EVALUATING THE NEURO-COMPUTATIONAL PERSPECTIVE AS A THEORY OF MIND

Baiju E.B. “Paul M. Churchland's eliminative materialism as a theory of mind”
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CHAPTER III

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"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
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 Neumannnesque 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.

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 on 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 activational 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 has 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

![Diagram of PDP Network](image)

**Figure 3.**

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 is 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*, 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*, 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. Feyerabend\textsuperscript{7} and T. S. Kuhn.\textsuperscript{8} Let us begin with classical reductionism.

Ernest Nagel is the exponent of classical reductionism. His work, *The Structure of Science*\textsuperscript{9} 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,\textsuperscript{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. 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, $M_i \leftrightarrow P_i$, (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 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 realisability 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 realisability.

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 fulfill. 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., T₁, T₂, T₃, . . . if philosophy of science must be strong to sustain neuro-computational perspective. Churchland agrees with Feyerabend in his account of proliferation of themes. 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'. 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](image-url)
"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". Please do turn to the above picture.

This Figure consists a population of input or sensory neurones \{l_1 ... l_n\}, which project their axons forward to one or more populations of hidden neurons \{H_1 ... H_m\} and \{G_1 ... G_3\}, which project their axons forward to a final population of output or motor neurons \{0_1 ... 0_v\}. 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 \(<0_1 ... 0_k>\) 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 national, 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". 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 sentimentally 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 Negel,
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’, 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 parallely 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 Chalmers and Jackson, 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". 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 causative/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
REFERENCES


3. Ibid., p. 296.


5. Ibid.


17. Figure is from *The Churchlands and their Critics* (Ed. R. N. McCauley Black Well, Oxford), p. 273.


