theorists' main contention was that folk psychological references to intentional psychological states are not causal explanatory. But Davidson's²⁰ papers on the explanation of causal action opened a new vistas in studying the folk psychological accounts of propositional attitudes as causal explanatory.

2.6 Propositional Attitude Psychology

Folk psychology is about propositional attitudes. More clearly, it is about the syntax and semantics of propositional attitudes. Propositional attitudes are those notions concerned with our conception of mentality terms such as desires, beliefs, intention, etc. Propositional attitudes are a species of causal explanations which plays a legitimate role in scientific psychology. In Jerry Fodor's book on the **Language-of-Thought**,²¹ we can see the development of a new wave psychology at work by taking propositional attitudes as semantically evaluable and casually efficacious. Fodor advocated the view that cognitive science is and ought to be committed to intentional realism. Hence, propositional attitudes are contentful. He held that information processing essentially involved the rule-governed computations performed upon mental representations. In short, mental states are computational as well as representational states. So, the received view of propositional attitude psychology attempts to meet the following demands:

1. To allow propositional attitude psychology to be integrated within theoretical cognitive psychology.
2. To throw light on the semantics of propositional attitude ascriptions.
3. To do reasonable justice to the way, we actually use propositional attitude psychology in day-to-day life.

Lycan²² argued that, we can satisfy all these three demands by seeing propositional attitudes as a relation between an agent and a sentence taken of the agent's language-of-thought. The most important assumption here is that our brain is a code language. Mind is a sentence-crunching machine. This is what is entailed by language-of-thought hypothesis. Such a hypothesis is supposed to integrate propositional attitude psychology with cognitive psychology. Fodor was of the opinion that propositional attitude ascriptions have striking semantical features. His language-of-thought hypothesis is that, '*mind is a sentence-crunching machine and cognition involves a mental code*'.²³ According to him, the best way to naturalise the mind is through naturalising propositional attitudes. Cognitive scientists are really the semanticists of propositional attitude psychology. Propositional attitude is either monadic and expressible in mentalese or dyadic in which it express about a relation between the agent and his belief. The following views are apparent about propositional attitudes:

1. Propositional attitude sentences can be naturalised (philosophical naturalism).
2. Propositional attitude sentences cannot be naturalised with the science of psychology (psychological naturalism).
3. Propositional attitude sentences cannot be naturalised by neuro-science (psychological naturalism).
4. Propositional attitude sentences can be partially naturalised, but not by science (instrumental naturalism).

Of these views, the second and third are said to be anti-realist and considered to be eliminativists. The second one eliminates propositional attitude psychology by means of epistemological grounds, while the third one eliminates propositional attitudes by developing a neuro-computational perspective. From this point of view, there develops an eliminativism of folk psychology and thereof, propositional attitudes.

Eliminativists are those who think that '*mental*' can be eliminated in favour of '*physical*' or '*neuro-biological*'. To them, mind is brain and so there is no need of thinking about a non-existing subject as mind. The eliminativists are very well-advanced scientists and they think about propositional attitudes – the basic postulates of folk psychology – as just like phlogiston which does not exist. So in their view, folk psychology hopelessly failed in explaining the phenomena what it is concerned with and it is a serious fall. This fall is beyond repair and needs to be replaced by a different theory. Hence, eliminativism. Now, we have two types of eliminativisms. The first is due to P. M. Churchland and the second is due to S. Stich. Churchland's eliminativism is termed as '*Elimination Now*' while those of Stich's is termed as '*Elimination in Prospect*' (due to P. Caruthers). Churchland argues that matured sciences is in a secure condition to eliminate folk psychology while Stich argues that future researches will reveal some aids to eliminate folk psychology. But meanwhile, he changed tacks in his second book by taking eliminativism as a species of '*deconstructionism*'. In his later book, he offers a critique of his earlier position. While Churchland takes the route of inter-theoretic reduction (via a reduction

of cognitive science to a species of philosophy of science), Stich takes it via the notion of reference that philosophy of language pursues and that needs to be deconstructed.

2.7 Paul M. Churchland's '*Eliminativism Now*'

Churchland's eliminative materialism is the thesis that our commonsense conception of psychological phenomena (folk psychology) constitutes a radically false theory. That theory is so fundamentally mistaken that both the principles and the ontology of the theory will be displaced (rather than smoothly reduced) by completed neuro-science. Churchland's opposition against folk psychology has the following three criticisms:

1. Folk psychology fails to explain a considerable variety of central psychology phenomena.
2. Folk psychology is a stagnant research programme, i.e., without any prospect of progress.
3. A smooth inter-theoretic reduction of folk psychology to completed neuro-science is impossible.

Now, we shall discuss the points one-by-one.

2.7.1 Explanatory Impotency of Folk Psychology

Churchland argued that folk psychology fails to explain in detail many of the psychological phenomena, e.g., mental illness, creativity, intelligence difference, etc.

According to Churchland, a true theory should not have such shortcomings. It is said that central and important mental phenomena remain largely or wholly mysterious within the framework of folk psychology. According to Kim Sterenly, the three main elements in Churchland's eliminative materialism are: first, intentional psychology fits badly to our picture of mind, because it fails to guide research. Second, Churchland's ontological conclusion that there probably are no beliefs and desires is followed by his semantical views. The meaning of a term derives from its theoretical role, e.g., the term '*gene*' derives its meaning from a bundle of laws about reproduction and inheritance of traits across generations. And the third holds that there are important alternatives to the view that mind is a sentential machine, accounts of cognition and representation much more closely tied to neuro-sciences. For these reasons, Churchland thinks that intentional psychology is deeply-flawed and it is a degenerating research programme because it fails to provide insights into a range of central feature of human psychology, e.g., sleep, mental illness, visual perception, sensory motor co-ordination, etc. Paul Churchland shares the opinion with Patricia Churchland that cognitive psychology is an inadequate theory of mind because its reliance on a sentential model of mental representation. They disagree on a language-of-thought hypothesis central to propositional attitude psychology. Folk theory is true only if there is a language-of-thought, there is no language-of-thought in folk psychology, and so, it is false.

2.7.2 Stagnation of Folk Psychology

Churchland wryly comments: "*The folk psychology of Greeks essentially is the folk psychology we use today, and we are negligibly better at explaining human behaviour in its forms than was Sophocles*".²⁴ Churchland thinks that since there is a very long period of stagnation and infertility, the integration of its basic categories must be questioned. Churchland calls attention to the greatest theoretical synthesis that provides descriptions and explanations of human sensory input, neural activity, motor control, etc. But folk psychology never took part in this greatest theoretical synthesis. He admits that "*Its intentional categories stand magnificently alone, without the visible prospect of reduction to that larger corpus (neuro-physiology)*". Quoting from Imre Lakatos, he remarks that, "*Folk psychology is a stagnant or degenerating research programme and has been for millennia*".²⁵

2.7.3 Impossibility of a Smooth Inter-theoretic Reduction

Like identity theorists, Churchland also believes in the reduction of the mental to the physical (brain). But in case of folk psychology, eliminativists doubt that a nice one-to-one match ups between the concept of folk psychology and theoretical neuro-science will occur. This doubt arises due to the fact that the basic categories of folk psychology (propositional attitudes such as beliefs, desires, etc.), will not be mirrored in the basic concepts of theoretical neuro-physiology. Churchland says that our commonsense psychological framework is a false and radically misleading

conception of the causes of human behaviour and the nature of cognitive activity. He continues to hold that folk psychology is not only an incomplete representation of our inner nature but also is an outright misrepresentation of our internal states and activities. From this, Churchland concludes that we can judge folk psychology to be an inadequate theory which is ripe for elimination and replacement by theoretic neuro-sciences, i.e., folk psychology stands in splendid isolation and perpetual stagnation without any prospect for reduction, it is better to be eliminated. Churchland's attack on folk psychology exploits an important feature of the proto-theory, namely that it is linguistic. Curiously enough, the influence of eliminativist motif occurs in philosophy of language also as seen in the way it can broadly be divided into folk philosophy of language and revisionary philosophy of language. The first one exposes the method of understanding interpretation and communication while the second have explanatory ambitions. Within Churchland's theorizing, a more pronounced revisionary motive is evidenced and this is directed against the sentential structure of classical cognitivism represented by Fodor and others.

Churchland counters: "*... even if our current conception of rationality ... is logically constituted within the sentential/propositional framework of folk psychology, there is no guarantee that this framework is adequate to the deeper and more accurate account of cognitive virtue which is clearly needed*".²⁶ *'Language is only one skill'* and *'it is extremely peripheral activity or an idiosyncratic mode of social interaction'*. We have to transcend the poverty of folk psychology, i.e., we must replace the propositional

kinematics by a general kinematics of cognitive activity. The second will accommodate the first. Incidentally, it may also be noted that similar arguments are available against theory-theory. As if to ensure, the revisionary motive is primarily meant to break the spell of the language-oriented approaches. Churchland reinforces the above by presenting the following three scenarios. The first two counter Chomsky's assumptions about innate structure called theory-theory and the third is a thought-experiment.

Scenario 1 : Our brain indeed contain innate structure, but those structures have their primary function in perceptual organizations.

What follows from this is that the language is just an additional function and it is mostly an incidental task.

Scenario 2 : Therefore, the underlying structures of our cognitive activities outstrip that of our natural capacities.

Churchland's earlier stand was to argue that cognitive science provides an alternative system – i.e., language-like system, but it is to be called '*Ubersetzonal*' (surveyable) attitudes, which contain no truth or entailment relations. Now, he is ready to give up this former stand. With this denial, along with affirmation of truth and entailment, there is little doubt that he will favour a view, according to which, compositional states are language-like syntactical states (quasi-sentential). These quasi-sentential states are gradually forced on him. He is, therefore, inclined to admit the plurality of folk psychology.

Scenario 3 : If our intra-brain communication between two hemispheres takes place, why not inter-brain communication between different cognitive systems takes place naturally ? Churchland may intercept to ask, “*In what way therefore, language would be a stumbling block to this ?*”.

As an eliminativist *per se*, Churchland’s main hunch may be understood as one about the non-identity (it is a judgement on the identity form of the judgement) as demonstrated by the following mode of presentation.

1. The properties of my brain states are known by the various external senses as having such and such properties.
2. The qualities of my sensations are not known by the various external senses as having such and such properties.
3. Therefore, the qualia of my sensation are not crucial to the properties of my brain states.

In response to Putnam’s critique of elimination, Churchland is ready to modify his anti-realism and present it in the form of pragmatic realism. Thus, his earlier argument (anti-realist), reads as follows:

Propositional attitude is not scientific.

Therefore, propositional attitude is a myth.

This is to be replaced as:

1. Propositional attitudes misrepresent reality because of its propositional modularity.
2. A current way of representing reality is by means of the connectionist modularity.
3. It follows that propositional attitudes must be succeeded by a new theory.
4. (2) is a better theory.

Again, foisting the problem of misrepresentation on language, and attributing it to the way language is used, he prefers to assert that:

5. Misrepresentation is due to propositional modularity.
6. (5) should be replaced by a quasi-sentential mechanism.

Churchland cannot totally give up the role of language. Characteristically, he is willing to concede a State-Space Semantics – i.e., a semantics with the activation vectors occupying a state-space – to his perspective from a neuro-computational point of view. Elimination is agreeable if only to admit of misrepresentation. But, Churchland's main problem is about the non-identity, i.e., it criticises identity. On either of the above grounds, his point is linguistic. Churchland shares a similar misgiving like Stich given as follows:

1. If folk psychology is not a theory then, it cannot be falsified.

2. But, it is false.
3. Therefore, folk psychology is a theory, though an unsuccessful one.

After all, folk psychology can be falsified. The upshot is to prove that eliminativists is not to be regarded as eliminating so long as they are indulged in revisionary motives, accepting the impossibility of one-to-one translation from one state (mental) to another state (brain).

2.8 Stich's '*Eliminativism in Prospect*'

Stich's²⁷ exercises the eliminativist option from an epistemological angle. What Peter Carruthers²⁸ termed as '*Eliminativism in Prospect*' holds that we have to wait and see the developments of future scientific field to eliminate folk psychology. Stich's view is that it is likely that once we learn about the real underlying process of cognition, then folk psychological categories, particularly belief, cannot be empirically defended. Stich was tempted by the following argument which was from Quine's stated as, "*Since cognitive science does not invoke the language or concepts of folk psychology, the states of folk psychology are not among the entities over which it quantifies. So these putative steps do not exist*".²⁹

Stich mentions that there are at least two families of arguments in favour of the claim that beliefs and desires do not exist. The first argument focuses on the structure of the cognitive processes and mechanisms portrayed by folk psychology. The major argument here is put forward by Ramsey, Stich and Garon in what is called a '*Stichian*

forecast of the doom of folk psychology,³⁰ which occurs in the context of their discussion on connectionism.

The first step stipulates that connectionist networks do not contain anything corresponding to beliefs, because beliefs are functionally discrete, whereas the information contained in a connectionist network is holistically distributed throughout the network. So, if our brains are connectionist networks, they do not contain any beliefs. They also argue that:

1. Folk psychology is committed to the claim that propositional attitudes like belief and desires are functionally discrete, semantically interpretable states that play a causal role in the production of other propositional attitudes (This is what Stich calls the propositional modularity).
2. There are no such states in connectionist modelling of our cognitive system.
3. Connectionist models are correct in their modelling.
4. The propositional attitudes posited by folk psychology do not exist.
5. Folks are not theoretically committed to any common mechanism that underlies grasp and exercise of the concept.
6. Propositional attitudes are no threat to folk psychology.

Stich closes this review by saying that whether connectionist models poses a threat to folk psychology or not is an empirical matter to decide and it is not to be decided in an *a priori* way.

While citing psychological evidences against the rejection of folk psychology, Stich presents a less complicated argument. It works against the elimination in the following way. Eliminativists claim that there are no such things as beliefs and desires because folk psychology posits them in a radically false theory. According to Gordon³¹ and Goodman³², the theory which posits a tacitly known folk psychology is radically false. This is called a theory-theory. Since theory-theory is false, there is no folk psychology. If folk psychology makes no claims, it makes no false claims. Hence, the critique against folk psychology will turn out to be false. On Stich's view, eliminativists can target a theory only if either of it is an internally posited system consisting of rules or it is just like a connectionist model which does not map propositions on one another. Otherwise, eliminativism can become compatible with an externalist (as opposed to the internalist which posits a cognitive mechanism, an externalist locates it in the external environment), account of epistemology and a connectionist account of neural system, which maps propositions with one another. Given the psychological evidence that goes against any wholesale rejection of folk psychology, folk psychology cannot be totally rejected. If eliminativism makes a stronger claim as given below:

1. Commonsense psychology makes any false claims about beliefs and desires.
2. There are no such things as beliefs and desires (ontological thesis).
3. Therefore, true believers do not exist.

The only way one can pass from (1) to (2) is to trivialize as in (3). This is clearly a false theory, as it cannot be agreed upon. Let us see what Stich has to say on the semantics of propositional attitudes. On Stich's reading, some of these arguments are '*firmly fussy*' and '*technical*'. They exploit at least three key notions namely supervenience, individuation and holism. The fussiness is due to the fact that philosophers have no theory of content. This is sufficient to doom the first family of projects. It is expressed as follows:

- A. A theory of mental representation is supposed to describe the concept of knowledge structure underlying our ordinary judgements about the content of one's beliefs, desires and other intentional states. It is enigmatic to know that if this is the theory that philosophers want, then what will be the role of philosophy. Stich's comment is a dismissal, '*we should give up philosophy in favour of philosophy*'.³³

On the other hand, Stich is more interested in the second family of projects which is as follows:

- B. A theory of mental representation does not much care about the commonsense conception of mental representation, because of the ontological distance.

This entails that the intuitions and tacit knowledge of the man in the street are quite irrelevant. Another important feature Stich mentions is that the real opposition between folk psychology and cognitive science is brought out by saying that while folk psychology is anti-individualistic (beliefs and desires cannot be specified in a way that is independent of the environment) cognitive science is individualistic (it has to describe mind *per se*). According to Stich's interpretation, this follows the heels of anti-individualism advocated by Putnam, Burge, etc. Further, accepting the plurality of theories, Stich wants to demonstrate that folk psychology may either trivially be true upon one theory of reference (naive description theory of reference), or it is trivially false, on another sophisticated (causal-historical) theory of reference. From this, Stich concludes that folk psychology is neither true nor false. Such is his anti-realist stance. Stich winds up his problem by saying that the whole problem is one about inter-theoretic relation where he almost comes to terms with Churchland.

But in his later work, he reflects "*My entire conception of the eliminativists debate was radically mistaken*".³⁴ Here, he wants to deconstruct the assumptions the eliminativists argument. In his words, what eliminativism really pursues is a

deconstructionist programme. Following his own self-criticism, he begins to equivocate eliminationism with deconstructionism after due examination of the entire structuration of eliminativist argument.

Premise I: Mental states like beliefs, desires, etc., are theoretical terms.

Premise II: Folk psychology is a seriously mistaken theory.

These two premises are defended by all eliminativists. But from these two premises, two conclusions can be drawn as:

Conclusion I: Beliefs, desires and other postulates of folk psychology do not exist.

Conclusion II: Folk psychological postulates will not be part of the ontology of any natural science.

Here, Stich criticises this by saying that neither of these conclusions can be followed without adding certain additional premises. Here, what the missing premise is a theory of reference of theoretical terms, which warrants a deconstructive conclusion. When a problem about a correct theory of reference arises, there will have two solutions. One is a proto-science account and the other is a folk semantic account. In the first account, the theory of reference is attempting to characterise a word–world mapping that will be useful in one or other empirical disciplines such as linguistics, cognitive psychology or the history of science. In the second account, the theory of reference is attempting to

capture the details of a commonsense theory about the link between words and the world. Philosophers generally favour the second account. Stich was also among them, but it was Searle who convinced him about his argument, which was a false one. Searle argued that Stich's argument is very general and there is nothing important or interesting about it. Here, after many years, Stich himself agrees the same with saying that the appeal to reference and the strategy of semantic ascent are non-starters when it comes to settling ontological questions like those raised by eliminativists.

In explaining the view that the goal of the theory of reference is to correctly describe our tacit folk semantics is to use an analogy. The analogy here is between theories of reference and theories of folk physics and to grammatical theories. If the job of a theory of reference is to describe and internalised folk semantics, then the theorists may misdescribe the folk semantic theory inside people's heads. Folk semantics is a collection of commonsense beliefs about reference. If folk semantics is like folk physics, then if we want to learn about reference, then we should study the science that tells us about reference. What this shows is that the analogy between folk semantics and folk physics is indefensible and the analogy with grammar is only tenable one.

In the case of Stich, the enquiry for the missing premise in the eliminativist argument still continues that needs to be deconstructed. His special attention is on the question, '*How are we to go about deciding whether or not the entities posited by any false theory exist ?*'. The answer is that they socially determinate. Anti-realistic turn is channelled into realism. We tend to think that he is not an eliminativist at all or his

programme is not eliminativistic one. This reinforces the interesting conclusion McCauley has reached. McCauley's findings have clear implication in Churchland's case because both commonsense psychology and cognitive psychology operate at different levels of analysis from neuro-science. Thus even if commonsense psychology and neuro-science are incommensurable, it would be incorrect to conclude that such incommensurability requires the elimination of one or the other. From this, it is clear that Stich does not agree to elimination. To him, incommensurability is admissible, but elimination is not. So we shall conclude that Stich is not an eliminativist. The question, '*Do eliminativists really eliminate ?*', evokes a negative answer in both of the above projects. "*Eliminative materialism is the thesis that our commonsense conception of psychological phenomena constitutes a radically false theory, a theory so fundamentally defective that both the principles and the ontology of that theory will eventually be displaced rather than smoothly reduced, by completed neuro-science*".³⁵

When we take inter-theoretic reduction into account (a detailed account is given in third Chapter), we can see that there are possibilities of theory elimination and theory proliferation. Theory elimination is one of identity, and if there is no identity there can be proliferations, e.g., when theory **T** is reduced to theory **T₂**, there is elimination only when **T**, is identical to **T₂**. But when multiple realizability raises problem for identity theory, this would not occur (Please remember the example of identity of pain and C-fibre firing). Thus, here neither identity nor elimination is not occurring between folk psychology and correspond with belief or such postulates of folk psychology.

So Churchland is fated to proliferate theories. We conclude that eliminativists do not really eliminate. Even though, Churchland appears to refute Quine's indeterminacy of translation, he accepts incommensurability which is yet another form of indeterminacy.

Within connectionist group itself, we can see that philosophers like Andy Clark³⁶ and Terence Horgan³⁷ try to defend folk psychology from a connectionist point of view. In Peter Caruthers and in Kim Sterenly,³⁸ we can see the defence of folk psychology not from its side but from a compatibilist position. When they argued for a combination or compatible position of neuro-scientific connectionism and classical cognitive science, this would defend folk psychology. It is because Fodor's Classical Representational Theory based on the thesis that cognitive activity consisting in the manipulation of propositional attitudes. So a compatibilist position would do a good job. It is also important to cite that Churchland later became less stronger on the eliminativist position. He says that, "*Eliminative materialism does not imply the end of our normative concerns, it implies only that they will have to be reconstituted at a more revealing level of understanding, the level that a matured neuro-science will provide*".³⁹ Here his urge is to reconstitute to higher level and not to eliminate.

They wanted to change the name of their theory '*eliminative materialism*' to some other names such as '*good guy materialism*' or '*revisionary materialism*'. Finally, we can say that eliminativists do not eliminate and they are not eliminativists at all. For the same reason, they wanted to change their name to '*revisionary materialism*' and it will be more suitable than the '*eliminative materialism*'. What they are doing is not elimination, but revision of folk psychology.

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CHAPTER III

EVALUATING THE NEURO-COMPUTATIONAL PERSPECTIVE AS A THEORY OF MIND

“I hope to make available here a conceptual framework of sufficient richness and integrity that will be able to reconceive at least some of your mental life in explicitly neuro-computational terms”.

3.1 Major Features of the Neuro-computational Perspective: A Review

In the previous Chapters, we have singled out at least one important feature of Churchland’s Neuro-Computational Perspective, namely its anti-linguistic character and counterposed it to the linguistic character of intentional realism and discussed in detail about its support to the eliminative materialist theory of mind. We brought out a comparison and contrast between two approaches to the eliminativist option. This Chapter is meant to be an evaluation of the second methodological feature namely its explanatory power that is sought to be achieved by means of the inter-theoretic reduction which contributes ultimately towards the support of realism. Churchland provides two sets of arguments for inter-theoretic reduction as opposed to the classical reductionism. Both will be examined in the sequel. Put together, all of them must explain the non-linear trait of neuronal plasticity. Such synaptic plasticity must also be

reconciled with scientific realism. So, before going into these questions, let us review some important features.

Churchland's Neuro-Computational Perspective on mind is one of the most scientifically advanced cognitive modelling of the brain, which claims that mind is nothing but the information carried across parallel distributed neural networks. As a theory of micro-cognition, it is a non-linear rather than a serial processing von Neumannesque Machine. Thus connectionist research represents one of the most advanced frontiers in cognitive science. Churchland refutes the adherence to spiritual or supra-physical. To him, everything in this world is physical and so also, mind and consciousness.

As seen in the previous Chapter, Churchland's neuro-computational modelling of the mind/brain can be taken as an alternative to the classical representational theories, but it remained only as a supplement since it cannot escape linguistic orientations. Nevertheless, it is really the anti-sentential approach that gives much impetus to this theory of micro-cognition. So, when we talk about neuro-computational network, the most important feature appears to be its non-linguistic trait. Such anti-sentential trait is also understood to embody a non-linear, i.e., parallel and not step-by-step, or what is called a recurrent neural network, i.e., it includes both feed-forward and feed-backward. This is in stark contrast to the linguistic modelling. Churchland thinks that with these features, he can overcome the differences confronted by classical modelling. Hence, the evaluation of such an important perspective is the most topical in cognitive science

research. In order to broach an in-depth consideration, we shall have to focus our attention on its explanatory power to which we are moving after a brief recapitulation.

3.1.1 Anti-sentential Feature

To Churchland, the nature of mental representation is not something sentential. He says that mind is not a sentence-crunching machine. In his view, the ability to think comes first and then only the ability to use language. So, thinking must involve some form of non-linguistic mental representation. This is the reason why he rejects a language-of-thought hypothesis. To him, everything is natural (physical) and there is nothing over and above the bounds of the physical. He says that with a modern understanding of man and his place in nature, it is natural to conceive ourselves as epistemic engines. Here, he stands firm on his view and quite opposed to the current state of an epistemic engine that is relevantly and adequately represented by a set of sentences or propositions. This line of sententialism favours the commonsensical view of mind, i.e., mind is a set of sentences. This was almost displaced by Churchland. He never wants to take man as a seat of beliefs and attitudes. He points out that the sentential paradigm is a defective modelling and its modelling itself collapses at the most fundamental level. We cannot take man as represented by sentences or sequence of sentences and by the properties of those sentences or by the relations between them.

Churchland advances his anti-sentential idea by proving that the sentential paradigm is parochial. To him, the language use is only one dimension of activity

acquired only after an enormous amount of prior cognitive development on the human part. It is plain that the higher animals display the capacity for learning from experience, but language plays no role in their activities. From this perspective, language appears as a peripheral phenomenon and looks like an idiosyncratic feature to a single species of epistemic engine. Churchland says that it is easy to imagine creatures whose use of a systematic medium of information exchange between individuals where the elements and the internal structure of that medium bear no similarity at all to the elements and structures of any human language. To quote: "*The idea that the fundamental parameters of cognitive development and intellectual virtue should find themselves displayed in the structure of human language is parochial as it is optimistic*".¹ To acquire a specific language is to learn to process peripheral information into the categories that language provides. The informational matrix, language embodies, comes to shape the processing of peripheral information from the top-down and by this means all those who learn it, are acculturated into a common view of the general nature of reality and the possible configurations it may assume.

More importantly, in the context of this inquiry, the sentential paradigm is also not sufficient to do justice to the plastic nature of human beings. We know the plasticity argument which says that human consciousness is plastic and it has no stable character and so it cannot be reduced to anything. To Churchland, language appears to be sufficiently plastic in their actual and potential responses to sensory stimulation, i.e., we cannot specify any permanent features or dimensions common to all languages at all

times. It is problematic that these factors or dimensions are suitable for framing a general characterisation of epistemological rationality. To Churchland, it is doubtless that all of a man's knowledge is grounded in the causal effects of the environment. His rational cognitive development can be subjected to certain general constraints and these constraints are better knowable by man himself. Such knowledge is understood to enhance his epistemic performance and so, the idea that these causal effects and general constraints can be ultimately construed, prove that sententialism is incorrect.

3.1.2 The Non-linear Character

The computation in a connectionist neural network is not a step-by-step serial processing programme. Connectionists distinguish between linear and non-linear modelling. Churchland identifies his theory of micro-cognition with a non-linear model. This is entailed by parallel processing of neurons as opposed to serial processing of neurons. We know that in a step-by-step (serial) programme, we cannot reach back to the earlier ones. But in this parallel, non-linear programme, there is a clear possibility to move backward and forward. This is what Churchland calls feed-forward and recurrent neural networks respectively. The question whether such recurrent networks are supported by biological or empirical research on the brain is to be answered in the affirmative. If so, it would immensely augment the explanatory power of this perspective. These neural nets have no representation of any rules, which the serial processing have. They simply embody the desired function and since the neurons perform massively parallel processing, they can be very much faster than serial (linear) programmes. Mind

is a brain with a massively parallel mechanism. To Churchland, this recurrent neural nets perform a better job than the classical feed-forward program. We can contrast these features of a feed-forward network and recurrent neural networks as shown below.

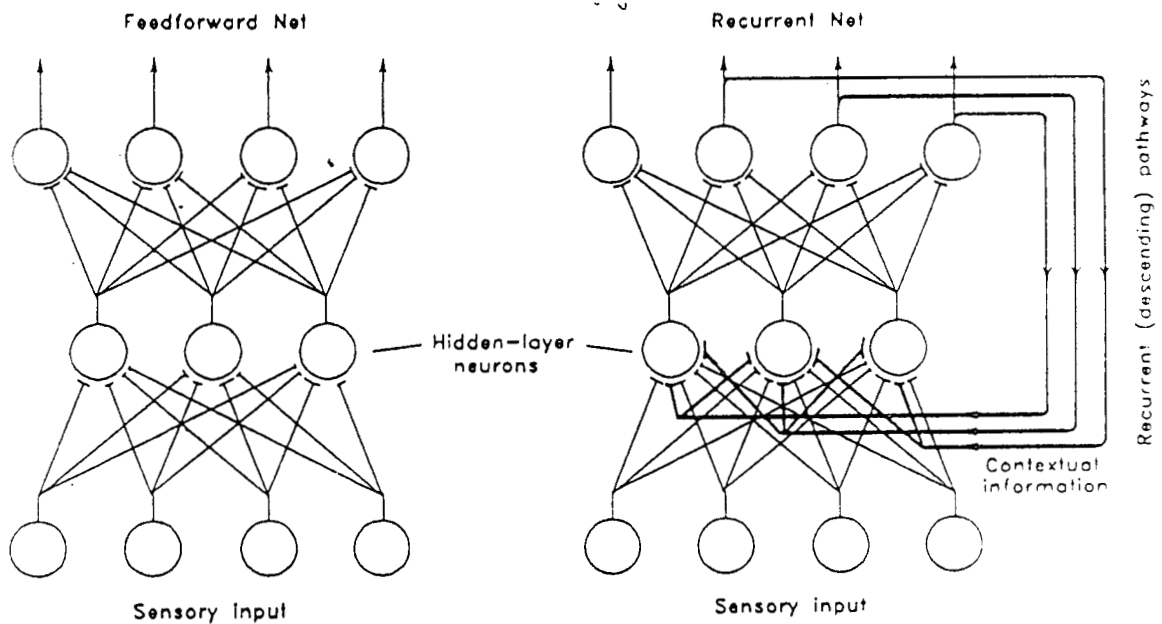


FIGURE 1²

FIGURE 2³

By closely examining these two pictures, we find that the differences between these two models are striking. There are significant advantages of recurrent networks over that of feed-forward model. In a feed-forward net, we see that there is only one type of programming, i.e., in forward direction only. It is in an ascending manner and one cannot

go backward in such a network. But in recurrent networks, there is programming in both directions, i.e., forward and backward and hence, it is called recurrent. In a feed-forward network, its response to a given stimulus is fixed to the structural features of the network, while in recurrent network the response varies.

In recurrent networks, the middle-layer cell receives an ever-changing set of modulating influences from the down stream cognitive activity. So, the responses of the middle-layer continuously unfold over time. This response of middle-layer is a sequence of activation vectors. The response is not a point, but they are in a trajectory in activation vector space. It is an important fact about the recurrent neural network that we can train the networks to respond to various input stimuli with proprietary activation trajectories by adjusting the weights and polarities of their synaptic connections. These vector sequences can represent salient causal relations in the networks' perceptual environment, and it also can serve as generators for motor sequences, as both have been trained. It is also important that the network achieves spatio-temporal command in the perceptual and motor domains. In general, the recurrent neural networks hold out a powerful set of theoretical resources with which to understand the phenomena of learning, memory, perception and motor control.

Given such a theory of micro-cognition, Churchland argues that recurrent networks can adequately solve the reductionist problem of consciousness to a great extent. As it will be shown at the close of this Chapter, certain important characteristics of consciousness are analogous to the recurrent neural networks. If they are empirically

supported by brain research, then the nature of consciousness is reducible to its physical or neuro-biological correlates. That is why he rejects the notion of personal conscious experiences. As such, brain is a recurrent neural network or neuronal system. There is evidence that provides initial support for the conjectures about the dynamical contrasts between deep-sleep, dream-sleep and dreamless (awake state). Thus we see that the recurrent network is invested with extraordinary explanatory power including the explanation of consciousness. Before examining how this will support a kind of reductionism, we shall fine-tune the theory a little more further.

3.2 Parallel Distributed Processing

During his journey through neuro-science, Churchland develops and uses the most important tools to remove the most important irritant namely, the sentential/classical paradigm.

1. His urge to naturalise everything in this world and so also mind/consciousness.
2. His fierce opposition towards intentional realism and its claim to naturalise intentionality in terms of *ceteris paribus* (exceptional or soft laws) of the classical sentential paradigm (Foderian response to the Covering-Law Model of hypothetico-deductive model of scientific reasoning in science).

These two are his most serious intentions at his philosophical cum neuro-scientific proceedings. Now, we can look at the way the Parallel Distributed Processing will adhere strictly to a scientific model of explanation.

Churchland was very much distressed with the deductive nomological approach of explanation in classical paradigms and advances two responses, called the first and second argument. In classical theories, the explanatory understanding consists in propositions and the relation between propositions. But in Churchland's words, these have nothing to do with propositions in explanatory understanding. Against this deductive-nomological approach, Churchland builds his theory of neuro-computation by developing an alternative inter-theoretic model of explanation. This theory provides the activation patterns across a large population of neurons instead of propositions. According to this theory, explanatory understanding and perceptual recognition are different instances of one and the same cognitive achievement of what is called prototype activation, which is the basis of all knowledge.

We have also explained that the character of one's perception, cognition and behaviour is determined by the particular configuration of weights within the interconnected network, which consists in one's basic cognitive apparatus. These weights determine what features in the world one responds to, which concepts one uses to process them, which values one embrace and which range of behaviour one commands, i.e., the connection of neurons causes our responses to outer-world. This connection of neurons in our brains are parallel which means that the sensory inputs are processed simultaneously and not step-by-step. Hence, it is called Parallel Distributed Processing.

3.2.1 Conceptual Organisation in PDP Network

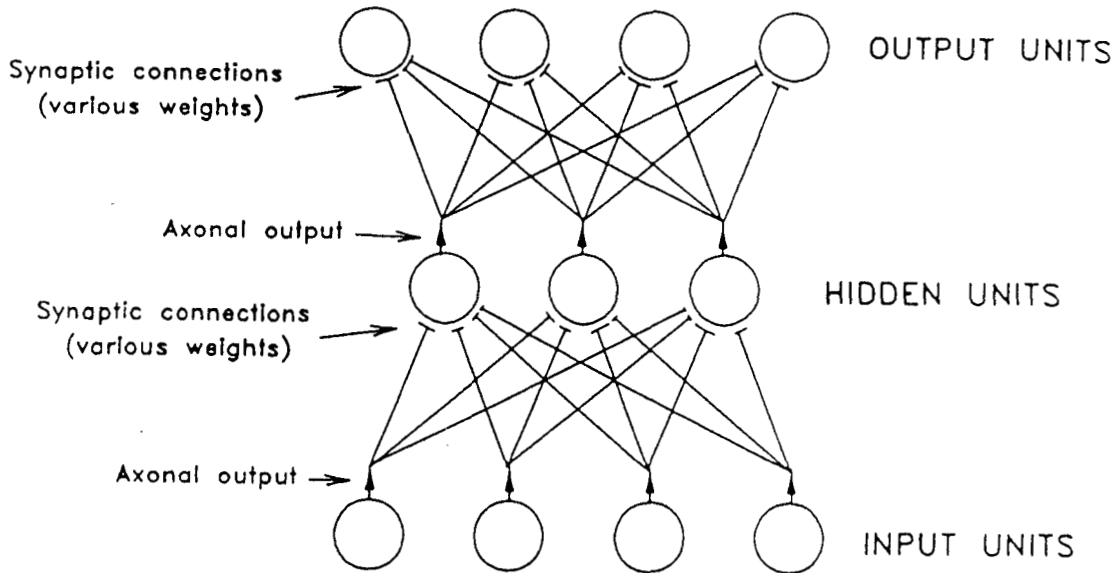


Figure 3⁴.

A → Synaptic connections with various weights

B → Axonal output

This picture illustrate how conceptual organisation takes place in a neuronal network. In this picture, the bottom circles represent a population of sensory input neurons. Each of these projects an axonal fibre toward a second layer of the units. There the axons divide into a fan of terminal branches to make connections (synaptical connections) with

every unit in the second population of neurons, i.e., a typical axon can make many thousands of connections.

The second layer of neurons is the crucial '*hidden*' layer. An input stimulus produces some activation level in a given input unit which conveys a signal of proportional strength along its axon and out the end branches to the many synaptic connections onto the hidden units. These connections stimulate the hidden units as a function of the strength of the signal, the weight of each synaptic connection and its polarity. This has the global effect that a pattern of activations across the set of input units produces a distinct pattern of activations across the set of hidden units. Which pattern gets produced is determined by the configuration of synaptic weights meeting the hidden units. As the earlier process, the pattern of activations across the set of hidden units produces a distinct pattern of activations across the set of output units.

This type of networks has many features such as:

1. The output verdict for any input is produced very quickly because the computation occurs in parallel. The global computation at each layer is distributed among many elements that are simultaneously active processing, the weighted synapses and the summative cell bodies, that is why the expression '*Parallel Distributed Processing*'.
2. The network is functionally persistent under the scattered destruction of synapses or units they degrade gracefully.

3. The network will regularly render correct verdicts given only a degraded version or a smallish part of a familiar input vector. This is because the degraded or partial vector is relevantly similar to a prototypical input and the internal coding strategy generated in the course of training is sensitive to such similarities among possible inputs.
4. This network can learn functions far more complex than the binary ones.

There are many points that need attention about the functional features of PDP network. The first one among them is the partitioning of its hidden unit activation vector space into a system of prototype representations, in a trained network. In this partitioning, there is one for each of the general categories to which the network has been trained. Another point is that a single activation vector across the hidden units represents a wide range of different possible sensory activation patterns at the input layer. A third point is that PDP networks are extraordinarily fast. They achieve the recognitions in a matter of milliseconds.

Churchland portrays brain as a recurrent network. He says that, brain consists of many layers of hidden units and divide into many distinct processing hierarchies working side-by-side on different problems. It is a committee of many co-operating networks. The input given to hidden units comes not just from sensory experience, but from elsewhere in the brain itself. In brain, in its many layers, any layer will receive some descending axonal projections returning from the next layer and also will receive

horizontal projections from adjacent networks. The fact is that, which prototype vectors get activated within a layer is a function of diverse inputs, some of which arrive from the sensory periphery and many of which reflect concurrent activity elsewhere in the brain. He also says that the behaviour-controlling factors reside within the brain as much as in the external environment, i.e., the brain's behaviour has become predictable only in its broadest outlines and only for very short periods to the future.

Churchland suggests an important point that the prototype vectors activation constitute the creature's recognition and concurrent understanding of its objective situation. This understanding is reflected in the creature's subsequent behaviour. About the failure or confusion in conceptual recognition, he makes a claim that have a form of a prediction, i.e., he says that, by way of whatever learning algorithm governs synaptic adjustments, the failures and subsequent success will modify the character and state-space location of the internal prototype activation of the creature, so also the situations of the puzzling kind just solved, will also successfully activate a prototype vector more readily in future. Churchland's point deserves criticism, i.e., "*How he can say that it will be so-and-so in future ?*". The future is not in our experience now and is unexplainable in terms of such predictions. To him, everything related to world/nation is explainable and physical. It is here we should locate one of the most interesting questions about synaptic plasticity. This may be phrased as: Can PDP, in their recurrent versions, have sufficient explanatory power to explain plasticity ? When Professor Kanthamani raised this question, he was about to ask whether PDP can explain the problem of illusion

taking it as number one problem in cognitive science, and provides a negative answer to the above question. If so, it will pass the test about the explanatory power.

3.3 Does PDP Explain the Plasticity of Human Nature ?

Churchland's adherence to PDP modelling of brain is a milestone in cognitive science research. But the problem of plasticity, i.e., does PDP clearly explain the plastic nature of human consciousness is the question that requires a positive answer. In his Neuro-computational Perspective,⁵ he claims that PDP model of brain can solve almost all the problems concerning the irreducibility of consciousness to brain. But when he reaches On The Contrary,⁶ his optimism plummeted. Earlier, he argued that PDP can explain all the problems of consciousness and so also the problem of plasticity of consciousness. Churchland never denies the plasticity of human nature even if it is an anti-naturalistic and anti-reductionistic claim. It is the claim that human nature is highly plastic and culturally configured. What constitutes a human consciousness is not just the intrinsic character of the creature itself, but also the rich matrix of relations it bears to the other humans, practices and institutions of its embedding culture. An implication to this claim is that, because of cultures are endlessly various and so also, human nature also is endlessly various. Human beings are self-defining entities and are plastic in nature. As human cultures evolve, so also consciousness, i.e., there is no stable human nature that a reductive/naturalistic account might hope to explicate or capture while defending these plasticity claims. Churchland tries to reconcile and explain the plasticity of human consciousness by a naturalistic and by means of reductionistic (inter-theoretic) approach.

Churchland claims that his approach to mind/brain, i.e., connectionism, which is an interface of computational neuro-science, cognitive psychology and artificial intelligence, can resolve the above-cited problems regarding plasticity. He argued that, through this new approach to the phenomena of human cognition, he can point out the weaknesses of the plasticity argument. In his view, connectionist approach is naturalistic, reductionistic and is capable of explaining both the radical plasticity of human consciousness and its dependence on cultural surroundings. Churchland argues that the plasticity problem is not so fatal since it can be explained by reductionists. His solution is that reductionistic theories never have the idea that human cognition and human consciousness admit only one configuration or style. So the plasticity is not a problem to the reductionists. He also gives a positive answer to the naturalistic reduction of plasticity. He says that plasticity can certainly be answered or explained by naturalistic theories. He cites connectionistic neural approach as an example to this, i.e., in that approach, one's basic cognitive apparatus consists of a very large network of interconnected units, which admits variation in the weights of its myriad connections. This particular configuration of the weights within that network determined the character of one's perception, cognition and behaviour. It is the many weights that determine what features in the world one responds to, which concepts one uses to process them, which values one embraces and which range of behaviour one commands. By giving a quantitative analysis of neuronal configurations in the human brain, which is greater than the total number of elementary particles in the entire universe, he gives us the idea how this will

help to overcome the problem of neuronal plasticity. If the above claim is true, i.e., the weights determine the character of one's perception, cognition, moral values, etc., then we can make two or more human beings as equally intelligent, morally good, etc., i.e., if it becomes true, then we can fill the world into only good and intelligent people by giving the appropriate weights to the neuronal system. So here, Churchland makes a serious mistake. But he thinks that this is an excellent position, which is capable of explaining the plasticity of human consciousness.

We must have a look at his proposal about the cultural embeddingness of human nature in this context. As regards the plasticity, he never rejects this also. He says that this is also not a problem to reductionists because the response and behaviours of human nature are wholly consistent with a reductionist programme for understanding the nature of human cognition. He says that suitably trained networks can represent and discriminate features of great subtlety. Here the important fact is that the network has a teacher who can help to shape the character of its internal representations and the pattern of its environmental responses. As what shapes them is the stimuli they receive. In the case of a human child, the infant is born into the local environment, which is the culture and the most dominant teacher. So in a human being the cultural surroundings really affect the organism.

3.4 Inter-theoretic Model of Reduction

One of the most important features of Neural Network Theory of Mind is the inter-theoretic reduction. As we know, reduction is a solution to many theorists of mind, but they do not completely succeed. To Churchland, all other reductions except inter-theoretic is wrong in the reduction of mind. Even though Churchland is a reductionist, his reductionism is not to be linked to classical reductionism, but it is a more sophisticated version of it. This particular method of Churchland makes use of recent developments in philosophy of science especially the socio-historical variety developed by Paul K. Feyerabend⁷ and T. S. Kuhn.⁸ Let us begin with classical reductionism.

Ernest Nagel is the exponent of classical reductionism. His work, The Structure of Science⁹ is known as the classical source on reductionism. It was a positivistic approach and the use of '*bridge laws*' was its special feature. There are as many as five responses to this classic position. Churchland turns paradigmatically against the hypothetico-deductive model of explanation, even though many critics argue that his model is no different from this. We have responses from Davidson who denied the efficacy of bridge laws in his account of anomalous monism. The third was due to J. Kim who preferred to construct a unique theory of mental causation making use of the notion of supervenience. The fourth response is from Searle who developed the notion of supervenience within the framework of his biological naturalist account as an answer to how brains cause higher functions of the mind. Lately Chalmers advances his logical idea of supervenience within his account of natural dualism. Davidson,¹⁰ for example, later

criticised this use of '*bridge laws*' by saying that there is no nomic laws connecting mental to physical. In this hypothetico-deductive model of reduction, the reduction of one theory of another requires the derivation of the laws of the reduced theory from those of the reducer theory. This is possible when terms of the first theory must be appropriately connected by '*bridge laws*' with those of the second. These '*bridge laws*' are taken to be bi-conditionals in form, providing a nomologically co-extensive property in the reduction base to each property in the domain of the reduced theory.¹ In short, Nagel's model reduction is an easy target that requires each mental property be provided with a nomologically co-extensive property in the reduction base.

In Nagel's model, reduction of each property **M**, of the theory to be reduced is correlated with a nomologically co-extensive property **P**, of the reducing theory, $M_1 \leftrightarrow P_1$, (by '*bridge laws*'). This is a model of conservative reduction, which conserves that which is reduced while the eliminative reduction dispenses with what has been reduced. This model of reduction is of comparable interest to that which consists in identity statements such as temperature = mean molecular kinetic energy. This type of reduction, which mostly operates in physical sciences, was a failure. There are many reasons for this failure, some of which are given as follows:

1. Davidson's criticism have the foremost importance, i.e., in his view, there should be no nomic laws connecting the mental to the physical.

2. The biconditional '*bridge laws*' are said to be too weak and they should be strengthened into some form of identities.
3. Often, the reduced theory is only approximately true and its laws are derivable only under special simplifying assumptions, which are false.
4. It is said that the condition of correctibility, which requires biconditional '*bridge laws*' is unrealistic and can seldom be satisfied.

A further case of reduction in the reduction of all psychological phenomena to neuro-computational and neuro-biological phenomena is a further type of reduction. But the irreducibility of qualia and the intentionality pose a problem to this type of reduction. This type of reduction is operative in cognitive science.

As a response to these failures, Churchland endorses a completely different model of inter-theoretic reduction. In this model, reduction of one theory to another requires a connected version of first theory or the image of that theory rather than the derivation of the first from the second. There are many examples of inter-theoretic reduction that can be seen in the history of science. Reduction of Kepler's astronomical laws to Newtonian Law of Motion, reduction of classical chemistry to quantum physics, sound to compression waves and light to electromagnetic waves, etc., are examples of inter-theoretic reduction. As Churchland takes it, these are all cases of conceptual unification and hence this forms one of the most important traits of inter-theoretic

reduction. In addition to this, the newer theory allowed us to explain much more than that the older theory had been unable to explain.

Within cognitive-theoretic reduction, when phenomenal qualia is reduced to its neuro-biological correlates, we can explain that the LHS is a special case of RHS. It also happens in the case of pain = C-fibre firing. The reason for taking this to be true is not far to seek. We cannot explain much about pain, but we are capable of explaining C-fibre firings. So, when pain is reduced to C-fibre firing, pain gets an explanatory validity, we can succeed to explain the folk concept of pain in terms of neuro-biology. But here, multiple realizability will raise some problem, i.e., pain can be multiply realised pain in human beings can be reduced or explained in terms of C-fibre firing in higher animals. But in lower animals this is not so. They do not have a C-fibre firing but this does not mean that they do not have pain. So, every instance of pain cannot be reduced to C-fibre firing because of this multiple realizability.

There are different pictures, which can be seen in the realm of inter-theoretic reduction. At one end, we can see the survival of old ontology (theory) in a significantly modified form. The old theory is being redescribed in a new and more penetrating vocabulary, e.g., when heat is reduced to mean molecular kinetic energy and light to electromagnetic waves, we can see claims of cross-theoretic identity. But at the other end, we can also see that the older ontology is eliminated entirely in favour of a more useful ontology and more successful laws of the newer theory. The reduction of old Phlogiston Theory of Combustion by Lavoisier's Oxygen Theory of Combustion, is a

good example for this outright elimination of the other. The elimination of caloric fluid, and the vital spirit of pre-modern biology are examples of this elimination.

Thus, in the case of the reduction of folk psychology to scientific psychology, chances are there for the outright elimination or for cross-theoretic identities. The eliminativist claim is that the basic propositions of folk psychology would not mirror the basic categories of scientific psychology. So it cannot be reduced in an inter-theoretic fashion, so it should be eliminated. But one cannot eliminate a theory such as folk psychology which has its strong foundations in the land of commonsense understanding.

3.5 The Rationale of Inter-theoretic Reduction

There are several reasons why Churchland favours an inter-theoretic reduction. They can be gleaned from the following:

1. Inter-theoretic reduction is a normal and fairly common place event in the history of science.
2. It consists of vindication of old theory at least in general outline.
3. Old theory is connected in some important details and in a restricted sense.
4. A '*deeper insight*' and thus a more effective control over the phenomena within the older theory can be provided.
5. Inter-theoretic reduction gives us a simpler overall account of nature.

6. In this type of reduction, the newer theory inherits all the evidences that had accumulated in favour of the older theory it reduced.

Let us turn towards the reduction of folk psychology to neuro-biology. We have earlier told that theory progression and elimination are the results of inter-theoretic reduction. Then, the question about folk psychology whether it should be eliminated or to reduced to a higher ontology, requires a fresh examination. Churchland's answer is that folk psychology should be eliminated. But his project was not a complete success. Elimination of folk psychology is not an easier business and hence, the question whether eliminativists really eliminate, evokes interest. Churchland himself has said that inter-theoretic reduction is not a sudden take-over of one discipline by another, but it more closely resembles a long, slowly maturing marriage. He says that the science of psychology will not disappear in the process of reduction, nor its role will not be limited to a passive-target of neural explanation. Higher-level science has helped to shape profoundly the development and articulation of its underlying science and it will surely be the same with psychology and neuro-science. Here, his ideas are not going for an elimination but a theory progression.

This inter-theoretic reduction is born out of Churchland's urge to unite philosophy of science with higher science. His methodological and scientific cues really derived from a Feyerabendian argument for incommensurability of scientific theories, which is closely on the heels of Kuhn's sociological account of scientific revolution in terms of paradigms. With the developments in experimental neuro-science and computer

simulation, much of the brain's microphysical organisation and functional significance are revealed. Churchland argues that now we are in a position to reconstruct the issues in the philosophy of science in neuro-computational terms.

Churchland enumerates five theses, which are central to the Feyerabendian philosophy as:

1. Perceptual knowledge, without exception, is always an expression of some speculative framework, some theory, it is never ideologically neutral.
2. The commonsense categorial framework with which we all understand our mental lives may not express the true nature of mind, nor may it capture its causally important aspects. This commonsense framework is in principle displaceable by a matured materialist framework, even as the vehicle of one's spontaneous first-person psychological judgements.
3. Competing theories can be and occasionally are incommensurable in the double sense that,
 - i. The terms and doctrines of one theory find no adequate translation within the conceptual resources of other theory, and,
 - ii. They have no logical connections to a common observational vocabulary whose accepted sentences might be used to make a reasoned empirical choice between them.

4. Scientific progress is at least occasionally contingent on the proliferation and exploration of mutually exclusive large scale conceptual alternatives to the dominant theory and such alternative avenues of exploration, are most needed precisely when the dominant theory has shown itself to be empirically adequate.
5. The long-term best interest of intellectual progress require that we proliferate not only theories but research methodologies as well.

Churchland argues that these claims jointly provide a unitary explanation to the reduction of connectionist model to Feyerabendian philosophy of science. He holds that, "*Just as Newtonian mechanics successfully reduced Keplerian astronomy so does a connectionist account of cognition reduce a Feyerabendian philosophy of science*".¹¹ In folk psychology's case, Churchland here says that the categories of folk psychology remain displaceable in favour of some more penetrating categorial framework. The real question is how large the doctrinal and ontological gap will turn out to be between new and old framework. Now, we can explain the above five theses in the light of a neuro-computational perspective.

1. On the Theory-ladenness of all Perception

About the theory-ladenness, the basic point is that, since there are endlessly many different possible observational frameworks the unprocessed activation vectors are explainable in terms of postulating hidden layer weight configurations. Human knowledge has causal but not epistemic foundations. The unprocessed activation vectors

at the sensory input layer are not propositional attitudes and they stand in no logical relations to anything.

2. On Displacing Folk Psychology

On the fate of folk psychology, he comments that whatever be its (folk psychology's) fate, i.e., reduction or elimination, the categories of folk psychology remain displaceable in favour of some new penetrating categorial framework. To him, the real question is how large the doctrinal and ontological gap will be between the new and old framework.

3. On Incommensurability

The prospect of widespread incommensurability threatens to make an empirical choice between competing theoretical frameworks impossible. But when one puts a theory aside, one can get down to the serious business of exploring how empirical data really steer out theoretical commitments. Here, Churchland is of the opinion that neural network processing frees us forever from the objection that incommensurable alternatives would make objective learning impossible. Since commensurability is just a measure of the similarity between alternative frameworks, incommensurability of theories are welcome which is both possible and actual.

4. On Proliferating Theories

Feyerabend points out that the important empirical facts can be properly dismissed when viewed from within one conceptual framework while those same empirical facts appear as tractable and incompatible with the first when they are viewed from within a second conceptual framework. This view is defended by Churchland from a neuro-computational perspective. He finds an achievement in error reduction from this point with an example of a simple feed forward network's journey during learning. He says that the moving point in weight error space is obliged to take a circuitous path in following the local error gradient downward in hopes of finding a global error minimum. But when the evolving weight-space point gets caught in a purely local minimum in weight error space in which the network is producing erroneous outputs. For any algorithm that moves the weight-space point, the network will be permanently stuck at that point, as it is concerned it has achieved the best possible theory.

There obviously exists some key discrepancies between T. S. Kuhn and Feyerabend concerning how much of our resources are to be put into proliferation and how much into pursuing a single but highly progressive '*paradigm*'. But Churchland comments, "*Proliferation is a desideratum that will never go away because the prospect of a false but compelling local error minimum is a threat that will never go away and because complacency is endemic to the human soul*".¹²

5. On Proliferating Methodologies

Artificial neural networks have recently proved capable to acquire some astonishing facts of knowledge. The striking fact about proliferation is that the space of possible learning algorithms is enormous. To Churchland, proliferation should be encouraged for the following two reasons:

- a. **Surface Reason:** This concerns the relatively limited aim of trying to understand how the human brain conducts its epistemic affairs.
- b. **Deeper Reason:** There is no reason to suppose that our biologically innate learning algorithm is the best possible algorithm or there exists a uniquely best learning algorithm. The proliferation of learning algorithms is a virtuous policy of long term science for the same reasons that proliferation is a virtue in the case of theories.

Churchland here adds a second argument to the proliferation of theoretical alternatives. This second argument derives its strength from our increased understanding of the computational capacities and the cognitive profile of recurrent neural networks. The argument goes, “*Recurrent modulation can make a decisive difference between success and failure in any given case*”.¹³ He adds, “*With recurrent network models of cognition, we can account for both the initial acquisition of prototypical categories and their occasional and highly profitable redeployment in domains outside of their original acquisition*”.¹⁴ Churchland argues that we can have additional data by proliferating

methodologies. But here the following question arises, '*Does it provide any additional data as he claims ?*'. When we proliferate theories, we hope a strong position which have more empirical power than the first argument. Let us examine each of the arguments below:

Argument I: A connectionist account of cognitive neuro-science can be reduced to a Feyerabendian philosophy of science.

Argument II: Large scale theoretical or explanatory advances in our scientific understanding typically consist in the swift deployment and subsequent exploitation in domains both familiar and novel of prototypes already learned from prior experience. With recurrent network models of cognition, we can account for both the initial acquisition of prototypical categories and their occasional and highly profitable redeployment in domains outside of their original acquisition.

In these two points, the second one gets its strength from the recurrent neural networks, which is different from the feed-forward network of the first. Here, Churchland will succeed only if the following two premises will fulfil. They are:

1. The second argument should have more empirical power than the first argument.
2. The second argument should explain the plasticity of human nature, since proliferation is granted only for explaining plasticity.

Hence, the explanatory power of the second argument is to be sought from the proliferation of theories, i.e., T_1, T_2, T_3, \dots if philosophy of science must be strong to sustain neuro-computational perspective. Churchland agrees with Feyerabend in his account of proliferation of theories. This is a consequence of the above meeting point between philosophy of science and cognitive science we come across in Feyerabend. But proliferation is granted only to explain plasticity (proliferation is a kind of multiplication, by Ockham's razor multiplication without necessity is wrong). We can say the second argument is strong only if, the second argument has the explanatory power to account for plasticity. But this recurrent back propagation network cannot explain the plasticity of human nature. If there is back propagation, we can make a person as we desire, but it is not possible. We know that all connectionist models are non-linear. If all connectionist models are non-linear, then they are expected to explain plasticity. But even so, PDP cannot be said to explain the problem of illusion, i.e., it cannot explain how a default arises or how a false belief arises. In the context in which human beings explain beliefs, the phenomenon of plasticity goes beyond the scientific or naturalistic explanation. Here, Churchland's position is nothing new but it only endorses a Quinean one. Thus it is said that cognitive science does not develop much beyond Quine. Nevertheless, Churchland may not agree.

3.6 Prototype Activation Vectors: The Basis of all Knowledge

Rationalists claimed that all knowledge depends upon innate states of mind, while empiricists claimed that all knowledge depends upon experience. Kant gave a synthesis

of the above two as the basis of his epistemological theory. Here Churchland gives us a scientific notion, namely, prototype activation vectors, which is the epistemological basis of his theory, neuro-computational connectionism.

*“An individual’s general theory of the world is not a set of propositions but a specific point is that individual’s synaptic weight-space. It is a configuration of connection weights, a configuration that partitions the systems activation vector spaces into useful divisions and subdivisions relative to the inputs typically fed the system. Useful here means ‘tends to minimise the error messages’.”*¹⁵ In a connectionist network, the weights on the various connections determine the response of the network to a particular input. The response of a network is a pattern of activation over a designated set of units. To him, the basic unit of animal-human understanding is the activation of neurones in the brain. The connections of neurones in our brains are parallel which means that sensory inputs are processed simultaneously and not step-by-step. Computer does it step-by-step fashion and if one connection is damaged, the whole system goes down. The view is supported by a group of AI researchers who work with a parallel computer system which is designed to recognise faces and is almost cent per cent successful in recognising faces. In this, the computer system has no mind or consciousness at all. As our brains work in the same way, we don’t have to postulate consciousness to explain how we recognise objects.

A further important feature of connectionist network is that they can recognise partly covered faces, i.e., the computer system of the brain is able to complete the picture

of the input. Part of a pattern to complete it what we have here is a primitive form of inductive reasoning, i.e., the important feature of the human capacity to gain knowledge. Churchland shows that this can be explained without an appeal to notions such as meaning or consciousness. This is very strong argument for reductive (eliminative) materialism. If he is correct, we can have the capacity to reason without meaning or consciousness. In this parallel neuronal connections not every connection is important even if a tenth of the connections are damaged the information will be processed. This is what is known as functional persistence or fault tolerance. When we see an object our brains transform it into a pattern of neuron activation somewhere in the brain. When the neurones in our visual cortex are stimulated in a way, the pattern emerges. The pattern differs with each face and each object so we can distinguish objects on the basis of slight differences.

According to Churchland, there is one pattern that represents the '*prototype*'. Churchland shows that object recognition is something for which no consciousness is necessary. We can recognise objects on purely physical basis. Churchland suggests that activated prototype vectors constitute the creature's recognition and concurrent understanding of its objective situation. By giving a quantitative account of neuronal network in the brain, he says that the total number of neurones in the human brain is greater than the total number of elementary particles in the entire physical universe. So much is the number of activation vectors. Explanatory understanding consists in the activational specific prototype vector in a well-trained network.

The prototype vector embodies an enormous amount of information. Each of its many elements constitutes one dimension of a highly intricate portrait of the prototypical situation. The vector has a great deal of structure whose function is to represent an overall syndrome of objective features, relations, sequences and uniformities. Its activation by a given cognitive circumstance represents a major gain in information. On each such occasion, the creature ends up understanding/misunderstanding more about the explanandum situation. What makes the recognition possible is the many and various examples, the creature has already encountered, and its successful generation of a unified prototype representation of them during the training.

The above view entails that different people may have different levels of explanatory understanding, even though their classification of the given situation is in the same way. The reason is that the richness of their respective prototype representations may differ. His unification theory of prototypes addresses the enormity of explanations. We have explanations such as causal, functional, moral, derivational, etc. To him, explanatory understanding is the same in among all these levels, but what differentiates them is the character of the prototype that is activated. Churchland gives many such type of activated prototypes namely property-cluster prototypes, etiological prototypes, practical, super-ordinate, social-information and motivational prototypes. This account of prototypes is interesting, which in my opinion, will vindicate his explanation of plasticity of human consciousness. We can now have a look on the different prototypes.

1. **Property-cluster Prototypes:** These are used to comprehend the vast majority of one's conceptual population, as and when they are activated on a regular basis in the course of one's worldly affairs.
2. **Etiological Prototypes:** These prototypes lie behind causal explanations and these are used to depict temporal sequences of events.
3. **Practical Prototypes:** Behind functional explanations there are practical prototypes. These also used to depict event sequences.
4. **Super-ordinate Prototypes:** These types lie behind the explanations of general truths. This kind of explanation is typically displayed in inter-theoretic reductions.
5. **Social-interaction Prototypes:** These types lie behind the ethical legal and social explanations. Since they all occur, the legal, moral, social sensibility may need a large system of social-intention prototypes.
6. **Motivational Prototypes:** These types depict a typical configuration of desires, beliefs and preferences, which underwrite folk psychological explanation of the mental.

He argues that the deployment of prototypes is central to explanatory understanding and for maximal virtue. It is important that they are thought to be part of a unified cognitive configuration. He hopefully comprehends that prototype-activation model of explanation

meets its own primary condition of virtue. The model really brings a uniformity among diverse kind of explanations. He also says that we should explore more about it.

3.7 State-space Semantics Vs Mentalese Semantics

As an eliminativist, Churchland's approach to intentional semantics is also profusely eliminativistic. His state-space semantics is against all the theories on a private semantics (intentions). On this account, there exists a live contradiction between Fodor and Churchland. Here, we are considering certain features of state-space semantics of Churchland that are quite opposed to Fodor's approach to intentional semantics.

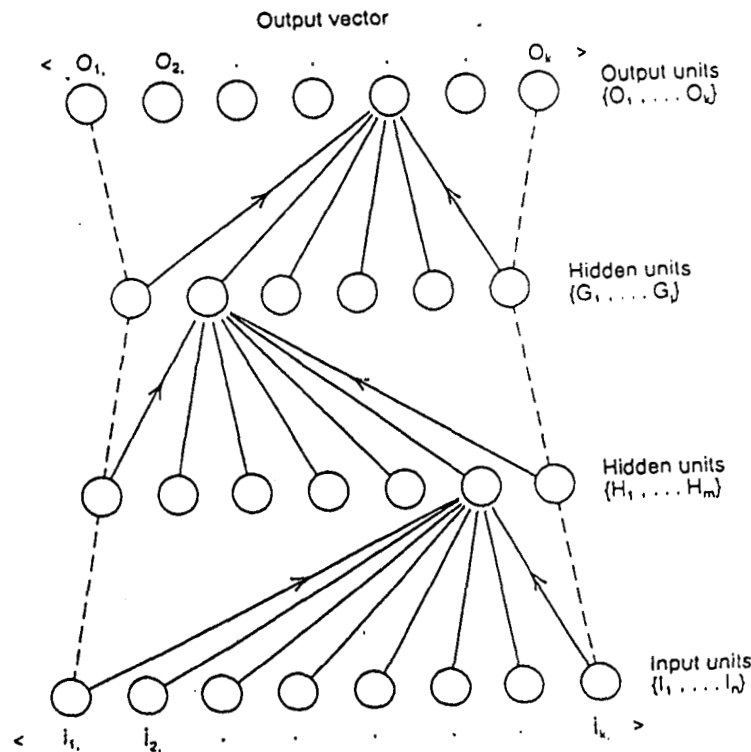


Figure 4¹⁶

*“The basic idea is that the brain represents various aspects of reality by a position in a suitable state, space and the brain performs computations on such representations by means of general co-ordinate transformations from one state-space to another”.*¹⁷ Please do turn to the above picture.

This Figure consists a population of input or sensory neurones $\{I_1 \dots I_n\}$, which project their axons forward to one or more populations of hidden neurons $\{H_1 \dots H_m\}$ and $\{G_1 \dots G_3\}$, which project their axons forward to a final population of output or motor neurons $\{O_1 \dots O_u\}$. The representation of network consists in the several activation vectors each of these distinct neuronal populations. It is this particular pattern or vector that has the semantic content. A parallel point holds for each of the network’s representations at each of the successive neuronal layers. The point of the sequence of distinct layers is to permit the transformation of input representations into a sequence of subsequent representation and ultimately to an output vector $\langle O_1 \dots O_k \rangle$ that drives a motor response of some kind. This transformational task is carried out at each stage by the configuration of synaptic ‘weight’ that connect each layer of neurons to the next layer up.

Churchland was criticised for the reason that in his characterization of sameness of content across distinct persons will require sameness of activation vectors across precisely parallel sets of ‘ n ’ neurons, one set for each person where the parallel consists in identical semantic significance for each of the corresponding elements or dimensions of the two n -tuples at issue, i.e., the objection is that one has the same meaning if and only if one has the same pattern over the same dimensions. Churchland’s answer is that

sameness of content becomes exponentially difficult to achieve when the dimensionality of the representations involved reaches into millions and where, we do not have a universal one-to-one correspondence between neuronal populations across individuals. There is enormous idiosyncrasy in the number and distribution of neuronal, cochlear or somatosensory cells. He says that only if we can get sameness of vectors, we can hope to get sameness of constituting dimensions.

Another question concerning the semantics of activation vector space is that '*Where do they get the semantic content ?*' Churchland clarifies by saying that the meaning of observation terms is independent of the sensory inputs that prompts their occasional application, i.e., his argument is that, two creatures could essentially share the same conceptual framework, even in the extreme case where they share no sensory organs in common. Churchland says that neural network can overcome the inevitable chaos, complexity, noise, etc., at the sensory periphery in such a way as to activate comparatively well-behaved and dynamically salient categories at higher levels of processing. From this, Churchland returns to a robust form of meaning holism. In the state-space or vector-coding approach, it provides a fresh account of our cognitive economy. Instead of a rule governed process of propositional attitudes, he presents a high-dimensional activation vectors being transformed into new vectors by virtue of passing through a series of well-trained matrices of synaptic connections. He says that the vector processing approach actually addresses the actual microstructures of the brain.

To what extent this will be regarded as an alternative to Fodor's approach ? Three arguments support the standpoint of the mentalese. Fodor's thesis that all thinking occurs in mentalese, is built on the edifice of at least three arguments that are formulated as follows:

I. The first argument of Fodor proceeds by attacking the natural sentential claim that beliefs and desires are relations to sentences in the natural language of the subject (believer), i.e., it's beliefs and desires are individuated in terms of the natural language sentences which one claims to constitute them. If so, then the resulting identity conditions to distinguish beliefs and desires in reality are same.

Fodor's claim is that once we have accepted that propositional attitudes are relations to sentences, the only theory constraint with the principle of individuation contained in the intuitive criterion of difference is that the sentences in question are sentences of mentalese. Look at the two sentences below:

1. *'The dog bit the man'*.
2. *'The man was bitten by the dog'*.

Fodor says that both of these sentences will translate into the same sentences of mentalese. The reason is that, both are equally acceptable to the public translations of the mentalese, which really constitutes their propositional attitudes.

II. Fodor's second argument for establishing mentalese is that animals and pre-linguistic human infants have thoughts (and so propositional attitudes) but no natural language. In this, the sentences constitutive of their thoughts cannot be in natural language and one cannot say that they do not have thoughts.

From Fodor's argument, the most important claim is that non-human animals have propositional attitudes. They entertain their thoughts in some form of mentalese whose sentences have the same meaning as simpler sentences of human natural language. But the problematic claim in this argument is that pre-linguistic human infants have thoughts and propositional attitudes. Peter Carruthers comments on this that, "*To suppose human cognition employs just one system of representation rather than two*".¹⁸ In his view, pre-linguistic infants thoughts are non-conscious one and so they may be relations to sentences of mentalese. But adult human thoughts are conscious but whether it is mentalese or natural language requires further investigation.

III. The third argument from Fodor to establish his thesis that propositional attitudes are relations to sentences of mentalese is based on the question of how natural languages are learned. His claim is that the only theory of learning which we have is that learning always involves an inference to the best explanation. In this view, learning consists of the familiar stage of scientific method such as data collection, hypothesis formation, testing and confirmation. This presupposes that the infant, when learns the meaning of a word has some symbolic system in which, it can describe and record the initial data. It can also express and modify its hypothesis. Since the symbolic system is medium of

representation through which natural language is supposed to be learned, it must be a universal, innate language-of-thought, i.e., to say, mentalese. It is instructive to recount Peter Carruthers's replies to these arguments. It is that knowledge of natural language is not so much a matter of knowledge. It is not the kind as the knowledge, which is involved in possessing a skill or practical capacity, i.e., learning our first natural language is not like learning quantum physics or acquiring the ability to ride a bicycle.

For his above argument, Fodor has two rejoinders, and they are stated as:

- a) If knowledge of a natural language is a practical capacity, it must be a special sort of capacity whose categorical basis in the brain reflects the semantic and syntactic structures of the language. In other words, the basis of the capacity to use a natural language is properly characterized in terms of propositional knowledge.
- b) The second rejoinder is a claim that, knowledge-*'how'* is to be assimilated to knowledge-*'that'*. Fodor claims that all cognitive processing at all levels of cognition involves computations on language-like representations. This language-like representation is criticised by the connectionists. This point will be taken into account in the fourth Chapter.

As described earlier, Fodor's **Modularity of Mind**¹⁹ can be considered as an example for classical computational (language-like) paradigm. In this model, he takes mind as decomposed into several modules and those modules are monitored by a central unit. Mind is organised into an input-output system – modules – and also as a central processor.

Modules include vision, audition, language processing and motor control while central processes include propositional attitudes and practical reasoning. The modules have the distinctive features such as isolated, innately specified and fast. It is because of the mental modules are dedicated processors, assigned a specialised role in cognition, they are isolated. And much of the operation of modules is innately specified and as a result of this, they are extremely fast in relation to central processes. Fodor's modularity view of mind has many other properties. But here our concern is to the language-of-thought and also to the language of mentalese in turn.

We can now turn to the commitments of Fodor to establish a modification of the hypothesis of language-of-thought, such as:

1. The subject needs a representational system for stating a hypothesis.
2. The subject needs a way of ordering candidate hypotheses for testing.
No subject will start with the hypothesis that a card is triangular if and only if, either there is a triangle printed on it or it is presented by an experimenter.
3. The subject needs a system for the representation of data.
4. The subject needs a way of matching data with hypothesis.

The above model requires something like a language-of-thought. For the representations must be fit subjects for logical operations and evaluations. Experience can rationally modify hypotheses only if, both data and hypotheses are represented in a suitable format.

Fodor concludes that cognition involves an inner sentential code. But that inner system is not the public language of the thinker, since pre-linguistic children and non-linguistic animals can have thoughts. Here, Fodor's central reason for denying that we talk and think the same language is that learning a language is a special case of concept acquisition. Fodor's stand is very much has been subjected to many criticisms by the connectionists and eliminativists. Especially, by the Churchlands. But with these criticisms, both his representational theory and language-of-thought hypothesis, can still have the prospect of defence and hence the incompatibility with Churchland's model requires a thorough probe so as to throw the hint that they are not as incompatible as they first appear to be. Briefly, there are different opinions among philosophers about the mental representation. Some think that it is sentential. Some others think that it is non-sentential. Here Paul M. Churchland has a non-sententialist view that is very much different from that of linguistic view on mental representation. In non-sententialists view, it is the ability to think which comes first and then only the ability to use language so thinking must involve some form of non-linguistic mental representation (i.e., non-sentential). The reverse is in the case of sententialists.

Churchland says that with a modern understanding of man (biological) and his place in nature, it is natural to conceive ourselves as epistemic engines. Here, Churchland claims that his non-sentential paradigm will have to ultimately reject the ideal sentential automation approach (sentential approach). On the sentential approach, one assumes that the current state of an epistemic engine is relevantly and adequately represent by a set of

sentences or propositions, i.e., we assume that the epistemic system is subject to inputs representable by sentences. In his view, there are two reasons for the domination of a sentential paradigm such as:

1. The sentential approach could hardly be more intuitive, i.e., when representing man by a set of sentences, the sentential approach is taking the commonsensical view. One does regard oneself as a seat of beliefs and specific beliefs as identified by the employment of a specific sentence. In short, this approach appears as a straight-forward attempt to make more systematic layout of what is already our fundamental conception of ourselves as epistemic beings. The sentential approach has its roots in the propositional theory.
2. The sentential approach is appealing because the theoretical resources are substantial by way of the links with the probability calculus and information theory as much as modern mathematical modelling.

But even if it is so, Churchland points out that: *“This thesis that rational intellectual development is an epistemic engine can’t at bottom be adequately nor even perhaps relevantly modelled or represented by sequences of sentences, sets and by the properties of and relations between them”*.²⁰

3.7.1 Parochiality Objection to Sentential Model of Representation

We can cite an argument from Churchland, which tries to show the poverty of sentential approach. The argument is as follows:²¹

1. Rational intellectual development in an infant cannot be accurately or even usefully represented by a sequence of sets of sentences suitably related. Bluntly, intellectual development at that stage is not ISA (Ideal Sentential Automation), that is, representable.
2. Rational intellectual development in an infant is entirely continuous with and it is not different in fundamental kind from the other. This is basically the same kind of activity as - rational intellectual development at later stages, even much later stages (adult stages).

Therefore,

3. As a general approach to what rational intellectual development consists in, the ISA approach is pursuing what must be within superficial parameters. This is, sentential parameters cannot be among the primitive parameters comprehended by a truly adequate theory of rational intellectual development, and the relevance of sentential parameters must be superficial or at best derivative even in the case of fully mature language using adults.

The above problem is known as the problem of early stages. Churchland proves that this argument is strong enough to reject a mistaken ideal of sentential approach. The cost is too high once we know that even for Churchland, the paradigmatic connectionist, with all his perspective is neuro-computational to the core, the incompatibility does not come to the surface. Thus, the hypothesis of language-of-thought or mental representation uses more or less the same method and hence not quite opposed. Now, we can search for the reasons he gave for the advancement of a non-linguistic approach.

By proving that sentential approach is parochial, Churchland advances this novel idea. He says that the kind of causal interaction we call language use is a dimension of activity acquired only after an enormous amount of prior cognitive development on the part of the human (infant). It is an ability that is never acquired by any or most of the many other natural epistemic engines with whose company evolution has graced us. It is plain that the higher animals are all centres of cognitive activity and all display the capacity for learning from experience. But, language plays no role in their activities. From this perspective, language appears as a peripheral phenomenon idiosyncratic to a single species of epistemic engine. Churchland says that it is easy to imagine creatures who use a systematic medium of information exchange between individuals, where the elements and the internal structure of that medium bear no similarity at all to the elements and situations of any human language, i.e., the idea that the fundamental parameters of cognitive development and intellectual virtue should find themselves displayed in the structure of human language is parochial as it is optimistic.

To acquire a specific language is to learn to process peripheral information into the categories that language provides. It is indeed to come to share in a specific view of reality. The informational matrix the language embodies comes to shape the processing of peripheral information '*from the top-down*' and by the means all who learn it are acculturated into a common view of the general nature of reality and of the possible configurations it may assume. Because of this, and their common command of a publicly manipulable matrix for specifying possible reality-configurations, the commerce of information exchange in such a group, can be as vigorous as we know it to be.

This is the primary role that language plays among human epistemic engines. It is sufficient to show against the inadequacies of sentential paradigm that language should play a such a role as to be consistent with the fact that its use must be acquired sustained and administrated by a more fundamental information processing systems of a non-linguistic kind at the micro-level. It is also consistent with the fact that language is characteristic idiosyncratic to the human epistemic engine and the particular elements and structures it happens to use are not uniquely essential to its abstract function as a medium of information exchange in any case. This is what is reinforced by his plasticity objection to sentential mental representation.

3.7.2 The Plasticity Objection to Sentential Mental Representation

Through this objection, Churchland shows that the linguistic paradigm is insufficient of the plastic nature of human beings. We know, Churchland's plasticity

argument that human consciousness is plastic has no stable character and so it cannot be reduced to anything. Here in the case of a language-based representation, he rejects the possibility for this. Language also appears to be sufficiently plastic in their actual and potential responses to sensory stimulation, i.e., we cannot specify any permanent features or dimensions common to all languages at all times. It is problematic that where these features or dimensions are suitable for framing a general characterisation of epistemological rationality. To Churchland, it is doubtless that all of a man's knowledge is grounded in the causal effects of the environment. His rational cognitive development is subjected to certain general constraints and these constraints are the acquisition of knowledge by man himself. Such knowledge enhances his epistemic performance. Then, the idea that these causal effects and general constraints can be ultimately construed sententially is incorrect.

3.8 Can PDP Explain the Status of Consciousness ?

Being an eliminativist, Churchland was severely criticised for eliminating consciousness. His notion is not eliminating the consciousness, but its subjective supra-physical feature. To him, there is nothing but the neuronal functions that carries the consciousness functions. The recurrent neural network modeling, he argued, can reduce consciousness. Recurrent neural networks have all the features of consciousness and so, he argued that consciousness can be reduced to physical/neurological. This is what his eliminating consciousness, i.e., the anti-reductionist nature, supra-physical character and personal appearance of consciousness that he eliminated. It was from Thomas Nagel,

Frank Jackson, David Chalmers, and John Searle the strong anti-reductionist arguments appeared. All of them are of the opinion that consciousness cannot be reduced to something physical. All of them recognised the inner nature of qualia or intentional phenomena, which is rejected by Churchland. The success of Churchland's model depends on the way he meets the above objections.

a) *'What it is like to be a Bat'*

Thomas Nagel through his *'What it is like to be a Bat'*,²² claims that the awareness that a bat has of the world has a distinct, subjective feel and this is not captured in physical descriptions of the bat. In short, we don't know what it is like to be a bat, because we don't have the experiences a bat has. I don't know what it is like to be you because you have your own experiences. Since experience and so consciousness, can't be reduced to something physical. From Churchland's point of view, we have a very good answer to this, i.e., everything in nature is within the bounds of physical science. Human beings, human-minds and consciousness are also in nature and it all can be reduced to physical science. His theory of neuro-computation is a novel cognitive modelling in which, the neuronal connections in the brain are all the facts. The neuronal connection are parallelly distributed and are in a recurrent fashion. This recurrent neural network can achieve all the characteristics of consciousness and so consciousness is something natural and not beyond the bounds of physical explanation or physical reduction.

3.9 The Hard Problem and the Explanatory Gap

Some philosophers, like Chalmers²³ and Jackson²⁴ took the problem of consciousness as the hard problem and believed that there exists a gap between the nature of consciousness and its causal/physical explanation. Some philosophers hold that this gap cannot be bridged, while some others tried to minimise the gap and some others scientifically argued that there is no gap. Consciousness is the part of human beings and so not beyond the bounds of physical/natural explanation. What make consciousness a hard problem is the subjective sensory qualia or the intentional character. It is called hard problem because a reductionistic account is not possible between consciousness and physical sciences. The intrinsic qualitative character or quale of a pain is to be sharply distinguished from causal, functional and relational features of a pain. Anti-reductionists argue that the quale cannot be reduced to anything physical while the reductionists argued that there is nothing subjective about the quale and so it can easily be reduced to physical explanations. Churchland argues that these are reducible to the explanatory aspiration of a growing neuro-science. *“The only requirement is to discover whatever states of the brain display exactly the same causal relational profile antecedently accepted by us as characteristic of the state of pain”*.²⁵ This would constitute a reductive explanatory account. Anti-reductionists account of consciousness is a first-person account and so it cannot be caught by others or it is incapable a third-person account. They make the claim that the intrinsic quale of pain is unique to each person’s knowledge. It is the unique awareness of consciousness whose essence cannot be captured by any type of reductive

explanations. To counter this, Churchland's neuro-scientific findings will serve a good solution, i.e., he makes possible the natural explanation of consciousness. Now, we shall add more details about the project.

3.10 The Reconstruction of Consciousness

By neuro-biological correlates and neuronal characterisation of brain, now we are reaching at a stage, where we can easily tackle the problem of consciousness and mind. The recurrent neural network model of brain, as developed by connectionists is one easy approach to consciousness. Even if, it is not so progressed, we can think that future researches will find in an all-agreeable physical status of mind and consciousness.

We have mentioned about the recurrent neural networks in an earlier section. Churchland gives some features of consciousness which stand out for a reconstruction as follows and also argued that those features also can be found in recurrent neural networks. They are:

- a) Consciousness involves short-term memory.
- b) Consciousness does not require concurrent sensory input.
- c) Consciousness involves directable attention.
- d) Consciousness can place different interpretations on the same sensory input.
- e) Consciousness disappears in deep sleep.

- f) Consciousness reappears in dreaming in an altered form.
- g) Consciousness brings diverse sensory modalities together in a unified experience.

Earlier, he had said that the only requirement to reconstruct consciousness is to discover which neuronal states of the brain can display the exact causal/relational profile, i.e., that is characteristic of a quale. Here, he agreed that the recurrent neural network have reconstructive resources that might eventually prove relevant to all of the elements of the above list. He says that any recurrent neural network already embodies a form of short-term memory, i.e., when the information processed through the cycle mode many times then a slow degradation occurs. Such a system provides a short-term memory. As consciousness does not require concurrent sensory input, the recurrent network also can engage in cognitive activity in the absence of the current stimulation at the input layer. It is because of the activity in the pathways can be sufficient to keep the system humming away all on its own. This can modulate the manner in which it reacts to sensory layer stimuli and the salience that certain aspects of the command of that input. Churchland says that this gives us a crude analog for both the plasticity of conceptual interpretation and perceptual attention. In deep-sleep, consciousness disappears in human beings can be considered as a cognitive shut-down, as in a recurrent network its pathways selectively disabled for a time (it will temporally revert to a feed-forward network) it will lose all cognitive capacities. A recurrent network can integrate information from different sensory modalities by delivering information back to common cell population. This is

relevant to the unified experience, i.e., brings diverse sensory modalities into unified experience, of consciousness.

Churchland concludes his construction of the consciousness by saying that we know that brain is a recurrent neuronal system and there is experimental evidence provides some initial support for the conjectures about the contrasts between deep-sleep, dream-sleep, and the waking state. His answer to the problem of consciousness raised by anti-reductionists is this. He says, "*A representation is an element of one's current consciousness awareness just in case that activation vector occurs at the focal population of a suitably central recurrent system in the brain, a system that unites the several sensory modalities and dominates the control of motor behaviour*".²⁶

Through his reductionistic hypotheses, Churchland mounts his criticisms against the anti-reductionists which are stated as follows:

1. We can surely give an illuminating physical account of the intrinsic nature of our various sensory qualia since they are all activation vectors.
2. We can suggest a possible account of when such vectors are a part of one's current conscious experience.

To a great extent Churchland succeeds in constructing a physical consciousness through his neuro-computational perspective. Critics accused him for eliminating the mind and consciousness. But what he eliminates is not the mind or consciousness, but their supra-physical nature and irreducibly to any natural laws. His position is eliminating the

necessity of personal conscious experience. To the anti-reductionists, Churchland replies that everyone has his or her personal neuronal network, his own internal resources for gaining knowledge about his own sensory and cognitive states. These are personal, causal connections that no one else has. This does not mean that there is something non-physical about these states. I can know what it is like to be a bat, but I cannot know it in the way the bat knows. In short, '*there is nothing supra-physical, nothing beyond the bounds of physical science here*'.²⁷

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CHAPTER IV

AN ESTIMATE OF NEURO-COMPUTATIONAL PERSPECTIVE AS A THEORY OF MIND

4.1 Connectionism and its Aftermath

In the previous two Chapters, we have singled out the two cardinal pillars of Churchland's Neuro-Computational Perspective and its consequent Scientific Realism as part of the understanding of eliminativist option, which is supposed to sustain eliminativism as a theory. The first was the eliminativist counter to the Fodorian linguistic modelling and the second was the eliminativist reduction of one theory to another without falling a prey to incommensurability. We have assessed its merits as a theory of micro-cognition with its anti-linguistic, anti-representational, imagistic eliminator, etc. Our conclusion was pointing at the way it could function as an independent theory of micro-cognition at the level of imagery alone. Secondly, we have analysed the potential of the inter-theoretic programme and pointed out its inherent drawbacks. Now, we shall situate his account within the ongoing contemporary debate between Churchland and the numerous other critics so as to place his theory on the map of cognitive science. First, we shall consider what happened to connectionist researches in recent years.

We saw that connectionist neural networks are multi-layered networks that simulate the human brain/mind. Parallel processing, back-propagation, etc., are its significant features. It is different from classical cognitivism, i.e., sentential. In connectionism, the basic categories of human knowledge is not sentences but activation vectors. Prototype activation of vectors produce basic understanding in human beings. It consisted in the view that brain consisted of a network of simple electrical processing units which simulated and inhibited each other. This network is with extensive feedback connections, hence recurrent network. Connectionists hold the view that if artificial neural network provide a good model of how the human mind works, then many of our commonsensical ideas, about human cognition will have to be abandoned. The problem is that whereas a computer of traditional design stores and processes discrete representations of information, connectionist machines do it in a widely-distributed fashion, i.e., no piece of information is locatable in any particular set of units, but all of the information is embodied in its overall activation pattern and connection strength. Thus any attempt to identify distinct beliefs with distinct representational states of a person's brain will be undercut by connectionist models of human cognition. If so, connectionist models present a serious challenge to both folk psychology and functionalism. The rise of connectionism really make human cognitive apparatus fully comprehensible by a reductionistic approach. But the influence of connectionism is questionable. Now, we can look on connectionism and its aftermath.

As the basis of estimation, let us turn to the usefulness of connectionist networks for simulating human performance. We already know that it is different from symbol manipulating systems. But in connectionist network, the connections allow the network to respond to patterns activated on the input units by activating patterns on the output units. Networks can be trained so that a variety of different patterns all result in activation of the same output pattern, while other group of patterns generate different output patterns. As a result, such networks can readily be interpreted as performing activities of pattern recognition and categorization. These networks exhibit some useful proportions for pattern recognition. With its merits, it will have to face myriad of criticisms. Now, we can turn towards the criticisms levelled against connectionism and also their responses to it. While there is a great deal of merit in connectionist research, such a paradigm is often subjected to criticisms, and what we want to examine here is whether connectionism can survive its criticisms.

1. Connectionism is irrelevant to cognition proper: Some cognitive scientists have the view that the term cognition refers to process involving reasoning. They reject the view of connectionists saying that cognition refers to a basic process such as pattern activation. Rosenberg¹ is one of the most important among critics in this sense. They elasticised connectionism with saying that connectionism is irrelevant to cognition proper. But connectionists have two possible answers to this in their hand. The first one is that, it is possible to train connectionist notions to use their pattern recognition capacities to carry out logical operations. The second answer is that, one might construe

it as an advance to refocus attention in cognitive source away from reasoning to these more basic cognitive processes that have been overlooked. But the difficulty in accounting for these processes are that they require pattern recognition and this process needs to be taken seriously.

2. Connectionist model's cannot perform any real computations: Minsky and Papert are the exponents of this criticism raised against connectionism.² As the followers of serial symbolic approach to artificial intelligence, they performed a careful mathematical study of perceptions. Their study was about single-layer perceptions and they showed that the classes of function or classes of behaviour that could and could not be computed by that type of system. Moreover, the problem of connectedness also could not be computed. But connectionists argue that even though Minsky and Papert were correct in their analysis, the results apply only to the single-layer networks and not to the multi-layered and non-linear networks. Minsky and Papert conceded that multi-layered networks can be constructed and compute the functions. But they also raise a further problem about the training of networks. To them, the multi-layered network cannot be trained which is a certain thing to the connectionists. Thus, the criticism raised by Minsky and Papert does not have much strength to attack and cut connectionism in size.

3. Against the anti-sentential model of connectionism: This criticism is from Fodor and Pylyshyn who argued that, "*The manner in which the meaning of complex sentences is built-up compositionality applied to thought generally and it requires a symbolic system*".³ They complained that connectionist models are not cognitive. This complaint is common to all classical computer theorists. As an example, thorough-going exponent of classical symbolic model believes in the systematicity, productivity and causal interactivity of sentences. To Fodor, all these qualities of a language is also common to a thought. They argued that classical symbol systems like language naturally exhibit systematicity since they employ symbolic representational operations, which are built-up by a compositional syntax. This compositional syntax supports a compositional semantics. This symbolic representation is lacking in connectionists architecture and so they are inadequate cognitive systems. Fodor's criticism evoked many responses among connectionist community. Among the responses, one is very interesting and nihilistic in nature, which is denying the systematicity of human thoughts, especially infrahuman thoughts. While doing so, they thought that this will reduce the efficacy of the above challenge, since it allows that much cognition might have a different character (not systematic) than the critics assume. There was another response which argues that the way systematicity appears in human cognition is due to the fact that humans have learned national languages, which themselves have a syntax and semantics. On this account, networks become sensitive to the structure of language so as to be able to

extract information from linguistic inputs and produce linguistic outputs. But this never entails building up an internal linguistic structure to use in internal processing.

Yet, it is doubtful that whether any of these approaches are sufficient to account for the cognition in adult humans. Whatever maybe the merit of this criticism, it is presumed that the connectionist may give some version of classical symbolic approach. Here Fodor's and Pylyshyn's views on compatibilism are stronger than that of connectionists. The main points of the compatibilist attack from Fodor and Pylyshyn are as follows:

1. Connectionism is either a theory of the implementation-level or is a theory at the computational-level.
2. If it is a theory of implementation, then it does not threaten classical cognitive structure, which is about the computational-level.
3. As a theory at the computational-level, it is wrong if it is incompatible with classical symbolic theory because only the classical theory can explain systematicity and productivity.
4. So connectionism is not a threat to classical computationalist structure.

This criticism against connectionism is the significant in that it argues that, if connectionism would accommodate this feature of classical cognitive theory, it can advance towards an interesting paradigm of connectionist research. Similar is the

argument of what Kim Sterenly calls as his compatibilist position. To quote Sterenly here, "*If connectionism replaces language-of-thought based views of cognition, it will do so in part by lowering our estimate of the powers of our cognitive engine*".⁴

4. Connectionist models are at the wrong level of analysis: Broadbent,⁵ argued against connectionism that they are at the wrong level of analysis. It is true that connectionist models are valid, but they are at the wrong level of analysis and therefore are not relevant to psychological data. He argued that psychological evidence is irrelevant to connectionist arguments about distributed memory, since the distributed nature of memory is only relevant at the implementational (psychological) level and the proper psychological-level is the computational-level (David Marr,⁶ provided a notion of levels of processing which was very influential analysis at the three levels of processing in cognitive science, i.e., computational-level, procedural-level and physical-level). Broadbent acknowledges only two levels of theory, i.e., computational (psychological) and the instrumental (physical). Connectionists like Rumulhart and McClelland argue that connectionist accounts of cognition are at the same level as most traditional models from cognitive science.⁷ In their view, connectionist accounts are at the algorithmic-level and are aimed at specifying the representation of information and the processes involved in cognition. What needs emphasis here is that the three levels as given by Marr, are causally related and viewing them independently is a mistake. The connectionist view is that as all the levels are interrelated, equal emphasis should be placed at all levels, not to focus at any one level, i.e., if a model were developed that

would require more than one serial step in every millisecond then that model would not be a good candidate for implementation in the brain.

5. Connectionism exercises in reductionism: This criticism raised against connectionism gives the idea that the connectionist models exercise on reductionism, i.e., all psychology is reduced to neuro-science, then ultimately to physics. It is argued that any coherent phenomena that emerges at any level requires their own language of description and that connectionism denies the essence of what is cognitive by reducing it to units and connections rather than adopting a more psychologically relevant language in any explanations. Connectionists respond this with the argument that their aim of understanding cognitive processes as emerging from interactions of connected units, i.e., they are concerned with all levels of understanding.

6. Connectionist models lack Neural Realism: A more severe criticism against connectionism is that connectionist models lack neural realism, i.e., connectionism does not look close enough to the brain. There are many facets of neuro-science that reflect in connectionist architecture. The connectionist models no more represent the architecture of the brain than do conventional computer architecture. Sometimes the fine structure of the brain represent the mechanisms that have been adopted and that are not known to exist in the brain (E.g., back-propagation). A very prominent example is the assumption that units may have both excitatory and inhibitory connections, when it is reasonably clear that most cortical units do not. Then, it is argued that if connectionism purports to be interested in the micro-structure of cognition, then why

should it ignore such a characteristic of the actual physical processes that underlie the micro-structure. It is true that cognitive models are of course approximations of the details of the current knowledge of the brain, but they are approximations that conventional computers cannot claim. It is accepted that our incomplete models must miss out some of the details of neuro-physiology and that connectionist architectures cannot claim to support all of human cognitive process. However, it can advance knowledge by understanding the type of cognitive processes it does support it by identifying those processes that it cannot support and direct research accordingly into these areas, i.e., current connectionist models are said to be simply one-step in a chain of approximations, where each step takes us closer to human cognitive architecture and therefore to understand human cognitive processes.

7. Another criticism against connectionism: Is from Pinker and Prince, who attacked on the language-learning account of neural networks.⁸ They attack one of the most important examples in connectionist network that appeared both to learn the past-tense form of English verbs and to go through the same learning stages that a child does. They argued that the developmental realism of connectionist model is an artifact of the learning-set on which the network is trained. They also argued that the connectionist account of language-learning fails for reasons intrinsic to connectionism. Through their paper, Pinker and Prince raise many critical issues against connectionism such as the radical replacement for language-of-thought based theories. They argue that connectionist representations are insufficiently rich and that attempts to make them

more adequate results in implausible and ad hoc micro-features. They argue that cognitive theories must recognise structural relations between representations, not just relations of causal association or overall similarity. They argued that the theoretical virtues of an account of cognitive processes based on rules operating on representations are understood by connections.

From all these above criticisms, we can understand if the connectionist models can accommodate the sentential paradigm with a natural language, it would be a good model as many thinkers thought of. As Bechtel cites, "*It is unclear as yet whether any of these (connectionist) approaches are sufficient for the kind of cognition found in adult humans. It may be that ultimately some version of the classical symbolic approach will be required*".⁹ Philosophers like Dyer and Sun are also developing such hybrid models that employ both connectionist principles and symbolic processing principles. As a novel paradigm, connectionism is in its way of making profound consequences in the fields of philosophy, psychology, biology and neuro-physiology. With its criticisms and advantages, we can wait to see whether this model spread easily and overwhelmingly. Because of its challenge against classical philosophic pattern, which was a matter of storing propositions and processing them in accordance with the laws of logic, this challenge was very influential in the field of philosophy. Nevertheless, the perennial question remains whether it provides a viable alternative to the classical model. Thus, it is presumed that connectionist model can perform better when it is in combination with classical model and hence, it can yield a perfect and full-fledged

system. So, the classical connectionist model, is a much more radicalised version than a non-classical connectionist model, which provides a modest version. In a sense, the fundamental questions as to what makes it a connectionist architecture, how does it function at the micro and macro levels and whether the processing is linear or non-linear remain a serious topic for future research. We have to include this here with a view to get a complete picture of the current developments in the philosophy of mind. The essential conclusion is that a thorough grasp of the brain-mind relation is plausible only in the light of family of models, none excluding the others. But, even if a hybrid approach is required, the connectionist elements in such models might serve to extend the conception of cognition beyond the traditional perspective of logical reasoning. This shows the primary importance of connectionist model. As Bechtel says, *“In helping to create this expansion of our understanding of the cognitive, connectionism has thus made a contribution to cognitive science”*.¹⁰ So, in connectionist philosopher’s opinion, even in a hybrid approach their model needs the importance. As we saw it, as a novel cognitive paradigm, connectionism is in its way of making better consequences. It not only broadens our perspective on the theory of mind, but it also broadens our epistemological domain.

Now, we shall introduce another nuance into our methodology to make a final assessment of Churchland’s realism. We shall counterpose other more interesting cognitive modelling, especially from Carruthers, Dennett, Penrose and Searle so as to examine how best it could be defended against the controversies. Among them,

Carruthers is first to be taken, since we know that in Carruthers understanding, there is a natural transition to folk psychology. Churchland is strongly against any transition to folk psychology in his eliminativist outlook. The propositional attitudes do not exist in his words. Still, he is in a search for a complete physical reduction of mind and its functions. We have already discussed Churchland's and Stich's cases against folk psychological realism, which resulted respectively, in scientific realism (Churchland) and a realism of Papineau-type (Stich). In his deconstructing programme, Stich criticises his earlier stand by saying that his entire conception of the elimination was radically mistaken. He takes folk psychology as a tacit theory and proposes that the process of uncovering and criticising tacit theories is the case of deconstruction, so much so that eliminativism pursued paradigmatically a species of deconstruction. Tacit theory of theory-theory has nothing empirical with it. On his re-reading, a word-world relation is missing in it. Here, he argued that what is missing in an eliminativist argument is a theory of reference, for which two solutions are available. The first solution is a proto-science account and the second is a folk semantics. But, he realises that the appeal to reference and semantic ascent are non-starters when it comes to settling ontological questions as raised by eliminativists. (About the existence of propositional attitudes).

In the field of cognitive science, a fierce opposition between theory-theory and simulation theory exists. Theory-theory and simulation are two views regarding our prediction of other peoples' behaviour actions. Theory-theory is based on a theory, which is innate, while simulationism is just simulating others. We just pretend to be in other's place and think what should we think or do in his place. The two views have its supporters and critics. When confronted with such a debate, Stich speaks as follows, "*When subjects do a poor job of predicting the behaviour of other people, the explanatory resources of the theory-theory are considerably greater than those of the simulation theory*".¹¹ He gives two points against simulation theory such as:

1. The predictor's decision-making mechanism is different from the targets.
2. The pretend belief and desire generator has not provided the decision-making system with the right pretend beliefs and desires.

This is what Carruthers also stresses in his approach. He says that the main issue between theory-theory and simulationism concerns the sort of cognitive process involved in mind-reading, i.e., whether it is knowledge-driven or process-driven. Here, Carruthers supports a theory-theory view over simulationism. Even with advocating a theory-theory view, he is not against a hybrid view, i.e., a mixed version of theory-theory and simulationism. For what simulation is needed is for inferential enrichment, i.e., going from already attributed beliefs to further beliefs have from

already attributed goals to further sub-goals. Carruthers advances his folk psychological realism by fully acknowledging the place of natural language in thoughts.

4.2 Churchland versus Carruthers

The main points of debate between Churchland and Carruthers are about the status of folk psychology and language-of-thought. Through his works namely, Philosophy of Psychology¹² and Language Thought and Consciousness,¹³ Carruthers gives his main points of this debate. We can first take the problem of the status of folk psychology. As opposed to Churchland's dismissal, Carruthers endorses a realist view on folk psychology, i.e., on the realism of intention and of facts. He is against an elimination of folk psychology for the irreducibility of folk psychology to scientific psychology. In his view, scientific psychology takes some of its terms and principles from the folk, and so scientific psychology should come to enrich the theoretical commitments of the folk. On Carruthers's view, even though folk psychology is silent about neural implementation, it does have a lot to say about the way in which the mind functions. He says that with the aid of a little reflection on our folk psychological practices we can tease out several significant implications concerning categorisation, causal activity and conceptualisation.

With this realistic commitments in mind about folk psychology, Carruthers argues that, both forms of elimination, i.e., '*elimination now*' and '*elimination in prospect*' are disturbing because they invariably suggest that folk psychology is

radically mistaken. In his view, refutation of beliefs, attitudes, etc., would cause a self-refutation to elimination, when it says that there is no such thing as thought. We have noted earlier Churchland's three important reasons for the elimination of folk psychology. They are (1) The explanatory Failure, (2) The Stagnation, and, (3) Its Irreducibility to other Higher-order Theories. Carruthers demonstrates that all of these reasons are not very strong. His points are summarised as follows:

1. When Churchland argue for the reasons for ultimate elimination of folk psychology, he takes folk psychology as powerless in explanatory features. He gave the examples of learning and memory in which folk psychology keeps silence. But Carruthers point is that when raising such objections as above, Churchland himself forgets the fact that he is dealing with a commonsense (folk) theory which doesn't have the comprehensive and systematic concerns of scientific understanding. There are gaps and limits to commonsense explanation. In the long history of folk psychology, thousands of generations of children have grown-up without their connective advances being tracked, probed and accounted. It only shows that folk psychology does not go far enough, not that there is anything wrong with it as far as it goes.
2. As to other complaint of Churchland against folk psychology about its lack of change in essential aspects throughout recorded human history, calling it as a form of stagnation and infertility indicative of degeneration, Carruthers agrees on the fact that folk psychology is stagnant for centuries, but it shouldn't be taken as

a sign of decay. He complains that here again Churchland misses the distinction between folk and scientific theories. To Carruthers, folk theories and scientific theories have a different focus of interest. To Carruthers, the explanation for scientific theories are general, whereas folk psychology is about the conduct of particular individuals. So in a way, one can say that folk psychology is the most fertile of theories, since it is reapplied for countless times, with endless individual variation in each generation.

3. Churchland's third reason for the elimination of folk psychology is its irreducibility. Carruthers agrees on this irreducible nature of folk psychology but he says that this irreducibility cannot account for the elimination. In his view, type-identification is occurring in such reductions and because of the multiple realisability problem, this reductionism is not a standard one. Carruthers takes folk psychology to be broadly correct in its causal functional categories and there is no reason for scientific psychology to ignore its intentional states. To him, this intentional contents are represented by a language-of-thought than a '*connectionists neuronal network*'. He argues for a version of '*mentalese*' as against '*prototype activation vectors*'. Now, we may turn towards his adherence to a '*language-of-thought*'. As against Churchland's anti-sentential model, Carruthers argues for a sentential (or semi-sentential) representation of intentional contents to the brain. He argues against the imagistic approach with saying that, "*It is plain that no image or sequence of images can, of itself, carry*

*the content of even a simple thoughts such as 'All grass is green'.*¹⁴ He also says that, there is no imagistic account to the concepts like 'and', 'or', 'not', etc., i.e., we have many concepts which represent things which do have an appearance, but which do not represent them in virtue of their appearance. Carruthers argues that it is not wrong to say that thought involves some sort of language since an image system would presumably mirror the structural properties and combinational powers of a language. So, sometimes our thoughts can consist in a mixture of images and sentences. A paradigm such as the above is found favour with Andy Clark,¹⁵ who defends folk psychology from a connectionist point of view.

Carruthers thought that a sentential form of mental representation will vindicate the propositional attitudes and their contents. In his view, there are three features which the propositional attitudes have such as (1) They are systematic, (2) They are productive, and, (3) They are causal interacting. He took sentential approach as a solution to these three problems, i.e., propositional attitudes are relations to internal sentences, for sentences have contents. So thought is productive and systematic because there is a '*language-of-thought*'. In the face of the combined variety of Fodor-Carruthers thesis account, folk psychology looks like a plausible theory, Churchland's criticism notwithstanding.

In the classical computational account, thoughts are carried by mentalese sentences, but the transitions among those sentences are computational and these

computational transitions among sentences are somehow realised in neural states of the brain. But this picture has been challenged by connectionist neuronal network theory. Carruthers uses the picture of Marr's three levels of analysis to cite the difference between classical cognitivism and connectionism. The three levels are Functional-level (top), Algorithmic-level (middle) and Implementational-level (bottom). At top-level, intentional laws are discovered and formulated, and at middle-level, the rules for transferring mentalese sentences may be specified and at bottom-level, physical processes sufficient to execute the algorithmic steps may be described.

Here, Carruthers makes an important distinction between connectionism as a claim about the mere implementational-level and attempts to use connectionism either at the algorithmic-level or at the functional-level. The mere implementation is not a threat to classical cognitivism. He says that it is impossible for a symbol-crunching machine to run on a connectionist machine, just as connectionist networks are in fact modelled by programs in classical computers. Anyhow, Carruthers's critique of connectionism cannot do much damage to Churchland's position for the simple reason it is compatibilist in its core.

4.2.1 Natural Necessity Theses of Language

Do our conscious thoughts really occur in a private or public language ? This question evolves much interest in cognitive science field and on this question Carruthers's solutions have some importance. In Carruthers's view, language has two

functions, namely language-for-thought and language-for-communication. He constructs two theses based on this fact in which one is strong and the other is weak (Natural Necessity Strong and Natural Necessity Weak). In Carruthers view, cognitive conception of language is more important than that of communicative conception. So he proposes to argue that there is a natural necessity attaching to the fact that human conscious thinking involves public or natural language (former stand). To him, human conscious thinking assigns a central role to language and he argued for a public language in cognition. In these two Natural Necessity theses, hence called as, NNw and NNs, the weaker version maintains that propositional forms of human conscious thinking necessarily involve public language, while the stronger one claims that many of the thought types are themselves essentially language involving. Here his suggestion is that, it may be naturally necessary that distinctively human (complex) thinking should involve public language.

4.2.2 Natural Necessity Weak (NNw)

*“Some human conscious thinking (viz. conscious propositional thinking) is such that of natural necessity, it involves public language, in virtue of the given architecture of human cognition together with causal laws”.*¹⁶ This thesis is weak for the reasons stated as follows:

1. It does not follow from the thesis that there are any thought contents, which can only be grasped through their expression in some public language.

2. It does not claim that all conscious human thinking involves public language. It is conceded that some conscious thinking can be imagistic without involving language.

4.2.3 Natural Necessity Strong (NNs)

*“Some human conscious thinking in such that of natural necessity it involves public language (in virtue of the given architecture of human cognition, together with causal laws) and necessarily some of these propositional thoughts belong to types which constitutively involve such language”.*¹⁷ One can draw a number of implications from this thesis. They are stated as follows:

1. Many of our conscious thoughts constitutively involve public language.
2. Conscious thoughts could not have been tokened in the absence of such language.
3. Many of conscious thought tokens belong to types, which constitutively involve public language.

In Carruthers’s view, the truth of NNs would mean that the language faculty is yet even more deeply embedded in central cognition. Not only conscious propositional thinking involve natural language sentences, but the thoughts so entertained would consist in relations to natural language expressions. Thus, not only would the language faculty be

employed in central cognition, but it would bring with it many of the concepts and conceptual structures which are distinctively employed in human conscious thinking.

Here at the first stage, Carruthers argued for the natural necessity of a public language in human conscious thinking, but he changes his stand to a hybrid position of mentalese and public language in his later work, Phenomenal Consciousness.¹⁸

In this, Carruthers distinguishes higher-order linguistic description of theory (HOD) of consciousness from higher-order-thought (HOT) theory of consciousness and prefers the second. His reason for it is that HOT is independent of language while HOD cannot be structured without the involvement of language. He argued that there is good reason to suppose that a mind-reading faculty capable of structured HOTs would have evolved prior to the appearance of natural language. It follows that HOTs are independent of language, i.e., a capacity for HOTs can be retained in the absence of language. Carruthers later stand really points to a situation where language is absent. But we know that there are no thoughts without contents. If thoughts have contents, then it should be in view form such as a mentalese, an image or sentence. Thus here, in Carruthers stand, the possibility for a private, innate language-mentalese is agreed upon. Carruthers really goes in tandem with Fodor's modularity of mind. Really Carruthers's intention is to protect folk psychological realism. He also has the intention to give an objective and natural explanation of phenomenal consciousness. He conjectures that consciousness (Phenomenal) can be given a cognitive explanation in terms of HOT theories. His conclusion is that by this the distinction or conflict between folk

psychology and cognitive science turns out to be illusory. This is an important signpost in understanding Churchland or Stich's position against folk psychology.

4.3 Churchland versus Dennett

Daniel C. Dennett¹⁹ is one of the influential philosophers of psychology. He is famous among them with his instrumental stand. In his view, content and consciousness are the two important topics in philosophy of mind. His aim is to demystify the nature of consciousness. For this, he first develops a theory of content and then a theory of consciousness based on the theory of content. For our present purpose, Dennett wears a look of an eliminativist. He invariably thinks that consciousness can be explained away. His eliminativism is more an eliminativism about qualia, as many critics point out. Dennett thinks that people have intentional states because the intentional strategy works as a predictor of their behaviour. But philosophers like Carruthers thinks that intentional strategy works as a way of predicting people's behaviour because people have intentional stance.²⁰ But Dennett maintained that ascriptions of propositional attitudes are produced by the adoption of a particular predictive stance, which is justified by its predictive success and practical utility. He introduced the idea that an intensional system was anything that was amenable to analysis by the certain tactic, intentional stance. Really it is the tactic of interpreting an entity by adopting the presupposition that it is an approximation of the ideal of an optimally designed self-regarding agent. Dennett's analysis of intentional stance have its relation to other two stances such as design stance and physical stance.

The design stance and physical stance are the extended analysis of intentional stance, but these two stances do not negate the intentional stance. In design stance, the design by which intentional stance is exhibited is considered when the very physical structure by which the design is implemented is taken into consideration, the analysis is at the physical stance.

As we told earlier, Dennett's theory of consciousness is based on his theory of content. Having a mind is a matter of being intention-ascribable, i.e., when a system can be considered as having mind, it has mind. But to Dennett, to be conscious is different from to have a mind. It is the self-awareness of one's own states what he called by consciousness. This self-awareness is inextricably linked with the development of language. That is why Carruthers prefers HOT theory of consciousness over HOD theories (Higher-order-theories of consciousness are independent of language while higher-order-dispositionist theories are linked with language). Carruthers comments that dispositionalist HOT-theories are wrong for a theory of phenomenal consciousness. But to Dennett, there is no such distinctions as access consciousness, creature consciousness, phenomenal consciousness, etc. His Multiple Drafts Model is against the Cartesian theatre conception in Cartesian dualism. He refutes the view that there is a point in brain where consciousness can be located. To him there is no such thing as consciousness separate from our self-awareness of our own states. Dennett complains that even the neuro-scientists make the mistake of locating consciousness at some point in brain. Dennett says that there is no '*filling-in*'

carried out by consciousness. For this reason, P. S. Churchland took Dennett to be wrong. They complained that Dennett's thesis is nothing but a variant of behaviourism.

His Multiple Drafts Model attacks the notion of qualia. He argues that the very concept of phenomenal consciousness is incoherent. His finding here is based on thought experiments. As per his Multiple Drafts Model, all varieties of thought or mental activity are accomplished in the brain by parallel, multi-track processes of interpretation and elaboration of sensory inputs. There is no centre, which has privileged access to the operations of mind. For this point, he is considered as an eliminativist by Ned Block. Ned Block examines Dennett's example of two coffee tasters to prove this. Ned Block states that:

"He (Dennett) uses a thought experiment about two coffee tasters, Chase and Sanborn. Both liked Maxwell House Coffee when they started, and both dislike it now. But they tell very different stories about what happened. Chase says that he has become more sophisticated, he used to like the taste of Maxwell House, but he no longer does. Sanborn is equally certain that he can remember what the coffee used to taste like, but he still thinks that the original taste is a great taste. The source of his change, he says, is a change in his perceptual apparatus, perhaps his taste buds. He no longer gets that nice old taste when he drinks Maxwell House. Dennett points out that either Chase or Sanborn or both might be wrong because of changes in their memories of the taste. For example, perhaps, Maxwell House Coffee still tastes exactly the same to Sanborn as it always did, but his memory of what it used to taste like has slowly imperceptibly

changed over time. So Sanborn's current dislike of Maxwell House could be traced to a memory change plus a change in his standards with no change at all in his perceptual machinery. Further Dennett points out, their reports are consistent with a variety of combinations of partial or total changes in memory, aesthetic standards and perceptual machinery".²¹

Here what Ned Block is trying to do is to reconstruct Dennett's arguments in an eliminativist pattern. He makes the following arguments which forms the eliminativism of Dennett:

1. Suppose phenomenal consciousness exists, that is, there are real phenomenally conscious properties.
2. Then there can be a fact of the matter as to whether Chase and Sanborn are right.
3. But, if there are real phenomenally conscious properties, they are transparent.
4. However, only an expert, say a neuro-psychologist who can examine the brains of Chase and Sanborn, could tell whether their memories, aesthetic standards and current conscious qualities on drinking Maxwell House have changed.
5. The fact that we cannot rely on the testimony of Chase and Sanborn themselves shows that phenomenally conscious qualities are not transparent.
6. From (3) and (5) we can deduce that there are no phenomenally conscious qualities.

Here, what Ned Block tries to reveal is the fact that Dennett's consideration of phenomenal consciousness, (and consciousness as such) is an eliminativist one, i.e., from the examples of Chase and Sanborn, it is true that phenomenal consciousness is not transparent. Hence, phenomenal consciousness does not exist.

But this eliminativist point is very much different from that of Churchland's. In Churchland's eliminativism we saw that, it is the supra-physical character of mind/consciousness that is being eliminated. Moreover, Churchland says that, we can locate consciousness somewhere in the brain with the advances of neuro-science. To him, mind is nothing but the neuronal activations in the brain. What Churchland eliminates is the supernatural character and he tries to bring them into the ambit of physical sciences. But what Dennett eliminates is the consciousness and the '*qualia*' or the qualitative nature of inner states. The rejection of qualia was a serious criticism raised against the behaviourist, Dennett also does the same. But here our main consideration is not this, but the refutation of the '*filling-in*' carried out by consciousness. In Dennett's Multiple Drafts Model, the single unified nature of mind/consciousness is broken-up in cerebral space and real time, i.e., fragmented into many distributed moments of micro-taking. Dennett says that there is no place where it all comes together and so many of the familiar assumptions about the denizens of human phenomenology turns out to be wrong. For the same reason, Dennett comments that '*inverted spectrum*' and '*absent qualia*' and '*propositional attitude*', etc., are fundamentally misbegotten. Dennett himself claims that the intermediate ontological

position he favours is a mild realism. It is a synthesis between Quine and Ryle. To quote Dennett, “*What do you get when you cross a Quine with a Ryle ? A Dennett, apparently*”.²²

Now, we shall look on Churchland’s attack on Dennett’s rejection of the ‘*filling-in*’. What is going on when one’s blind spot is seen as filled-in is analogous to two things such as visual perception and non-visual perception. In these two things, Dennett favours the second one, i.e., acquiring the non-visual representation that the family dog is under the bed, on the basis of one’s visual perception of his tail slicking out. But in visual perception it is a representation of the whole dog. Dennett’s hypothesis is that, “*The fundamental flaw in the idea of ‘filling-in’ is that suggests that the brain is providing something when in fact the brain is ignoring something*”.²³ Dennett’s claim is that the brain ignores the absence of data from the region of the blind spot. Here what follows is the data that strongly implies that at least some instances of filling-in do involve the brain providing something.

With their neuro-biological evidences, P. S. Churchland and V. S. Ramachandran argue that, when one sees an apple, the brain is in some state that can be described as representing an apple. This representation consists of a pattern of activity across some set of neurones, particularly in the visual context, that have some specific configuration of synaptic weights and a specific profile of connectivity. Dennett says that, the area of blind spot is simply neglected, i.e., the brain doesn’t have to ‘*fill-in*’ for the blind spot, since the region in which the blind spot falls is already labelled. According to

P. S. Churchland and V. S. Ramachandran, the trouble with Dennett's approach to the various filling-in phenomena is that he confidently prejudices what the neuro-biological data at the cellular level will look like. They accused Dennett of jumping to conclusions about what the brain does not need to. To quote, "*Reasoning more like a computer engineer who knows a lot about the architectural details of the device in front of him than like a neuro-biologist who realises how much is*".²⁴ Still to be learned about the brain, Dennett jumps to conclusions about what the brain does not need to do ought to do, and so forth.

They are also in conflict with Dennett's claim that, there are no homunculi, who are supposed to care about information arising from the part of the visual field covered by the blind spot and so when nothing arrives, there is no one to complain. Dennett also says that, "*The brain's motto for handling the blind spot could be: 'Ask me no questions and I will tell you no lies'*".²⁵ P. S. Churchland and Ramachandran say that Dennett's may seem to have engineering plausibility, it is a bit of *a priori* neuro-physiology gone wrong with him. Biological solutions are not easily predicted from engineering considerations. Dennett is appreciated for his brilliant proposal to debunk the idea of brain that contains a Cartesian, theatre where in images and the like are displayed. But it is the hypothesis of '*filling-in*' (absence of) that makes Dennett's position problematic here. Churchland and Ramachandran argue that it is the strict adherence to behaviouristic ideology that makes Dennett's position. It looks as if

sometimes Dennett's position of debunking the Cartesian Theatre appears to come closer to that of Stich, but it has more Rylean content.

Here they give us the heart of Dennett's behaviourism, as the conceptual framework of the mental does not denote anything real in the brain. The importance of the mental framework is not derived from neural or any other reality rather, it is an organising instrument that allows us to do fairly well in explaining and predicting one another's behaviour, the literal unreality of Qualia and so forth, notwithstanding. According to Dennett, even though there is nothing really in the brain that corresponds to visual awareness of red, there is something or other in the brain which allows us to get on pretty well in making sense of people's behaviour on the pretence that the brain really does have states corresponding to awareness of red. But Churchland and Ramachandran comments on the debunking treatment of Dennett by saying that it is just as the teaspoon of sugar that makes the medicine of behaviourism go down. Dennett has argued against the neural reality of mental categories but argued for the instrumental utility of them.

Dennett's instrumentalism conveys the idea that, "*The brain doesn't fill-in, there is nothing whatever to distinguish between a misperception and a misrecollection, there is no time before which one is not aware of, a sound, and after which one is aware, human consciousness is a virtual machine that comes into being as human learn to talk to themselves, and so forth*".²⁶ While Churchland's scientific realism is in contrast to Dennett's instrumentalism conveys that we determine by empirical means what

hypotheses are probably true and hence what categories truly apply to the mind-brain. At this stage, it is reasonable to consider sensory experiences to be real state of the brain, i.e., states whose neuro-biological properties will be discovered as cognitive science proceeds. Even with Dennett's achievement with showing the dangers of Cartesian Theatre, Churchland comments that it is an ensnare to those who refer to perceptual filling-in by means of the expression 'filling-in'. If it is so, then the achievement of Dennett is semantic but not empirical. They comment that Dennett's thesis of '*no filling-in*' is merely a semantic hypothesis and a linguistic prohibition about the mind-brain. To quote, "*Taken as a linguistic prohibition other than an empirical hypothesis about the mind-brain Dennett's thesis is that 'the brain does not fill-in' sounds uncomfortably, like a quirky of the word 'police'.*"²⁷

4.4 Churchland versus Penrose

Much controversy between Penrose²⁸ and Churchland has been taken place with respect to the problem of consciousness. It is known to us that for the Churchlands consciousness is certainly a property of the physical brain. The mystery is how neurons achieve such effects as feeling pain or experiencing some senses. But in Penrose's view, the mechanism for consciousness involves quantum-gravitational phenomena, acting through micro-tubules in neurons. But it is doubtful that consciousness is generated in micro-tubules. Here, for examining this first, we may consider Penrose's hypothesis and then Churchland's reactions to it.

4.4.1 Penrose's Toilings with Micro-tubules

We can simply formulate Penrose's hypothesis in the following piece of an argument:

1. Human thought is non-algorithmic or non-computational.
2. Non-algorithmic quantum-gravitational phenomena conceivably implicates micro-tubules.
3. Micro-tubules conceivably implicates consciousness.

Here what Penrose is doing is conceiving consciousness in a new vein. But its plausibility is problematic. Penrose's hypothesis is based on Godel's results for leverage. Using Godel's result, Penrose argued that the mechanism for consciousness involves quantum-gravitational phenomena, acting through micro-tubules in neurons. A compact version of Penrose's hypothesis is given in the Churchlands (1998) as follows in three parts.²⁹ First part is about the non-algorithmicity of human conscious thought, second is to the inadequacy of current physical theory and third part is about the micro-tubules as a means of generating consciousness.

Part I: Non-algorithmicity of human conscious thought.

Ia. Human thought, at least in some instances, is sound yet non-algorithmic, i.e., non-computational.

Ib. In these instances, the human thinker is aware of or conscious of the contents of these thoughts.

Ic. The only recognised instances of non-algorithmic processes in the universe are perhaps certain kinds of randomness.

Id. Randomness is not promising as the source of the non-algorithmicity needed to account for Premise **Ia**.

Therefore (via **Ia-Id**),

Ie. Conscious human thought, at least in some cases, perhaps in all cases, relies on principles, which are beyond current physical understanding, though not in principle beyond any future scientific physical understanding.

Part II: Inadequacy of current physical theory

IIa. There is no current adequate theory concerning the ‘collapse’ of the quantum-mechanical wave function, but an additional theory of the quantum-gravity might be useful to this end.

IIb. A more adequate theory of wave function collapse could incorporate non-algorithmic and yet non-random process.

IIc. The existence of quasi crystals is evidence for some such currently unrecognised, non-algorithmic physical process.

Therefore (via **IIa-IIc**),

IIId. Future theories of physics, in particular quantum-gravity, can be expected to incorporate non-algorithmic processes.

Part III: Micro-tubules as the means of harnessing quantum-gravity

IIIa. Micro-tubules have properties that make certain quantum mechanical phenomena possible.

IIIb. These non-algorithmic non-random processes will be sufficient in some sense, to account for **Ie**.

IIIc. Micro-tubules play a key role in neuronal functioning.

IIId. Neurons play a key role in cognition and consciousness.

IIIe. (via **IIIc** and **IIId**) Micro-tubules play a key role in cognition and consciousness.

Therefore,

IIIIf. Micro-tubules, because they have one for in quantum mechanics and the other in conscious thought provide a window for non-algorithmicity in human cognition.

Therefore,

C (via **I**, **II** and **III**).

Quantum-gravity, or something similar, via micro-tubules, must play a key role in consciousness and cognition.

The points given in three parts above give a compact vision on Penrose's idea of consciousness. Now, we shall turn to how the Churchlands refute it.

When Penrose argues that human consciousness is non-algorithmic, he meant it is non-computational. Because of this rejection of computation it is not suitable to cognitive science. We all know that cognitive science takes mental functions basically as computation (computational representation understanding of mind), i.e., non-algorithmic. Penrose meant that the performance of the system could not be produced by any algorithmic procedure, or it could not be approximated by an algorithmic procedure. But the question that whether such a non-algorithmic system, which is physical exists is not answered adequately. Penrose adds that quasi-crystals may such phenomena. When saying about human consciousness, Penrose tells that the brain must be such a deeply non-computable system. To quote Penrose, *"It is a kind of reduction and absurdum argument in which I try to show what would happen if we tried to construct robots with the kind of ability to understand that we have. Because the Godel argument is basically about understanding, it tells us to how to move from one formal system to a system outside that from the understanding of what the system is trying to say. It is concerned with the question of the meanings of the symbols, which is a dimension that a computational system does not have, a computational system just has the rules which it follows what one can do in mathematics is, by understanding the*

*meanings of the symbols, one can go beyond the formal rules and see what new rules must apply from those things, and one does this by understanding their meanings”.*³⁰

Here in this account what Churchland’s answer is that non-formal systems can do the works as done by formal systems. They gave the examples of Artificial Neural Networks that can do a significant job as said. Artificial Neural Networks (ANN) are capable of learning complex pattern recognition tasks. In the former chapters, we have discussed about neural networks. Once the synaptic weights have been set, networks can perform very well on new cases - training up the network. This training is not a programming with an explicit algorithm. In any case, the ANN has no explicit rules that govern its performance. The ANN processes are analog and parallel and the machine is flexible and plastic. These striking capacities make ANNs exciting to robotics which makes them relevant to real nervous systems. In the early stages of connectionism, ‘*computing without rules*’ was its motto. The ANN’s can learn, they have analog properties, they are flexible, fault-tolerant, or can give good answers to degraded inputs - these make neural networks more suitable and powerful than classical programming. The point is that these input-output functions are carried in algorithmic design and so here what Penrose argued for becomes intolerable.

In a compact version of Penrose’s hypothesis, we have seen that Quasi-crystals are example for non-algorithmic physical process. Churchland took this as an unconvincing evidence. For showing it, we can here take the arguments of Penrose in this context, as reconstructed by Churchland and RickGrush.

- a) Because there exist sets of tiles, which tile the plane only non-periodically, the question of whether a given set of tiles will tile the infinite. Euclidean plane is not decidable (algorithmic).
- b) Some of these non-periodic sets tile the plane with five-fold symmetry.
- c) There exist '*Quasi-crystals*' whose lattice structure exhibits a similar five-fold symmetry.
- d) So, the growth of these crystals depends on non-algorithmic process (may be).

Therefore,

Conclusion: *The existence of Quasi-crystals is evidence for some such currently unrecognised non-algorithmic physical process.*

Churchland argues that the argument is unconvincing. The main reason is that Premise **d** and **Conclusion** do not follow from Premises **a – c**, i.e., even if the analogy between the structure of Quasi-crystals and the non-periodic tilings were close, the problems whose computability is at issue in each case are different. The reason is that, Quasi-crystals are in fact finite, i.e., unlike the Euclidean Plane, and hence their growth undoubtedly is computable. Algorithms are indeed proposed for the growth of such crystals. Penrose himself had noted this fact earlier and this will go against his hypothesis.

4.4.2 Do Micro-tubules Really Generate Consciousness ?

Penrose argued that micro-tubules play a vital role in cognition and consciousness. In his view, the micro-tubules, which reside in the body cell, generate consciousness. Now we shall to ensure whether this story is a convincing one.

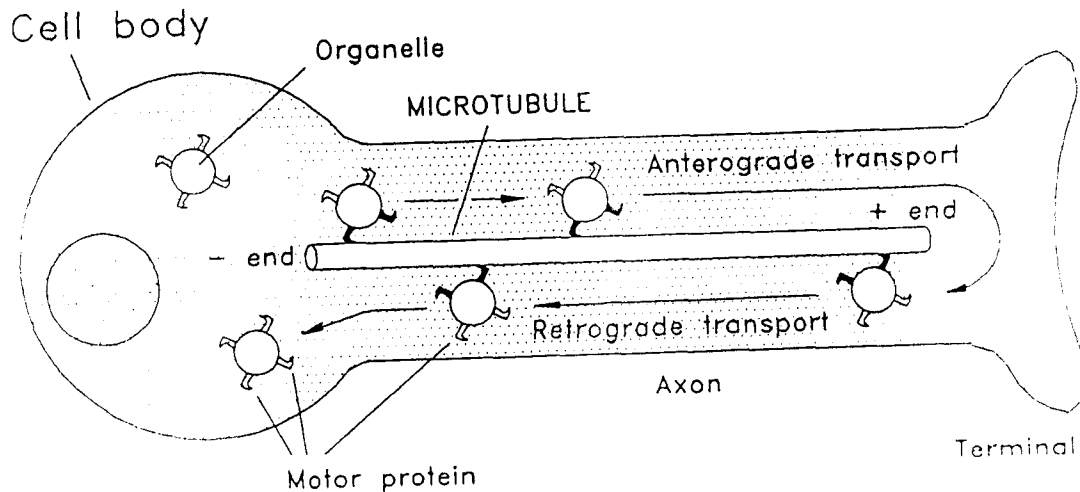


Figure 1³¹

This schematic drawing of a neuron shows the micro-tubule's role.

All body cells have micro-tubules. The main function of these micro-tubules is to support cell division. The preferred role for micro-tubules is altering neuronal signalling by way of modifying presynaptic efficacy. Penrose's idea is this: If the

tubules can do the above said job, then they can shape specific patterns of activation in the brain and these particular patterns are what support consciousness. Here, what micro-tubules must do is, to encode the information derived from sensory outputs, to process it and modify the firing of neurones in such a way as to support consciousness.

But, Churchlands object to this idea of micro-tubules generating consciousness. To them, it is impossible to the micro-tubule clusters in different neurones be in unity or co-ordinate their activity to shape the neural activity which support consciousness. It is sure that changes in a single neurone will not cause the generation or loss of consciousness. Thus by attacking the three parts of Penrose's hypothesis, Churchland shows that Penrose's hypothesis is incorrect. The important points are summarised as follows:

1. There is reason to doubt that human cognition or consciousness must take the advantage of non-algorithmic processes (against non-algorithmicity of human consciousness).
2. There is no evidence at all that, there are any non-algorithmic process anywhere in the universe (against Quasi-crystals which Penrose shows us as the evidence for non-algorithmic process).
3. It is doubtful that micro-tubules generate consciousness, i.e., because micro-tubules can depolymerise without noticeable effect on consciousness they can't support consciousness.

Here Churchlands doubt that micro-tubules generating consciousness. They said that, they are not proving the falsity of quantum-consciousness connection. But this is a mere objection, not a frontal attack. Now, we shall have to turn towards the controversy that exists between Churchland and Searle.

4.5 Churchland versus Searle

John Searle,³² a fierce critic of strong artificial intelligence and an anti-reductionist, is taken here for consideration. He opposes the view that computer/machine can simulate human mind/consciousness. There is much controversy taking place between Churchland and Searle, where I take some of them. It is very much granted that Churchland is the advocate of Scientific Realism. He also thinks that, everything regarding human beings can be reduced to physical or natural, since human beings are part of the natural world. So his idea is that consciousness is also a neuronal function and nothing supra-physical needs to explain it. When we answer a question, '*Could a machine think ?*'. Churchland's answer will be '*Yes*' and Searle's will be '*No*'. To Churchland, even the thoughts are being constructed mechanically. Here, we may relate into the broad features of the controversy.

4.5.1 Against Strong AI View

Searle refuted the strong artificial intelligence in one sentence saying that, "*Minds cannot be identical with computer programs because, programs are defined syntactically in terms of the manipulation of the symbols whereas minds have mental or*

semantical content".³³ More than a syntax, they must have a semantics. His refutation of this strong artificial intelligence is known as '*Chinese Room Argument*', which can be paraphrased as follows:

"A non-Chinese speaker is locked in a room with a box full of Chinese symbols and given instruction on book in English for matching Chinese symbols with other Chinese symbols and giving back Chinese symbols in response (answer) to Chinese symbols put in through the window (questions). The symbol-box inside the room is a database and the English instruction book is a programme. The people who give questions and designed the instruction book is called the programmers and the non-Chinese is indistinguishable from the response of a Chinese. Through this, a non-Chinese speaker is passing the Turing Test for understanding Chinese without understanding a word in Chinese".³⁴

Searle's refutation of strong artificial intelligence can be written logically as follows:

1. Programmes are formal (syntactical).
2. Minds have contents (semantical).
3. Syntax is not sufficient for semantics (programmes are not sufficient for contents).
4. It follows, therefore, something is left out in our conceptualisation of mind.

5. Consciousness is irreducible to any form of matter (anti-reductionist conclusion).

This argument shows that a system could instantiate a programme so as to give perfect simulation of some cognitive capacity such as the capacity to understand Chinese, even though that system had no understanding of Chinese whatever. The point is: “*If I do not understand Chinese, on the basis, of implementing the programme for understanding Chinese, then neither does any digital computer solely on that basis because no digital computer has anything that I do not have*”.³⁵

Churchland’s defence of cognitive science comes by citing the question begging nature of the above argument. On his view, the functionalist can determine the type identity of any propositional state by imagining a sufficiently programmed computer that can display an economy of internal states whose interconnections mirror our brain. Against holding that purely formal operations lack meaning, understanding and intentionality, Churchland defends his position by saying that, if the Chinese Room were upgraded suitably to include content just as any normal humans do along with all the inductive skills we are endowed with we can understand the Chinese, and *a fortiori* the various computational states would have meaning and intentionality.

Here, in this context, Churchland cites ‘*Luminous Room Argument*’ parallel to Searle’s ‘*Chinese Room Argument*’ to show the inadequacy of ‘*Chinese Room*’.

The ‘*Luminous Room*’ goes as follows:

1. Electricity and magnetism are forces.

2. The essential property of light is luminance.
3. Forces by themselves are neither constitutive nor sufficient for luminance.

Therefore,

- C. Electricity and magnetism are neither constitutive of nor sufficient for light.

This argument raised an opposition to the suggestion of James Maxwell that, light and electromagnetic waves are identical. Here what really occurs is: *“Consider a dark room, containing a man holding a bar magnet or charged object. If the man moves the magnet up and down, then according to Maxwell Programme of Artificial Luminance (AL), it will initiate a spreading circle of electromagnetic waves, and will thus be luminous”*.³⁶ But as all of us who have toyed with magnets or charged pith balls well know, their forces, even when set in motion, produce no luminance at all. It is inconceivable that you might constitute real luminance just by moving forces around.

This is what the story of Luminous Room. Here what Maxwell can do to route out of this criticism is three points, which are:

1. He can say that, the Premise 3 of the argument is false.
2. He can say that the Luminous Room experiment demonstrates nothing of interest, one way or the other about the nature of light.
3. He can insist on the point that, what is needed to settle the problem of light and the possibility of artificial luminance is an ongoing research programme, i.e., a

programme to determine whether, under appropriate conditions the behaviour of electromagnetic waves does indeed mirror perfectly the behaviour of light.

The same is what happens to Searle's argument Churchland comments, "*Even though Searle's Chinese Room may appear to be 'semantically dark', he is in no position to insist, on the strength of this appearance that rule-governed symbol manipulation can never constitute semantic phenomena, especially when we have only an uninformed commonsense understanding of the semantic and cognitive phenomena that need to be explained*".³⁷ That is, even though Searle's Chinese Room lacks real semantic understanding, it might constitute intelligence. Here, Churchland complains that, Searle simply exploits our ignorance of them. To cite Churchland, "*Rather than exploiting our understanding of these things, Searle's argument freely exploits our ignorance of them*".³⁸

What Churchland wants to comprehend is that, artificial neural networks with Parallel Distributed Processing can simulate human intelligence to a great extent. Churchland says that, vector transformer in brain-like networks can escape from Searle's criticism. It is because of the fact that, parallel systems can do many of the cognitive skills besides symbol manipulation. Searle's criticism affects the symbol manipulating systems, but not the parallel ones. But being aware of parallel systems, Searle also thinks that they too will be devoid of real semantic content. For showing their failure, Searle outlines a second thought experiment, '*Chinese Gym*', in which a gymnasium full of people organised into a parallel network which proceeds as in the

Chinese Room. Here what Churchland's answer is that, even if the single persons fail to understand Chinese, the whole unit succeeds in it. So even if one neurone in artificial neural network fails to understand, the whole system can succeed. Here what bases Searle's position is his commonsense intuition about the presence or absence of semantic content, while Churchlands take the specific virtue of brain-like network as the basis. This is the most important point of difference between them.

4.5.2 The Irreducibility of Consciousness

There is another point of dispute between Churchland and Searle about the nature of consciousness. We know that Churchland believes in a complete reduction of mental phenomena, which is the root of his '*eliminative materialism*'. Here lies the opposition from Searle. To Searle,³⁹ consciousness can't be reduced to something physical or natural. It is the intentionality that makes this too impossible. Searle emphasises his anti-reductionism with rejecting all the reductionistic approach concerning the mind. His position on mind, he calls, '*Biological Naturalism*' holds the view that mental states are natural states of biological organisms. He asserts that mental phenomenon is entirely natural phenomenon caused by the neuro-physiological activities of the physical brain. But insists on the view that mental phenomena form an ontologically distinct class of natural phenomena that causally arise from the interaction with physical phenomenon but cannot be reduced to any physical phenomena.

Here, we have to discuss a '*Family-of-Arguments*', which is about the anti-reductionistic nature of consciousness put forward by Nagel, Jackson, Searle, and Chalmers, Ned Block. These arguments are criticised and rejected by Churchland. Now, I am going to illustrate the arguments and Churchland's criticisms. In order to this, Churchland takes the example of light and finally shows that what is there irreducible in the nature of light is not really irreducible or it is simply reducible. Now, the '*Family-of-Arguments*' are:

1. Original or intrinsic visibility Vs derivative or secondary visibility.
2. The original visibility of light marks to a unique ontological category, i.e., the phenomena of light must be irreducible to any purely physical or not-essentially-visible phenomena.
3. Electricity and magnetism are neither identical no sufficient for light (Strong Eliminative Materialism).
4. There is ontological distinction in the nature of light, which can be seen in the distinction between visual appearance and reality.
5. The visible properties of light are distinct from the physical properties of electromagnetic waves.

6. Light is always a necessarily visible, there can be no such thing as invisible light. [This is called the Connection Principle, since it unites the points (a) being light, and, (b) being accessible – from the visual point of view].
7. Light is a phenomenon ontologically distinct from irreducible to any purely physical phenomena.
8. The intrinsic feature of light, which is responsible for the original visibility, is luminance, which is unique in being epistemically accessible only from the visual point of view.
9. Even complete knowledge of the physical facts still leave something of the nature of luminance and therefore, luminance must be non-physical.
10. There exists an explanatory gap between physical process and luminance.

Now, we shall summarise Churchland's criticism against all of these points mentioned in the above.

1. The first statement falsely elevates an extremely peripheral feature, light into a deep and presumptively defining feature of light.
2. The second statement breaks the question on exploitation of superficial stereotypes and electromagnetic ignorance because some unfamiliar physical things may indeed have original visibility.

3. The third statement is plainly against the central question of physicalism. It is false because electromagnetic waves of suitable wavelengths are sufficient for original visibility.
4. This statement is a reflection of our own ignorance rather than an unique ontological status the light had. This is because of the fact that the reflection is nothing more than our unfamiliarity with how light is perceptually apprehended and with how that intricate process can occasionally produce false perceptual beliefs.
5. Churchland argued that objective properties of light are identical with electromagnetic relation and also the various casual properties are explained by the smooth reduction to electromagnetic features rather than '*left-out*'.
6. Against the sixth Premise, Churchland argues that most light is invisible, not just shallowly invisible, but permanently beyond human visual apprehension.
7. Against this anti-reductionistic statement, Churchland argues that there is no motivation for any such anti-reductionist research programme and it is a certain fact that light can be smoothly and systematically reduced to electromagnetic waves.
8. To this statement, Churchland's reply is that there is no hard problem at all and there is no defensible ontological distinction between intrinsic and extrinsic

features. Luminance is just a normal and entirely physical capacity of electromagnetic waves to excite our own rods and cones.

9. The ninth statement gives a false idea that light has two distinct modes of epistemic access such as, physical features by scientific description and a special range of non-physical features by normal human vision. But Churchland's criticism is that, we know well that there is only thing rather than two, i.e., one class of objective features.
10. Last statement was about the explanatory gap that exists between luminance and physical processes. But here, Churchland argues that it is false and there is no explanatory gap exists. Since we have no need for an account of how electromagnetic waves might cause the various phenomena associated with light, because the systematic reconstruction of optical phenomena within electromagnetic theory leads us to believe that light is identical with electromagnetic waves. Here finally, he concludes that criticisms against the '*Family-of-Arguments*' wilts saying that the '*Family-of-Arguments*' on which they are modelled is just as empty of real virtue. Besides this '*Family-of-Arguments*', Churchland takes into consideration a further argument in the form as follows:

- I. We must draw a distinction between the real and objective properties of objects and the contingent subjective effects those properties happen to have on the conscious process of humans.
- II. The scientific reduction of observable phenomena typically ignores their contingent subjective effects on the conscious process of humans and reduces only the non-subjective aspects of the phenomena.
- III. When we attempt to provide a physicalistic reduction of subjective conscious effects, the reduction would simply leave out what is essential to their nature, i.e., the subjective phenomena are exclusively and essentially subjective.

Therefore, mental phenomena are irreducible to physical phenomena.

Here, what Searle and Nagel complaint about is of leaving something important and essential, i.e., the effects on human consciousness. Their argument point out that physicalist reduction precludes the essential c-effects. But, here what Chuchland's answer is that there have been no significant reductive attempts at such target (subjective) within the history of science. The phenomena of human conscious experience have quite properly been waiting for the maturation if the only theory that has any realistic hope of providing such a reductive account to an adequate theory of brain. If and when that approach has been fully tried and proves a failure, then, it will

be time to insist on non-physical approaches. Now, there is no need of such subjective reductions.

Here, with the parallel lesson about light, what Churchland states is the complete physical reduction of light as well as mental states. Light can be smoothly reduced to electromagnetic waves and mind can easily be reduced to neuronal states of the brain. He argues that, "*Even if conscious phenomena are ontologically special in some way, roughly analogous to the case of light, there is no reason to think that the argument of Searle, Jackson and Chalmers do anything to illustrate or establish it*".⁴⁰

Thus, what Searle really makes is an ontological gap between the mental realm and physical realm. Here, he reaches in a dualistic position as well as an epiphenomenal one. Here, what makes him to such a position is the '*intentionality*' or the meaning or content of a thought. It is the '*subjective*' feature that gave him motivation. It is the subjective nature of the mental that forces Searle to argue against their reducibility to objective physical things. His fear is that, if we reduce mental to the physical then the qualitative nature of the mental would be lost. E.g., When '*pain*' is reduced to c-fibre firing, the essential features of '*pain*' would be left out. Searle says, "*No description of the third-person, objective, physiological facts would convey the subjective, first-person character of pain, simply because the first-person features are different from the third-person features*".⁴¹

It is an important point to note that neuro-science is in a best position to comprehend mind and the mental. Multifaceted experiments are going on in the field to do the above, as the connectionist neural network theoreticians hold. The artificial neural networks can simulate human cognition and consciousness. So in such a context, the theory of Searle is a least important one. We have to think of a future in which a full comprehension of brain and mind will take place and then we would be in a position to speak of mind, the mental, consciousness, etc., in purely physical/natural terms. Moreover here Searle's idea of mental commits a fallacy within itself.

Take his two views about the mental such as,

1. Mental states are natural states of biological organisms
2. Mental states are irreducible to natural/physical status.

Here, on examining these two, we can see that the second view is on the contrary, to the first view. If the first is right then the second will be wrong and vice-versa. So, we can say that Searle himself is not in a firm position. If he is correct then, all of our natural states would be subjective. It is not correct and here is the time to discard or to reconstruct his theory of mind. The conclusion of this Chapter is that Churchland emerges stronger in his outlook on realism. We are now onto a final assessment in the following Chapter.

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CHAPTER V

SUMMARY AND EVALUATION

5.1 Churchland's Defence against his Critics

The question whether Churchland's theory of eliminative materialism will adequately serve as a theory of mind and if so, in what sense, can now be answered. Throughout we have expressed serious reservations to the most prominent features of the theory. First, we counterposed the major programme of neural network theory to Fodor's mind-as-code (mentalese) theory of intentional realism and found wanting. Similarly, we examined the post-positivistic model of inter-theoretic reductionism and tried to cast aspersion on its explanatory power. These two features were singled out to be the most prominent features of Churchland's eliminativism.

If they point to anything, it is not that folk psychology has no chance being eliminated from the province of scientific psychology, but the arguments concerning such an eliminativist option cannot be sustained. The compatibilism between these two types of cognitive modelling is hindrance enough and hence it needs no defence as there are too many practicing cognitive scientists who are ready to toe the line of compatibilism. Thus, the eliminativist project cannot register any success in this climate. So also, we have examined the credentials of the eliminativist option by comparing and contrasting it with that of Stephen Stich's theory. We have shown how

the eliminativist option is blocked by looking at the structuration of the arguments put forward by Churchland and Stich. In Churchland it is regressing into a mere variant of identity theory even while its realistic credentials become inoperative except when they are softened into a continuum model of progress. This one of the succinct claims of MacCauley.¹ And in Stich, its realistic credentials were seen as much more ramified into a species of philosophical naturalism which takes us beyond Churchland. The credentials of such an exercise will have to be further probed to drive home the above point. The question whether eliminativists eliminate evokes a negative answer in the above context. In brief, there are many grounds to suspect the explanatory power of the theory as providing a viable theory of mind. Even so, we found adequate reason to believe that the neural network theory of functionalism continues to be live option. To some extent, this was demonstrated by counter-posing many other cognitive modelling.

Let us return to one of the methodological assumptions we have posited in the beginning. That is, the various cognitive modelling were to be brought under a spectrum of oppositions. Accordingly, the linguistic is opposed to the anti-linguistic or the imagistic (neural network), the folk-psychological (irrealism) is opposed to the scientific (realism), the linear (serial) to the non-linear (parallel machine), the static is opposed to dynamic modelling, the theory-theory to simulationist modelling.² The correct way of understanding the mind would have to wait in the matrix of

oppositions. Once these oppositions are best understood as a providing rivalry to the other. As such, eliminativist option is ruled out *ex-hypothese* at the outset.

Inevitably, this suggests a further line of attack by choosing two sets of arguments. Accordingly, we counterposed first Carruthers and Dennett and following this we counterposed Penrose and Searle. What we understand from the former is that the distinction between linguistic and anti-linguistic modelling is a distinction without much difference. There is no rough and ready opposition between them and hence their rivalry remains at the level of speculation without the backing of much theoretical content. Similarly, we understand that the distinction between the folk psychology and scientific psychology cannot also be sustained in the face of compatibilist projects. If we look at the further distinction between linear and non-linear modelling, or between the static and dynamic modelling, or between the theory-theory and simulationism, they also require revision since the hybrid model is at work everywhere. This is what we learn not only from Carruthers and Dennett, but also from Penrose and Searle. Thus the impetus to sustain a distinct model over others requires to be sacrificed. This means that eliminativism cannot muster an exclusive precinct of argumentation, nor has it a prospect of experimental verification. By way of final appraisal, this Chapter is meant for a summary and evaluation in which we firstly take the main objections raised against eliminativism by Churchland's critics before seeing Churchland's own defence to those objections. Here we are mainly concerned to recapitulate the objections raised by

Robert McCauley, Patricia Kitcher, Andy Clark and Lycan with regard to eliminative materialism.

Firstly, we shall the criticisms advanced by McCauley's³ sympathetic reading of Churchland's philosophical projects of Neurophilosophy and Neurocomputationalism from the point of view of explanatory pluralism. After examining the version of naturalized epistemology that was originally inspired by Quine, and now combining with Kuhn's account of scientific revolution, Sellars's attack on the Myth of the Given, and Feyerabend's account of incommensurability of scientific theories, McCauley concludes that, his programme registers constructive successes. No contemporary philosophical programme is more imaginative, more productive, more empirically responsible or more comprehensive, asserts McCauley. McCauley characterizes it as a decidedly pragmatic approach to the metaphysics of science. After carefully considering the varieties of co-evolution between theories at the inter and intra level, McCauley claims that Churchland introduces a dynamic element into the continuum or commensurability than the opposite incommensurability model. His main observations to Churchland's theory are to be stated as follows. Incidentally, we must note that even while talking about McCauley's criticisms, we mean that he saves Churchland from much malignant criticism. This is due to one primary motivation. He soft-pedals the weakness of Feyerabendian realism by suggesting a continuum model, but this can hardly warrant the elimination of folk psychology. At the most, it may be understood

that they lie in a continuum, folk psychology being an approximation to scientific psychology. The proposed elimination does not work.

1. The first observation is that while presenting three different scenarios of co-evolution of theories, namely Co-evolution M (Microreduction), Co-evolution P (plurality of explanatory paradigms), and Co-evolution S (Superceding of the earlier paradigm), Churchland obscures critical distinctions between the three different types of inter-theoretic relations. The obscurity is solely due to the fact some of them directly oppose each other. For example, the first and the last lie at the ends of the spectrum. Whereas Co-evolution S might support elimination, Co-evolution M may not. If we assume that they all lie in a continuum, they must be regarded only as different stages in the evolution of theories. Co-evolution P is what is finally preferred. It transpires, therefore, that the inter-theoretic reduction is not as tidy as it is claimed to be. Accepting this criticism, still we feel that the continuum model is softened variety of an intra-theoretic reduction. As such, it is not threatened by plurality of explanatory ambitions. In other words, eliminativism in science is principally an intralevel process, involving same-level analysis as opposed to new or different level analysis. As an integrative process of inter-theoretic reduction, the extreme eliminativism is eliminated in favour of revisionary eliminativism.

2. Even though the co-evolution interpretation encouraged recurring eliminativist inclinations concerning Folk Psychology, it is the least possible interpretation as an analysis of the relations between Neuroscience and Psychology. The relation between Folk and Scientific Psychology cannot exactly be mapped in the way, as it has been originally recommended by Churchlands. The continuum image obscures the eliminativist option, by introducing features of pragmatism.
3. (1) and (2) alone will warrant a different way of looking at the phenomenon of inter-theoretic reduction. A close study will support more a continuum theory than an epistemic break.
4. McCauley is further convinced that psychology will undergo substantial revision and future scientific progress may lead to the elimination of some psychological theories. But, at the same time, he complained that the Churchland's case has only offered an unhelpfully oversimplified account of inter-theoretic dynamics.
5. McCauley points out that the interpretations emerged from co-evolution of Neurophilosophy recognises the value not merely from integrating scientific disciplines but of preserving a plurality of semi-autonomous explanatory perspectives. Here, McCauley claims that eliminative adjustments of theory are never motivated by considerations of cross-level conflict. Rather, they are typically or properly motivated by conflicts of theory at or within the same level. What McCauley wants is that we should stand back and let the gradual

inter-level knitting of theory proceed. The continuum interpretation bends backwards to sustain the inter-theoretic identity while at the same time poses a threat to the eliminativist option. Naturally, Churchland has a definite objection since he cannot recognise that there is enough argument to sustain a continuum hypothesis. His first and foremost object lies in exercising the eliminativist option. He argues therefore that it still remains a live option. Radical displacement of one theory with another could be supported by history of science. Citing the example of Astronomy, he is inclined to add strength by holding that Folk Psychology cannot be insulated from displacement.

Churchland's reaction is to have McCauley's guess as a largely retentive reduction remains a live possibility. But the historical pattern suggested by him is not so uniform, and any probative classification of reality into distinct levels is something that is itself hostage to changeable theory. Churchland illustrates the example of astronomy and opines that many of the ancient high-level theories turned out to be false. Because of this, their ontologies and principles were displaced, rather than smoothly reduced by higher sciences. Here what he says is that the same will be happening to Folk Psychology. Here, Churchland concludes his defence by saying that the claim that psychology comprehends a distinct level of phenomena comprehended by a distinct set of laws that are uniquely appropriate to that level is not an assumption that Churchland's opposition can have fee for.

The focal point of Patricia Kitcher's objection to Churchland's programme is the contribution thesis.⁴ If neuroscience does not contribute towards the explanation of mind-body relation, then it will die. Though this might be true, but the claim only turns out to be less interesting aspect of his programme. This is because even non-neural theories will contribute towards the philosophically relevant aspects of understanding. It is also because, neuroscience cannot be regarded as the most important contributor, since it explains only some part of cognition. Thus, the whole issue turns on the alleged gap between neurons and epistemology. Hence, we must turn on the very terminology, which Churchland introduces. It is about the terminology of '*Neurophilosophy*' where he tries to cast aspersion on the terminology, and more accurately, to the prefix '*Neuro*'. While examining the three theses (we have already discussed in first Chapter), she accuses Churchland by pointing out that the '*Neuro*' part of the project is premature and should wait upon further developments in psychology. She proposes that the Churchland's jargon-like term '*Neurophilosophy*' must be replaced in favour of what one might call '*Psycho-philosophy*'. Churchland's reply to this objection has three parts and they are stated as follows.⁵

1. Churchlands have been committed to the idea that neuroscience cannot do the co-evolutionary vision of research proceeding on many levels simultaneously and so experimental Psychology is indispensable to have an understanding of the nature of mind-brain.

2. There has been a tremendous flowering activity and results in cognitive neuroscience. Research in that field focuses on the overlap between Psychology and Neuroscience and it is certainly located in the wider programme of understanding the neurobiological basis of psychological functions.
3. We can cite many examples of neuroscience relevant to current issues in philosophy.

Be that as it may, we are prone to question the empirical support Churchland's project receives or likely to receive. This is exactly the question Patricia Kitcher also raises. She wonders whether PDP modelling got so little attention in Neurophilosophy relative to other works such as Llinas et al. The work of Llinas and others is considered to be a major breakthrough in the computational understanding of the brain.⁶ Thus it is essential to the PDP research. However, Churchland's emphasis is curiously less on this phenomenal contribution. Churchland reviews this research paradigm in his most recent book in a favourable light. But Kitcher's quest is whether it will contribute towards neurobiological realism. As Churchland presumes that this may serve as a real contributor, but the suspicion remains and the issue is to be decided in the light of future research in neuroscience. So, Churchland reacts by pointing out that Kitcher's inquiry is ill motivated and inaccurate. The fact is that large scale neural net modelling did not really take off until after the discoveries concerning automated and efficient update rules, free floating hidden units and non-linear functions. According to the most recent

account, the empirical support for back propagation (non-linear modelling) comes from recent research on the brain such as the one cited above.⁷ Patricia Kitcher also questions about the biological realism of PDP models to which Churchland replies by holding that, "*Network models that are highly constrained by neurobiology, rather than on high level psychological models because network models are more straight forwardly testable against the independent reality being modelled. At the same time, we prefer models of capacities that are well studied in Psychology and NeuroPsychology, so that we can take advantage of economising constraints from top-down research*".⁸ So Churchland defends the contributor thesis by pointing out that there are more than dozen experiments which can empirically support what is called the recurrent model of PDP research. Such a uniquely encompassing recurring system might support the very notion of consciousness which at present lies in obscurity.

The main focus of Andy Clark's objections are directed against two fronts. On the one hand, it is against his deep-rooted pessimism about the ultimate integrity of folk psychology. Andy Clark's objections against Churchland's arises on account of his compatibilist plea. On the other hand, he is equally vehement against the dogma of sentential kinematics. Andy Clark's questions this by asking the following question: supposing the some such non-sentential model will turn out to be information-processing. This will have an immediate impact both on the nature of folk Psychology as well as on the nature of sentential or quasi-sentential paradigms. On both counts, the

distinction made earlier between two apparently rival modelling will turn out to be vacuous. Assuming that Clark's comments are mainly based on their rejection of folk Psychology and acceptance of connectionism, then such exclusiveness cannot be sustained. It is the intense interest in the claims about folk Psychology that served to obscure their observations concerning the changing nature of explanatory resources of the study of the mind. Andy Clark proposes that this is unfortunate because the two issues are orthogonal and the insights concerning the methodology and explanatory profile of future cognitive science should be valued by the claims concerning the poverty of Folk Psychology. He concludes his objections with saying that the lack of fit between the ontology and explanatory resources of a future cognitive science and Folk Psychology is the best clue to the peculiar virtues of the folk framework. In particular, Folk Psychology is best as engaged in a kind of global knowledge detection and that scepticism about the value of the folk concern the form of representation in cognitive subsystems. He suggests that we are clear that the main lack of inner quasi-linguistic items is not itself sufficient to undermine the folk discourse. The way is therefore open to build a balanced image of the folk project. Once such an image is in place it becomes clear that the most likely impart of scientific advance takes the form not of an eliminativism but of an augmentative materialism. Augmentative materialism allows that scientific advance may indeed contribute to the enrichment of the knowledge the folk psychology evokes. If what Andy Clark says is agreeable, this will definitely alter

the argumentative dialectic that was set as the targets of attack on some alleged understanding of their rivalry.

Now, we shall cite what Churchland's response to these objections. Churchland points out four important factors in Andy Clark's theory which are to be stated as follows:⁹

1. A pragmatic toleration of a strictly false but nevertheless highly useful casual/explanatory theory.
2. A generous version of the identity theory.
3. A form of Dennettian intentional-stance instrumentalism.
4. An alternative portrayal of folk Psychology as an ontologically innocent form of pure social practice rather than a framework of corrigible factual suppositions.

If anything, these points are sufficient to provide a positive case for Folk Psychology. But Churchland argued that we have no assurance concerning the respective empirical contents of folk Psychology and a matured connectionist- Psychology-cum-cognitive neuroscience even within the domain of common human experience. The complacent view is that vector coding, vector transformations et al., will remain. Similarly, they will all be submerged below the level of practical attention and mundane manipulative advantage.

Andy Clark is trying to preserve not only a descriptive role for the propositional attitudes, but something like their current casual explanatory role as well. But Churchland argues that it is clear that propositional attitude will no longer play the central casual role they play in current folk psychology. Eliminativism in this sense is the elimination of propositional attitudes. Churchland cannot be credited with this particular eliminativist option since it involves the question about the identity between two sides that is flanked by the identity sign. As remarked previously, this recreates the identity relation without eliminating the left-hand side. Andy Clark goes a little further. Within the new framework, this role is played by high-dimensional activation vectors and synapse-mediated transformations the neurons. The internal structure of the new casual dynamics is alien to the classical dynamics of the propositional attitudes. Any reduction of folk psychology is likely to be strained and highly deflationary at best. There is no clear and compelling case that the explanatory framework of propositional attitude will survive more or less intact within the updated Folk Psychology.

Churchland rejects Clark's contention that folk psychology does not serve the same purposes as a scientific psychology.¹⁰ Churchland claims that as a scientific psychology, it will serve for folk psychology. Churchland claims that a scientific Psychology serves the same purpose as our current Folk Psychology. And hence the eliminativist defence cannot be easily disposed off.

Lycan's¹¹ objection to Churchland's theory is about the PDP approach to what Churchland terms as explanatory understanding following the 'pragmaticist' school. The idea is to explicate explanation in terms of understanding. This means that it considers the actual or hypothetical perlocutionary effect of a speech act on an audience. That is, according to Churchland, explanatory understanding is a neural condition. As such, it needs to be explained in terms of connectionist network. Lycan proposes to examine the ground of Churchland's rejection of deductive-nomological (D-N) theory of explanation and consequently, the quantum of support it gives to his eliminativist programme. On Churchland's view, deductive-nomological model of explanation is neither psychologically nor biologically real. Lycan's comment is that Churchland has no right to reject at least for two reasons. One is that as early as 1970, Churchland himself has accepted it and used it in the context of defending folk-psychological explanation. Secondly, neither Hempel nor Oppenheim showed any interest in psychological explanation. Thus he only launches a 'rubber arrow' against this model. What goes in tandem is his further rejection of sentential epistemologies, since the way the above model is to be couched is in terms of propositions and truth-values. Once the DN model is rejected, the propositional model also gets rejected. Here, what Lycan urges is that he somehow wants to save a deductive-nomological theory of explanation, for the simple reason that this is the only standard model of scientific method in town. That is why he objects Churchland's prototype activation model even goes to the extent of praising its merits. Lycan raises as many as four questions here and Churchland

successfully counter it by answering each one of them. The inadequacy of his mode of explanatory understanding is shown to be obvious from the following questions and answers:

1. Lycan: What makes one type of explanation better than the other ?

Churchland: A virtuous mode of explanatory understanding (an activated prototype vector) should be a rich portrait of the general type, and hence it should be strongly warranted, and it should be correct. It should also be part of the most unified configuration possible. These desiderata are not adequate to differentiate explanatory understanding from explanation.

2. Lycan: If Sentimentalist epistemology is to be cast out, what are the others that are to be utilized as explananda ?

Churchland: We have explanatory understanding of a problematic thing, event or state of affairs. The linguistic expression is secondary. Presumably the things, events etc., are those whose microfeatures are represented by a coherent succession of input vectors. But these are representations in the brain, not external things. It follows, therefore, that Churchland's withdrawal from sentimentalist mode of explanation is not adequately justifiable.

3. Lycan: How exactly is explanatory understanding related to perceptual recognition other than by being another species of the same interesting genus ?

Churchland: Understanding differs from perceptual recognition primarily by being a response to a wider variety of cognitive situations, and so, it is not limited to sensory inputs. Perceptual recognition itself is just a case of explanatory understanding at the sensory periphery, i.e., perceptual recognition is a species of explanatory understanding. Such opposition cannot escape explanation as such.

4. Lycan: What of good old scientific explanation in the robustly sentential; discursive, left-brained etc., sense ?

Churchland: Lycan is confusing what is only a useful means toward explanatory understanding with explanation itself.

Here the real intention of Lycan is to defend a deductive nomological (DN)/Hempel–Oppenheim model of explanation and to point out the virtues and shortcomings of prototype activation as an account of an individual's explanatory understanding consists in. In the case of Lycan's criticism, Churchland is saved because Lycan is fully aware of the prototype – activation model and does not entirely disapprove it. He only wishes to defend DN model, but not to criticise Churchland. What follows from Churchland's account of different types of explanations and the difference between DN model and PA model of explanations.

Churchland enumerates four important faces for the notion of explanation. They are stated as follows:

1. Explanation should be taken as a way of understanding.
2. Explanation as an object of discovery.
3. Explanation as a focus of evaluation.
4. Explanation as a set of statements or sentences.

Here, Churchland argues that DN model is only concerned with the fourth feature and derivatively with third feature. While the PA model's primary concern is the first and then second and third features. The fourth feature is the least concern of PA model.

Now, we shall cite the important virtues of PA model over DN model, as given by Churchland. Lycan's objection is that while rejecting the sentential epistemologies, Churchland cannot have any recourse to a novel mode of explanatory understanding. This is only buttress his claim that there is a definite mode of psychological explanation given in the form of explanatory understanding. Since Churchland's rejection of the classical Nagelian type of reduction is complete, we can concede that PDP comes forward with a new type of explanation in terms of inter-theoretic reduction that requires further understanding. This is what is required to keep alive the eliminativist

option, criticisms notwithstanding. Thus on the whole it seems that his eliminativist programme will not be weakened by the above critique of explanatory understanding.

In the above discussion, we have been exclusively concerned with standard criticisms levelled against the programme of eliminativism. One of the important lessons here is that while considering the stand taken by McCauley, Andy Clark, Patricia Kitcher and Lycan, we were pulled in opposite directions. It was their objections that seemed to set rest the programme, but at the same time we discussed Churchland's defence and the support he gets from empirical evidence. In examining, we saw that none of these criticisms are stronger than Churchland's own 'empirical' defence, i.e., Churchland can overcome these objections, if proper empirical evidence comes from brain research. And now, we have to turn toward the counter positions with some other critics.

5.2 Postures and Counter-Postures

The problems and issues discussed in the above are kept alive when Churchland's defence is taken fully into account. Nevertheless we should be cautious to assess once more the defensible points in order to see how best the existing controversies in the field of cognitive science can be seen in the above light. Each of these controversies is apparent in Churchland's each critics. Here we now propose to

address ourselves to two major lines of argumentation and while discussing the cases of Fodor, Carruthers, Dennett, Penrose and Searle, we hope to throw further light on. The exact rivalry between a strong or radical eliminativist option and the way it could be subdued.

When taking Fodor, Carruthers and Dennett we can see that their cognitive modelling display similar features in their theorizing. In the case of Carruthers, it is the wholesale adherence to folk psychological realism that makes the similarity among these thinkers and the controversy between folk psychology.¹² Following this, there is a more scientific psychology has clearly been undermined by adopting a hybrid model which includes the best features of both of the above models. This result can be likened to the one we gained when we, at the beginning, counterposed Churchland to Fodor in order to bring out the clear opposition. But, we failed to capture the exact tenor of the rivalry because there is actually no clear opposition between them. In a similar vein, one could glean that the opposition between non-linear model and linear model stands can be thought of as one between Fodor's linear and Churchland's non-linear model.¹³ But, we cannot make such a sharp distinction between these two because it is the hidden layer that makes Churchland's model non-linear. Nevertheless, the input – output process is same as that of linear process. This itself is cause for paradox but such a paradox arises only when we think that the rivalry between these is one of sharp

opposition. What we see in Fodor's folk psychological realism does not bear comparison, because we cannot speak of it in the tone of linear model without clearly understanding why he has not given any justice to the non-linearity of human cognition. But our aspirations are limited in simply juxtaposing the linear and the non-linear and attributing respectively to Fodor and Churchland. Fodor took folk psychology as an integral part of science and as a science, the laws that govern it could be constructed in terms of *ceteris paribus* clause in exactly the same way as every other science does. Such a claim cannot be evaluate within the compass of the present object. But construing the real opposition between Churchland and Fodor as one between folk psychology and scientific psychology, one has no means of adjudicating the rival features as the controversy is still an on going one. But, this controversy is not settled down and no one knows how to answer to it in a positive tone. So, we cannot take Churchland or Fodor to be entering into opposition holding fast to rival paradigms.

A similar scheme of argumentation is apparent in other domains. While thus counterposing Carruthers, we found that the above point is reinforced. The controversy between linguistic and non-linguistic is only a distinction without much difference. So, also we found that the opposition between tacit theory and simulationism is one that is immune from a raging controversy. Carruthers's folk psychological realism is a hybrid between both of them.¹⁴

Counterposing Dennett, we find that the distinction between folk psychology and scientific psychology is not to be agreed in toto. So also, the distinction between linear and non-linear modelling is not able to facilitate a rough and ready distinction. There are thinkers like Dennett and Andy Clark who follow both of the modellings without recognising them to be incompatible. They argued for a combination of connectionist model with a sentential approach. This leads us to conclude that these two are not opposing models. If they are in opposition, they cannot be combined. This is an important lesson to learn while studying the different cognitive modellings.

In the light of the above points, we must understand that there is something really at stake in Churchland's programme. What means are available to sustain a programme such as the one Churchland evolves? Can it survive the onslaughts mentioned in the above/ answers to these question are not easy to find. The intuitive understanding is that the above points might survive not because of the hybrid models like folk psychological realism but because Churchland's model represents a high water mark of connectionist research. When the controversy reaches at the compatibilist level, we can see that Churchland's model is rather diluted or weakened by the opposition. Here Churchland's theory might have to face a theoretical opposition. But as we shall see the picture cannot be construed either way. Let us see. The relation between language and cognition and the role of language in cognitive process has never been properly understood and the debate on the side becomes more and more serious in

recent years. This is partly due to evolution, which is added to as one of the deciding domains in cognitive science research. Language has evolved over the years. Likewise mind. Cognitive studies include primitives, even fossil records in an effort to locate origin of language and its close links with the evolution of mind.

In the previous Chapter, we have reason to group many of the Churchland's critics into two categories, one is represented by Carruthers and Dennett on the other hand the group led by Searle and Penrose. Among the first group, we saw that the final point that is emerging is that Churchland's case for eliminativist thesis should be either weakened or diluted by the criticisms. Now we shall counterpose Churchland to Penrose and Searle.

When we counterpose Churchland to Penrose, the main issue is about computability or algorithms.¹⁵ Penrose argued that human consciousness is non-algorithmic in nature and so non-computational. It is against neuro-computational perspective of Churchland's. In this situation, the controversies are not been resolved, even though Churchland met the criticisms successfully. So, we can say that Penrose's criticism was not as dangerous as it appears at first sight because Churchland's defence is by far successful.

Counterposing Churchland to Searle we found that the distinction between building block theory of biological naturalism and network theory of scientific realism is not as complete as one would like to think.¹⁶ We know Searle as a biological naturalist while Churchland's theory is also a biological one. Searle argued for a linguistic theory of the mental, which is rejected by Churchland. But, when we examined the issues surrounding them, we found that this opposition is not strong enough to prevail, because Churchland's theory of mental also have a semantics in state – space terms. Thus, both of the theories are semantical in one way or other. In Churchland's theory, semantics is working at the prototype level, which is semi-linguistic. In this position we wonder that how this position leads to an eliminativism. The distinction between propositional attitude psychology and its semantics and its outright rejection cannot form a stable position even within Churchland's own modelling.

Further opposition between Churchland and Searle is about the reducibility of consciousness. Churchland's reduction of consciousness to recurrent neural network strictly opposes Searle's qualia based irreducibility principle of consciousness. In this debate, Churchland seems to be defensible in order to which an evidence can be cited from recent science experiments. This is from Rodolfo Llinas, based on the neuro-physiology and biophysics department at NYU School of medicine.¹⁷ The

experiment concerns the behaviour of the human brain in which the data point to the fan-out/fan-in recurrent network.

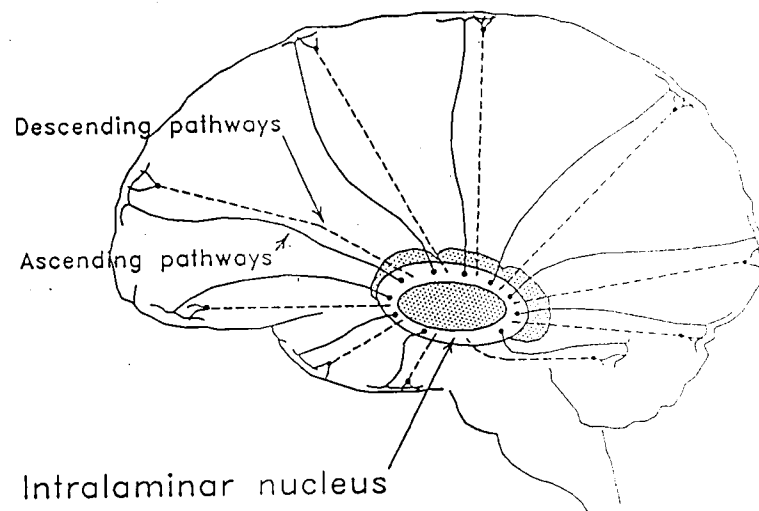


Figure 1¹⁸

The above modelling of Llinas strongly supports Churchland's recurrent neural network and reconstruction of consciousness in neuro-computational terms, in which the recurrent network have all the attributes of consciousness. So, Churchland is defensible to a great extent. In his most recent book, Churchland stakes claim for a position similar to this.

Now, we shall have a look on the structuration of the eliminativist arguments advanced by Eliminativism Now and Eliminativism in Prospects respectively due to Churchland and Stich. In our previous examination of this, we have concluded that they lead to two types of realism. Eliminativism leads to a Kuhn-Feyerabend type of Realism and the Eliminativism in Prospects leads to a Papineau-type of Realism. The question before us is to ask whether they have any prospects of convergence. It is from this collating of these two types of structuration, a final question arises that is, '*Does eliminative materialism really entail realism ?*'. We shall try to answer the question after giving the structuration, first Churchland's and then Stich's.

5.3 Structuration of Eliminativist Argument in Churchland

If we closely examine the structuration of the argument for eliminativism, we shall learn that he is basically a follower of inter-theoretic strategy. This has a distinct interface with philosophy of science. This follows closely on the heels of recognition that philosophy is continuous with science. Moreover, it also contains within it the prospects of philosophically related issues about mind-body relationship. Thus the relation is complementary and one of mutual support. On a sense it was originally inspired by a naturalistic tradition inaugurated by Quine. Churchland's scientific realism is simply a consequence of naturalistic epistemology. Besides, Churchland's inter-theoretic model of theory progress is often taken to be nothing more than an explanatory device about identity. Thus, he is confronted with the challenge that he

cannot address himself to semantics. But Churchland overcomes the crisis of identity overcome by what he calls the state-space semantics.¹⁹ His defence of state space semantics against the accusation of Fodor is significant in this context. Churchland proposes to resolve the exact tenor of the relationship between two theories that is between Folk Psychology and Scientific Psychology by a unique recourse to a new post-positivistic philosophy of science.

However, Churchland's explanatory ambition gets stuck on the question of plasticity. It is this, which forces him to turn to the non-algorithmic model or non-linear without putting any premium on this. The question whether PDP can explain plasticity evokes a paradoxical answer. On the one hand, it stands firm on a stabilized model and on the other hand, it agrees to a flexible model. Thus the distinction between linear and non-linear modelling gets suppressed. It is in this context critics like McCauley intervenes to offer a very sympathetic consideration which takes the sting out of the eliminativist plea by having recourse to a continuum model.²⁰ Inevitably, this directly takes us in the direction of intra-level commensurability rather than inter-level incommensurability of paradigm which is what is warranted by Churchland's reduction of neural network theory to a species of philosophy of science.

Where exactly one has to assess the realistic credentials of such a project. Churchland's own in this respect is that Kuhn-Feyerabendian philosophy of science is to be made consistent with some form of scientific realism. Thus Churchland's claim

about realism is true only when the above species of philosophy of science warrants the recognition about realism. The answer to this complex question remains unexplored at present. Now, let us review the structuration of the argument in favour of eliminativism, as it is more elaborately handled by Stephen Stich.²¹

5.4 Structuration of eliminativist argument in Stich

Stich starts with the plea that eliminativism is pursuing a paradigmatically deconstructionist programme thus equivocating elimination with deconstruction. Deconstruction as it is ordinarily understood can hardly be regarded as standing for any positive programme. In the sense Stich uses it, it stands for deconstruction of certain of the assumptions of eliminativist argument. It is in this context he has recourse to self-critique. That is the original argument advanced for eliminativism cannot be regarded as yielding an eliminativist conclusion without constraints. The constraints is that the original argument needs a missing premise which makes a semantic ascent to a theory of reference. Once this premise is supplied, then we find it opens up at least two important routes none of which is satisfactory.

The full argument may be stated now as follows:

First Premise: Belief is a posit/Belief is a theoretical term.

The Missing Premise: What is the reference of this posit or theoretical term ? This is to be captured by no less than a theory of reference. Hence this warrants a deconstructive conclusion.

The Conclusion: Folk psychology is a '*seriously mistaken theory*'.

The two routes are to be understood as follows:

Route (a): Beliefs and desires do not exist.

Route (b): Folk Psychological states do not exist.

Route (a) is intriguing and hence it is not clear. Stich remarks that it is less obvious. It might be incoherent since it is almost a false proposition. We cannot accommodate within mature science. But this simply reverse the other **Route (b)**, which looks stronger. This route looks stronger than the other **Route (a)** simply for the reason that **Route (a)** can be subjected to criticism from simulationist point of view. Simulationism is opposed to tacit or folk theory which assumes that beliefs are part of tacit theory.²² In a sense, therefore, it reverses the conclusion of the **Route (b)** which holds that mature science cannot involve these entities. None of these premises is defensible. The only option that is open to us is to deconstruct or uncover the assumptions of tacit theory. The plausibility of this view is reinforced by the supplied missing premise which holds that a reference theory works like a tacit theory. In other words, it is a not having the shape of scientific theory. Hence it belongs to proto-science. Similarly the second

route also posits folk semantics. The onus therefore on us to deconstruct the folk roots of reference theory. Stich finds that the most plausible way of executing this idea is to have a recourse to a 'pragmatic' solution. Accordingly, we must ramify the theory of reference into social and political factors. This is what is sought to be achieved by Papineau in his variant of realism. We can now easily grant that the above epistemic orientation is too sweeping to get it bypassed. It is at least clear that both of the above options of eliminativism require epistemic orientation but they stem from different sources. The question therefore whether there is any likelihood of their coming together. Do the two types of realism converge? The answer is not very obvious. Thus Stich's epistemic considerations remain relatively independent of the inter-theoretic considerations of Churchland. We cannot do anything to strengthen the case for eliminativism.

While Churchland's investigation claim to be realism in the sense that it is compatible with the realism of Kuhn and Feyerabend, Stich is in favour of realism, which is much more philosophical as suggested by Papineau. The point of enquiry must turn to the credentials of the second type of realism, which lies beyond the scope of this thesis. This may be read as not in conformity with McCauley's provocative conclusion which was very sympathetic to Churchland.

Unless and otherwise we have reasons to think that that is not to be treated as inconsistent with Papineau-type of philosophy of science, which claims to be consistent

with the credentials of scientific realism, we have no reason to conclude our query in either way.

5.4 Does Eliminative Materialism Really entail Realism ?

As an evaluating question, the above question is taken into consideration and the answer of which will serve the purpose of winding-up the present thesis about Churchland's eliminativist thesis. During our examination of eliminativism of both type, we can infer on the following points.

Eliminative materialists cannot eliminate folk psychology. In Churchland's case, the elimination becomes one of identity and this makes elimination problematic, i.e., nothing is eliminated. In his inter-theoretic strategy, we saw the incommensurability of folk psychology to scientific psychology, as he argues. Even though incommensurability is admissible, eliminativism is not agreeable to all. In Stich, we saw his hopes in future sciences, but he is criticising his own earlier stands. What they both of them reached at end is different type of realisms. In Churchland, it is a scientific realism which reigns in contemporary sciences, like a Kuhn-Feyerabendian type. But in Smith, the realism is of a socio-political type, which we can see in Papineau. Both these realisms are of different realms and thus eliminativism do not really entails a unique realism.²³ Moreover, Churchland's scientific realism is cracking under the problem of plasticity of human nature. His PDP model cannot fully comprehend the problem of plasticity. Even though his inter-theoretic programme aims

at making such prospects, it only resulted in a continuum model. This model follows the proliferation or multiplication of theories.

But with these drawbacks, Churchland's connectionist model have a better place in cognitive science. Because of it is distilled from a philosophy of science, it represents a high watermark of connectionist research. So, whether it is eliminating or not, the model is substantial and still it is a most advanced scientific modelling. Thus, even though his thesis becomes weakened or diluted because of the compatibilist paradigms, he is defensible to some extent.

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