

Modular Versus Unitary (Non-modular) Views on the Brain and Mind

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Abstract

This article aims at delineating the two distinguished paradigms as far as their views towards learning in general and language in particular are concerned. Moreover, it attempts to discuss different views on the flaws and praises raised by each of their proponents and opponents. Therefore, the purpose of this article IS NOT to claim anything in favor of either view. To this end, this article reviews brain and mind issues as well as Modularity and Non-modularity views.

Keywords: brain, mind, modularity views, non- modularity views

1. Introduction

Psychology as an ancient rooted disciplinary, over 100 years old (Anderson, 1995) [1], has been facing many challenges swinging between behavioristic and cognitivistic paradigms to describe and explain its most entranced applied multidisciplinary science of second language acquisition (SLA). Once the mundane behaviorally oriented tradition focuses on animal learning (behavioristic view towards learning rejecting the role of mind, pre-Chomskyan), then the applauded cognitively oriented tradition focuses on human learning (Chomskyan and post-Chomskyan view towards language) and now more empirically oriented novelty focuses on neurological based learning. While the first view towards language learning is outdated, the second and last views are challenging to win the paradigm for settling the SLA problems, probably if they can. Now, two latter epistemologically different views on learning are challenging over modularity and non-modularity nature of mind.

This article aims at delineating the two distinguished paradigms as far as their views towards learning in general and language in particular are concerned. Moreover, it attempts to discuss different views on the flaws and praises raised by each of their proponents and opponents. Therefore, the purpose of this article IS NOT to claim anything in favor of either view. To this end, this article reviews the following sections:

1. Brain and mind Issues
2. Modularity and Non-modularity views

2. Brain and Mind Issues

There are two philosophical approaches towards brain and mind relationship. One proposes that the relationship between the mind and brains analogous to the relationship between the hardware and software of a computer (functionalism). Another one views brain and mind as identical (materialism). These different views resulted in the advent of two different ontological views towards Brain and mind. The former refers to functionalism and the latter is named as materialism (Andrade and May, 2004) [2]. In functionalism, "mental processes and states are functional, that is, they cause input information to be transformed into output information or behavior" (Andrade and May, 2004, p.2) [2]. However, materialism, the alternative approach, views mind and brain as identical. Accordingly, human thought and behavior can be understood by studying neural activity in the brain. While Functionalist explains information processing through observing human behavior, the second view focuses on "neural anatomy and biochemistry."

3. Modularity and Non-modularity Views

Under the influence of two schools of thought in philosophy, as mentioned above, two approaches to study language learning have emerged: one viewing mind as a uniform system and one looking at the mind as a set of autonomous systems or modules that function mostly independent of one another (Fodor, 1983) [8]. The latter assigns a separate module for language and language learning named as "language faculty" (Chomsky, 1986 cited in Gregg, 1996 a) [10].

Although these two approaches are different from each other, there is a near-consensus among the proponents of each school of thought as to the questions are trying to address: What is the nature of language to be learned and how it is acquired? And in the case modularity be real, is second language acquisition (SLA) modular? Or is first language acquisition (FLA) modular but SLA is non-modular?

4. Modularity View on Learning (Mind)

As mentioned above, modularity approach holds the idea that mind, like brain, consists of separate autonomous parts each with different responsibilities. According to Brase (2002, p.3) [3] the concept of "multi modular mind" refers to the idea that "mind is a collection of cognitive adaptations, or modules, that have been naturally selected over evolutionary history in response to specific adaptive problems faced by our ancestors." Elsewhere, Fodor (1983) [8] assigned two features of domain specificity and content dependence to mind. Domain specificity refers to the aspects of the world in which the particular module is applied. By content dependence he meant that each module is assigned to a job; each module is "hard-wired to particular input source." Also, Sperber (2002) [15] defined cognitive module as a genetically specified computational device in mind whose job is content and domain specific.

Among these modules, one module is assigned to and responsible for the first language learning which is called "language faculty" or "UG." Chomsky (1988, p.68 cited in Flynn, 1996) [7] mentioned:

The initial state of the language faculty consists of a collection of subsystems, or modules as they are called, each of which is based on certain very general principles. Each of these principles admits of a very limited possibility of variation. We may think of the system as a complex network, associated with a switch box that contains a finite number of switches. The network is invariant, but each switch can be in one of two positions, on or off. Unless the switches are set, nothing happens. But when the switches are set in one of the permissible ways, the system functions, yielding the entire array of interpretations for linguistic expressions. A slight change in switch settings can yield complex and varied phenomenal consequences as its effects filter through the network. To acquire a language, the child's mind must determine how the switches are. (p.125)

Chomsky tried to describe the way UG as an autonomous module works in first language acquisition through principles and parameters. While principles are invariant and parameters function as switches. However, the question is that whether the concept of modularity can be applied in L₂ learning or not. Gregg (1996a, and 1996b) [10] defined modularity in L₂ and discussed different positions on the role of UG in L₂ acquisition. Accordingly, there are two main positions regarding the contribution of language faculty in second language learning: one holds that UG is not directly involved in L₂ acquisition and the other one views UG as a causal factor in second language learning. The first position, which is called *deism*, refers to nonmodularity approach which will be discussed later. The latter is called *theism*.

Theism claims that either there is no difference between FLA and SLA (the strong version) or UG operates in SLA as well (the weak view). What actually differentiates weak from strong theism is that in the former UG as well as First Language knowledge (L₁) interference play role while in the latter there is no interference. Elsewhere, White (1996) [16] described three possible relations between L₁ and Second Language knowledge (L₂). These are (1) same competence, same

means of acquisition, (2) different competence, different means of acquisition, and (3) different competence, same means of acquisition. She provided evidence for each of these three possible relationships. Also, Flynn (1996) [7] proposes three different possibilities for accessibility to UG as full access, partial access, and no access.

Another explanation in favor of modularity is restructuring and the notion of U-shaped performance in L₂ learning (McLaughlin and Heredia, 1996) [13]. U-shape behavior means that once an occurred correct form might appear in wrong form through restructuring. In this view, practice can lead to improvement in performance to an automated one or it may lead to restructuring and overgeneralization.

5. Non-modularity View on Learning (Mind)

There are both implicit and explicit denials of modularity approach towards learning. When learning is as a general processing irrespective of objective modularity assumption of the mind is rejected implicitly. There is a surge of research that explicitly deny the plausibility of modularity on the ground that modularity is an abstract improvable model of "boxes and arrows." According to Gasser (1990, p.2) [9], traditional modular view "suffers from a very unhuman-like brittleness" and is very symbolic.

There is no single version of non-modularity; actually, there are a trend of research whose focus is learning in general not for language. The nonmodular models include: connectionism (Gasser 1990) [9], Parallel distributed processing (for example, Rumelhart, PDP research groups cited in Gregg, 1996a) [10], general nativism (O'Grady, 1998) [14], and evolutionary connectionism (Calabretta & Parisi, 2001) [4] each of which will be explained below.

According to connectionism view, mind is a more homogeneous system that basically genetically inherits only a general capacity to learn from experience. For connectionism mind is not symbol manipulation and is not a computational system but is the global result of the many interactions taking place in a network of neurons modeled with an artificial neural network and consists entirely of quantitative processes in which physico-chemical causes produce physico-chemical effects. Chomsky believes that the mind is computational and that there is a specific mental module specialized for language (or for syntax) but he does not believe that language in humans has emerged under some specific evolutionary pressure; connectionism does (Fodor, 1983) [8]. Connectionism is generally associated with an empiricist position that considers all of mind as the result of learning and experience during life. It is also empiricist in that any claim in this model can be tested and falsified (Dilworth, 2005) [5].

Connectionism is also anti-innatist in that, it thinks that even if something changes during development it is due not to learning and experience but to some "temporal scheduling encoded in the genetically inherited information" (Calabretta and Parisi, 2001, p.6) [4]. Connectionism, unlike modular models which are anti-developmental, is developmental. This means that modules are not present in the phenotype from birth, i.e., in newborns or in infants, but develop later in life and, furthermore, they believe that modules are only very partially encoded in the genotype but are the result of complex interactions between genetically encoded information and learning and experience.

Current connectionist models, also referred to as neural networks and parallel distributed processing (PDP) models, are related to the work of neuroscientists and computer scientists in the 1940s and 1950s (McCulloch & Pitts, 1943 ; Rosenblatt, 1962), who were interested in the computational power of networks of simple neuron-like processing units. Another connectionist model is evolutionary connectionism which does not deny the existence of modules which are as a result of development and learning rather than being innate (Calabretta & Parisi, 2001) [4].

6. Non-modular Models Common Feature

Most connectionist models share the following basic features:

1. The system's memory consists of a network of simple processing units joined by weighted

Connections which determine the degree to which the unit at the source end of the connection activates or inhibits the unit at the destination end of the connection. 2. The behavior of units is based on neurons. They sum the inputs they receive on connections and compute an activation, which is a function of the total input, and an output, which is a function of the activation. 3. In learning models, these weights are adjusted as a consequence of processing. 4. Processing is parallel. In most traditional models, as in conventional computers, decisions and actions are made one at a time. In connectionist models, as in the brain, there is activity in many places simultaneously.

7. Conclusion

The advent of non-modular view is followed by the dissatisfaction with the achievements of classical symbolic models of cognition (Gasser, 1990) [9]. However, nonmodularity failed to answer one of the key questions raised by SLA, i.e., what is language? Modularity is believed to be a symbolic paradigm (Gasser, 1990 [9] as well as Calabretta & Parisi, 2001 [4]), an innateness driven approach (Calabretta & Parisi, 2001 [4] as well as Gregg, 1996b [10]), a computational approach towards language learning (Gasser, 1990 [9]; O'Grady, 1998 [14]), an anti-developmental approach (Calabretta & Parisi, 2001) [4], and a grammar based model (O'Grady, 1998) [14]. On the opposite, nonmodular approach as connectionism, although vast in variety, is believed to be a subsymbolic paradigm (Gasser, 1990) [9], an anti-innatist driven model (Calabretta & Parisi, 2001 [4]; Gregg, 1996b [10]), a developmentalist (Calabretta & Parisi, 2001) [4], and a rule based approach (Gregg, 1996 [10]). The incommensurable nature of these two approaches shows the advent of the possibility of a paradigm shift in the epistemological as well as ontological view towards language and language learning.

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