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MODULARITY OF MIND

Yasaman CHOUBSAZ*

Abstract

When we are talking about language acquisition, an important issue is how the different abilities including acquiring syntax, phonetics and vocabulary are picked up by infants from very little input. A range of theories have been created in order to explain this problem. The aim of this article is to review Chomsky and Fodor's theories about the structure of mind, modularity of mind, and more specifically modularity of language. Chomsky's work over several decades has provided a wealth of evidence that "the language faculty constitutes a separate module in this sense, akin in many respects to any other organ of the body." Chomsky believes that there are two notions of modularity and he provides evidence for both kinds of modularity. Jerry Fodor who is an American philosopher and cognitive scientist believes that in order to represent the realities of human mind, the existence of various kinds of cognitive psychological mechanism is necessary. He maintains that our mind has two kinds of faculties: vertical and horizontal. The most important characteristics of these two faculties and their contribution in acquiring language are discussed in the article and the last part is the pros and cons concerning the modularity thesis.

Key Words: Chomsky, Modularity Thesis.

Introduction

Language acquisition is a process by which humans acquire the ability to perceive, produce and use words to understand and communicate. These abilities are: picking up syntax, phonetics and vocabulary. When we talk about language acquisition, it usually refers to first language acquisition, which studies infants' acquisition of their native language, rather than second language acquisition that deals with acquisition in both children and adults of other languages.

An Important issue about language acquisition is how these abilities are picked up by infants from very little input. A range of theories have been created in order to explain this problem, including *Innatism* in which a child is born prepared in some manner with these capacities.

The theory of Innateness was first introduced by Plato (Omid, 2008) and had been developed by later philosopher and linguists. But that version of Innateness that I am going to discuss was mainly developed by Noam Chomsky. After the revolution that Chomsky had made in linguistics, Jerry A. Fodor, an American Philosopher, made further contributions on the notion of innateness (which was originally introduced by Chomsky) and the structure of mind. Fodor's most important contribution in this area is the Modularity thesis.

The aim of this article is to review Chomsky and Fodor's theories about the structure of mind, Modularity of mind, and more specifically Modularity of language.

Chomsky's Contribution

Chomsky's view of language and the mind is not like the previous linguists. For him, human languages are not expressions of culture and society_ in effect, human artifacts. They are, in a sense,

* M.A. student of linguistics, Human Science and Literature Faculty, Razi University of Kermanshah, E-mail: y.choobsaz@yahoo.com

expressions of our genes: all the existing and possible natural languages are biologically encompassed within what he calls "Universal Grammar." (Neil Smith, 2005)

According to Chomsky, humans have inherent talent and linguistic ability in their brain. Chomsky considers himself a Rationalist. In this school of thought, understanding and perception of the world in human being are justified in terms of inherent characteristics of his mind. This view of Chomsky in the area of language learning is called "Innate hypothesis" or "Innateness".

Chomsky's theory is based on the fact that linguistic ability is an independent faculty and it's distinct from other faculties of the mind. This linguistic ability, a kind of common language faculty between all humans, only gives them the power of learning and using language but not any other works. Believing in specialized linguistic talent and formation of natural language knowledge through this talent is a characteristic of innateness hypothesis.

There are a lot of proofs in order to acknowledge the notion of innateness. One which is the main concern of my article is Modularity of mind.

"Modularity of mind is the notion that a mind may, at least in part, be composed of innate structures which have established evolutionary developed functional purposes." (http://www.wikipedia.org/wiki/modularity of mind, 31.Jan.2010)

In order to illustrate the notion of Modularity, you can imagine the structure of a machine, or more specifically, a car. Although its mechanism is not as complex as our mind, it'll illuminate the concept. Different parts of a car, e.g. wheels, gear, engine etc. can be considered as a module. Each of them has a specific responsibility and they have independent structures.

Chomsky's view of Modularity

Human mind is notoriously the most complex entity known. Fortunately this complexity can be broken down into more manageable chunks, where each chunk constituents a specific domain of investigation. While these chunks (parts) are distinct from each other, they can be related as well. This attempt to divide the mind to its sub-divisions is seen most clearly in "Modular" analysis of the mind.

"Chomsky's work over several decades has provided a wealth of evidence that the language faculty constitutes a separate module in this sense, akin in many respects to any other organ of the body (Chomsky 1975, 1984)" quoted by Smith(2005).

Chomsky believes that there are two notions of modularity:
The first one is that language faculty is a module of the mind and it is distinct from modular judgment, music, and mathematics. And the second notion is that the language module itself divides up into sub modules, relating to sound, structure and meaning. (Smith, 2005)

Evidence for both kinds of Chomsky's Modularity:

One can be blind without being deaf, deaf without being blind, because our ears and eyes are separate organs. Also, it is now well understood that no one any longer expects the misfortune of blindness to correlate with IQ, because the functions of various components are independent of language and the same is true in the case of language.
(Smith, 2005)

Evidence for the 1st Notion of modularity

A proof which is quoted by Neil Smith for the above claims is the case of Christopher(Smith & Tsimpli , 1995) a man who cannot take care of himself , who cannot solve problems of intellectual complexity but who can read, write and speak and understand 20 languages.

Evidence for the 2nd Notion of modularity

An example of the sub modules of language faculty is the case of MC
(Froud 2000) again quoted by Neil smith. This case can read nouns and verbs of arbitrary complexity, but cannot cope with "function words" like *after, not, the,* or *because* at all.

So as we have seen in the above discussion, the term "Modularity" was first coined by Chomsky but the person who developed it more and elaborated on it was Jerry A. Fodor. Following in the path plowed by Noam Chomsky, Fodor developed a strong commitment to the idea of psychological nativism.

Who is Jerry A. Fodor?

Jerry Alan Fodor (born in 1935 in New York City, New York) is an American philosopher and cognitive scientist. He holds the position of State of New Jersey Professor of Philosophy at Rutgers University and is also the author of many works in the field of philosophy of mind and cognitive science, in which he has laid the groundwork for the Modularity of Mind and the Language of Thought hypothesis, among other ideas.

Fodor's Contribution

"Modularity of Mind" is the name of the book in which Jerry A. Fodor made his most illuminating contribution in the study of architecture of mind. Fodor points out that his aim of writing the book are the following: (Fodor 1983)

"1. Distinguish the general claim that there are psychological faculties from a particular version of that claim, which I shall call the *Modularity Thesis.*
2. Enumerate some of the properties that modular cognitive systems are likely to exhibit in virtue of their modularity. "

Fodor believes that in order to represent the realities of human mind, the existence of various kinds of cognitive psychological mechanism is necessary. He maintains that our mind has two kinds of faculties: *vertical and horizontal faculties*.(Fodor 1983)

He has applied the concept of vertical faculty from Franz Joseph Gall – famous phrenologist of nineteenth century_ but he has coined the term "vertical" himself. The most important characteristic of vertical faculty is that they are *domain specific*, *genetically determined*, they are associated with *distinct neural structures*, and they are *computationally autonomous.* (Fodor 1983)

As Fodor states, the other faculty which is horizontal refers to mental processes as if they are interactions between faculties such a memory, imagination, attention, sensibility, perception, and so forth. He believes that these faculties are NOT domain specific (e.g., a judgment remains a judgment whether it refers to a perceptual experience or to the comprehension of language) (Fodor, 1983)

In the third chapter of his famous book, Modularity of Mind, Fodor suggests that there are six kinds of input systems in our mind, including: hearing, sight, touch, taste, smell and one more for language. But he also maintains that what is proposed is much more than these.

For example in the case of audition, candidates might include computational systems that assign grammatical descriptions to token utterances; or ones that detect the melodic or rhythmic structures of acoustic arrays.

What I have inferred is that all of these six kinds of input systems are a module of vertical faculty of our mind.

Mr. Rafiee (2005), a student of PhD in the field of neurology clarifies the notions of vertical and horizontal faculties with a great example:

"Imagine that you are sitting in a classroom and your friend tells you that a tiger is sleeping under your chair. You hear what he said very fast. The comprehension of the grammar structure of his speech is so fast that you don't even need any mental effort to get it. You cannot even help not hearing it. But, believing the fact that if there's a tiger sleeping under your chair or not, depends on both your previous back ground knowledge about your friend (maybe he is a funny guy or a liar) and what you see under your chair. Plus, believing this utterance also depends on some of your information about tigers, the place that they live, and the possibility of their existence in your classroom. "

In this example, hearing and understanding that sentence is one of the functions of your vertical faculties. But establishing the utterance as a belief, encompass a collection of your information in different areas. Fodor attributes these types of functions to horizontal faculty of the mind.

Fodor (1983) also states that modular systems must at least to "some interesting extent" fulfill certain properties:

1. Domain specificity: modules only operate on certain kinds of input.
(They are specialized.)

2. Informational encapsulation: modules need not to refer to other psychological systems in order to operate. This property is one of the most important characteristics of modules, and it means that modules do not have access to the whole information of the organism.

3. The operation of modules is mandatory: You cannot help hearing an utterance of a sentence.

4. Input systems are fast: the processes of input analysis are fast *because* they are mandatory. Because these processes are automatic, you save computation (hence time) that would otherwise have to be devoted to deciding whether, and how, they ought to be performed.

5. Shallow output: modules provide limited output, without information about the intervening steps that led to that output. (Bates, 1994)

6. Limited accessibility: There is only limited central access to the mental representation that input systems compute.

7. Fixed neural architecture (localization): We do find neurological structure associated with the perceptual systems and with language.

8. Pathological universals: modules break down in a characteristic fashion following some insult to the system. (Example: agnosias and aphasias)

9. Characteristic ontogeny: modules develop in a characteristic sequence.

Central Systems

As Fodor states, central systems are those processes like solving a problem and thinking which are sub categories of our horizontal faculty and thus non modular. In thinking, for example, we use different kind of information and domains. That's why it is not domain specific and non modular. Other properties of the central systems are the following:

1. They are domain *in*specific

2. They are slow processes (e.g. playing chess, or planning)

3. Central system's information are not encapsulated and communicate freely with other systems.

4. Their pathological break down is not like module's break down.

5. They do not have a certain neurological area.(they cannot be localized)

The pros and cons concerning the Modularity Thesis:

As quoted by Nemat zade (2000), Laura was first introduced in the book "Laura, A case for the modularity of language" by Yamanda. Laura was a retarded girl with a nonverbal IQ of 41- 44. She could not add 2+2. she was not sure of when" last year" was. Nevertheless, she produced complex sentences, with multiple phrases, and she used and understood passive sentences. Laura also was able to inflect verbs for number and person to agree with the subject of the sentence. But she didn't know where she lived in her own age or who the president of the US was at that time. Therefore she was weak in the comprehension of the world around her and in pragmatics, but she could manage the syntactic features of her language very well. (Framkin, 2003)

The case of Laura shows that, language, and more specifically its syntax, can develop even if the other cognitive organisms have problems in developing. So it can be inferred that she is experimentally a good case for the fact that modules are independent from each other.

Another case who was first introduced by Smith and Tsimpli (1996) is Christopher, whom I talked about him a little bit at the beginning of my article. He must live in an institute because he is unable to take care of himself. The tasks of buttoning his shirt or cutting his nails are too difficult for him, but he is able to speak and communicate 15- 20 languages with few errors.

In a nutshell, these two cases can be considered as evidence for the fact that there's not any mutual relationship (dependency) between language and other cognitive abilities such as intelligence. So can we consider language as a module?

Elizabeth Bates (July 26, 1947- December 13, 2003) was a Professor of psychology and cognitive science at the University of California, San Diego. She was an internationally- renowned expert and leading researcher in child *language acquisition*, *psycholinguistics*, and the *neurological bases of language*, and she authored 10 books and over 200 peer reviewed articles and book chapters on these subjects. Bated died at age of 56 after a year- long battle with pancreatic cancer.

In one of her articles, Modularity, Domain Specificity, and the Development of Language (1994), Bates challenges the notion of modularity and more specifically Domain specificity of language.

She points out four kinds of evidence in the article against the domain specificity of language, which are (1) Phylogenetic recency, (2) Behavioral plasticity, (3) Neural plasticity and (4) Arbitrariness of form-meaning mapping. (For more information, see Bates 1994)

I, myself, found her "Argument based on Normal and Abnormal Language Development" interesting. She argues that it is well known that children go through a series of universal stages in language learning: from babbling in vowel sounds (around 3 months) to babbling in consonants (between 6-9 months) ; from first signs of word comprehension (from 8-10 months) to the onset of word production (on average 12 months); from the single word production stage (12- 20 months) to the onset of word combination.

> "But can we conclude that these milestones reflect the unfolding of a domain-specific module? Probably not. First of all, there is enormous variability from one child to another in the onset and duration of these stages. Second, there are important variations in this basic pattern from one language to another (e.g. children who are exposed to a richly inflected language like Turkish often display signs of productive grammar in one-word stage). Third, each of these milestones in early language

> is correlated with specific changes outside the boundaries of language (e.g. the use of familiar gestures like drinking, combining or putting telephone receiver to the ear as a way of "labeling" common objects). In other words, one cannot conclude that the universal maturational time table for language is really universal, or that it is specific to language. "

Bates, then brings some examples of abnormal cases in research on abnormal language development, which were first thought as evidence for "domain specific" disorders, but later on disapproved by other researchers. She concludes that in the recent years, a great deal has been learned about the biological foundations for language development. "Evidence for innateness is good, but evidence for a domain specific 'mental organ' is difficult to find." The alternative is that language learning appears to be based on a relatively plastic mix of neural systems that also have other functions.

Conclusion

Although Descartes was a philosopher who didn't deal much with linguistics issues, Chomsky did dare to revive his ideas of human mind's creativity and he elaborated on them. The elaboration of Chomsky led linguistics into a new era. So that linguistics is divided to two periods of before- Chomsky, and after- Chomsky. Fodor who was interested in Chomsky's ideas, tried to make further *philosophical* contribution to linguistics theories of Chomsky, and his Modularity Thesis was a significant step in this way. I've tried in my article to have an un-biased look over modularity thesis raised, defended and challenged by different researchers and philosophers and I hope that it could be considered a little contribution in the vast area of linguistics**.**

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