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THE POVERTY OF THE STIMULUS EXPLAINED BY THE NATIVIST THEORY AND THE CONNECTIONIST PARADIGM

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To the people I love.

“I hope to be more than just an ‘ECHO’ of my parents!!”

Hanna-Barbera, *Flinstones*

ABSTRACT

The topic of this paper was initially theorized by Plato in one of his dialogues, *Meno*. The problem concerns the process of learning which a child goes through during their development. Plato questions how a child can produce complex structures being exposed to the environment for a short period; and it is called as the poverty of the stimulus or Plato's problem. This monograph was done through researches based on two main paradigms about language learning: Nativism and Connectionism paradigms. While Nativist hypothesis makes use of abductive theory and believes on the existence of a language acquisition device which contains the rules common to all languages; Connectionist paradigm explains it through findings of neuroscience. Instead of claiming that we are born with a device, Connectionist researchers state that we learn through the construction of networks and maturation of the brain. As a result, Connectionism is able to answer more questions about the poverty of the stimulus than Nativism. Having computational networks as its main instrument, the Connectionist paradigm has a larger area for further studies since technology is evolving day-by-day.

Keywords: Nativism. Connectionism. Poverty of Stimulus.

TABLE OF ILLUSTRATIONS

TABLE OF CONTENTS

1. INTRODUCTION

Since Plato, philosophers and scientists have been trying to explain some aspects about language acquisition. The major aspect we will discuss in this paper is the ability children have to learn language within a short period of their lives, known as the poverty of the stimulus.

In this paper, we will focus this problem to the linguistic area. Plato's problem, as it is also known, generates discussions among linguists and how they can explain it better and in a more practical way. The criteria for explaining the main topic is given through important researches based on Nativism and Connectionism. I will present some computational models and their results, and apply them to the studied context.

The overall aim of this paper is to show how Nativism and Connectionism hypotheses clarify the concept of the poverty of the stimulus. Nativism, being known and accepted for many years as one of the most suitable explanation for language acquisition, will be compared with a new and unfamiliar paradigm, called Connectionism.

The present work is organized as follows: firstly, I will elucidate the origin of the concept of the poverty of the stimulus. In the second chapter, I will talk about the theory which developed the main concept and some aspects that support the hypothesis; following Plato's point of view, Nativism questions the ability children have to build complex linguistic structures being exposed to poor input environment. After, I will approach an emergent paradigm which goes against some aspects of the previous theory and how it provides an alternative view of the classical theory of the mind. At last, I will compare these two paradigms and present my view on which is the most consistent paradigm.

2. THE POVERTY OF THE STIMULUS

Since Plato, scientists have been interested in learning; linguists have been interested in explaining an aspect which questions our ability to learn the unknown during a short period of time. This chapter talks about the problem of this paper: the poverty of the stimulus. Firstly, I will define what the concept of the term is and who thought about it, and after, I will mention some contemporary literature.

The concept was initially theorized by Plato in one of his dialogues, *Meno*. Being Socrates' student, Plato wrote down all his tutor's philosophies which were given through dialogues with people. Socrates, while discussing with Meno about virtue and knowledge, experienced what he was trying to explain Meno about anamnsesis[1] when asking questions to a slave. He claimed that one of Meno's slaves knew geometry without having ever being taught. Therefore, Plato inquired how an uneducated person, inserted in an insufficient environment, can learn something without being exposed to it.

The dialogue took place in Athens in 403 – 402 BC. It started when a young aristocratic from Thessaly called Meno questioned Socrates. This young man, who was 18, had a particular taste for discussions about virtue and had studied many philosophers such as Gorgias. At that moment, he was eager to chat with Socrates. In that period, Socrates was accused of corrupting the mind of young citizens, but he was trying to help them through thought.

The dialogue starts when Meno asked Socrates if virtue comes from teaching or nature.

> Can you tell me, Socrates – does virtue come from teaching? Or does it come not from teaching but from practice? Or does it come to people neither from practice nor from being learnt, but by nature or in some other way? (Day 1994, p. 35)

Then, the philosopher claimed that before answering the question, they should find the meaning of virtue first. Meno (Day 1994, p.38) defined virtue for a man as "running the city well", while for a woman, "running a home well." However, Socrates observed that virtue should be something for both sexes, it should be universal. For this reason, they spent a long time trying to find the perfect definition, but all they could come up with were examples of virtue until they gave up trying to find out the true meaning of it. Eventually, they went back to the main questions and Socrates started talking about the immortality of the soul

[1] Plato defines anamnesis being a recollection of ideas from previous lives.

> (...) since the soul is immortal, and has been born many times and seen both what it is here, and what is in Hades, and everything, there is nothing it has not learnt. So no wonder it's possible that it should recollect both virtue and other things, as after all it did know them previously. (Day 1998, p. 47)

He (Day 1994, p.48) also stated that "searching and learning are just recollection." Recollection, as Socrates (Day 1994, p.55) defined in the dialogue, is "recovering knowledge which is within one for oneself." The philosopher exemplified his statement by calling one of Meno's slaves. He assured that the boy could speak Greek and did not know anything about geometry, and after that, started asking the boy some questions. The following excerpt was taken from the dialogue translation by Jane Day (1994, p. 48)

Socrates Observe carefully then which of the two things he shows himself to be doing, recollecting or learning from me.

Meno I shall do.

Soc. Tell me now, boy, you know that a square figure is like this?

Boy Yes I do.

Soc. So a square figure is one which has all these four lines equal?

Boy Yes indeed.

Soc. And it is one which also has these lines through the middle equal, isn't it? [*Throughout his conversation with the slave we must imagine Socrates drawing figures as he describes them.*]

The philosopher kept on leading the boy into an extremely difficult geometry issue and sometimes stopped to talk to Meno about the process the boy was going through. When he stopped interrogating the boy, he pointed out a new topic for discussion (1994, p.55);

Soc. What do you think Meno. Has he answered with any opinions of his own?

Meno No, only with his own.

Soc. And yet he certainly didn't *know*, as we said a little while ago.

Meno What you say is true.

Soc. But he certainly had these opinions in him – or didn't he?

Meno Yes.

Soc. So someone who doesn't know something, whatever it may be he doesn't know, has true opinions in him about the very thing he doesn't know?

Meno It appears so.

Soc. And at present it's as though in a dream that these opinions have just been aroused in him. But if someone questions him many times and in many ways about the same things as now, you may be sure he will end up knowing them as precisely as anyone does.

Meno It seems so.

Soc. And it won't be through being taught by anyone that he knows, will it, but through being questioned, recovering the knowledge from within him for himself?

(...)

Soc. Well, the knowledge which this boy has now – he either acquired it sometime or else always had it, didn't he?

Meno Yes.

Soc. Then if he always had it, it follows that he was always in a state of knowledge. On the other hand, if he acquired it sometime, it could certainly not be in his present life that he has done so. Or has someone taught him geometry? For he will do just the same with anything in geometry or any other subject of knowledge. *Has* someone taught him everything, then? Presumably you should know, especially as he's been born and brought up in your home.

Meno No, I know that no one ever taught him.

In the previous passage from the dialogue, we can see the problem reaching its highest point of discussion. The characters do not know whether knowledge comes from teaching or nature. As a result, they start a new conversation around this topic, and Socrates' major argument is whether we can teach virtue, because if we can, there must be teachers and students for that. However, they could not find people who would be able to teach virtue, such as respected authorities from that time whose children were completely different from their parents in relation to personality. They concluded that wise men could not teach what they had best, they just had it. So, it was stated that virtue came from supernatural forces.

This breach between knowledge and experience was named as "Plato's problem" by Chomsky. How can a child produce a complex structure since they have never been exposed to it? Linguists are trying to reach a more practical explanation for this "lack of input". According to Fromkin et al. (2003, p. 351), children can build complex structures because they "do not start from scratch." They believe that children are born with a device for language which has the principles of all languages. Chomsky (1986) says every child is born with a pre-wired knowledge, which means, we acquire information we have never been exposed to because our mind is predetermined to do it.

This predetermination of our mind is called by Plato (Day 2004, p.72) as “divine dispensation.” After a long dialogue of his professor with an aristocratic, all Plato knew was that we have this aptitude of knowing things without any explanation. Linguistically speaking, the problem lies down on the skill that children have to create sentences with difficult grammatical structures such as relative clauses, subordination. They do not commit concordance mistakes, while adults have some kind of difficulties. Linguists are trying to explain how language acquisition is given because children go through the same stages when learning a language. The following chapter will illustrate better how this topic is treated and how the Nativist theory explains it based on Plato’s work; how they bring this issue up and develop it with the help of new concepts.

3. NATIVISM

Throughout this chapter I will answer Plato's question presented in the previous chapter based on Nativism, how children have this ability of acquiring and producing language and the main concepts of this theory.

It was Descartes who pointed out what things we could know and with what degree of certainty. Fodor (1987, p. 07), when discussing about this matter, observes that "the paradigm for mental structure is the implicational structure of systems of semantically connected propositions." In short, he says that the child's mind has particular propositional contents.

The Innateness Theory (Chomsky, 1986, p. xxv) was developed to explain "how we can know so much given that we have such limited evidence". This theory believes that we are born with a substance that keeps knowledge and it is activated, as Fodor (1987, p. 09) says, through "mechanisms which put what you know into action." Chomsky (1986, p. xxvi) defines Innatism.

> (...) the biological endowment that constitutes the human 'language faculty,' the innate component of the mind / brain that yields knowledge of language when presented with linguistic experience, that converts experience to a system of knowledge.

Brown (2000, p. 24) similarly defines Nativism as being "a genetic capacity that predisposes us to a systematic perception of language around us, resulting in the construction of an internalized system of language."

This 'language faculty' is also known as Universal Grammar (UG) which is the main topic of this hypothesis. Its overall goal is to discover the common elements of all languages. According to Chomsky, all dialects have the same principles, but each one has its parameters; this is what differs them. Fromkin et al. (2003, p.351) state that "the innateness hypothesis also predicts that all languages will conform to the principles of UG. (...) It's part of our genetic makeup for language." Therefore, UG has various sets of rules of all languages. In addition, children reproduce complex grammar easily because they do not start from zero. They already have the principles of the UG (a background); "the rules are part of the innate blueprint for language that children use to construct the grammar of their language." (2003, p. 351) Figure 01 illustrates the idea better.

Figure 01 – LAD model of Language Acquisition
Source: Cook and Newson (1996)

Nevertheless, the child needs to be exposed to the environment to get their native language parameters, for instance, a child from Brazil will learn the SVO sentence order, while a child in Japan will learn a SOV sentence order. However, in all languages there is a subject, a verb and an object. Each language will have the head of the sentence and its complement. Independently from word order or syntax structures,

> "all this make sense from a logical point of view, and it is a fact of some interest that a natural logical structure is directly represented in the mental representations that underlie the actual expressions of language." (Chomsky, 1988, p. 89)

UG as Chomsky (1986, p. 03) affirms "(…) is a theory of the 'initial state' of the language faculty, prior to any linguistic experience." He (Chomsky, 1986, p.04) also argues that language is what differ us, humans, from animals; "humans acquire language merely by applying generalized learning mechanisms of some sort." Moreover, we can perceive most part of the properties of the language; we understand sentences in a subtle way, such as metaphors. This psychological factor is what introduces the world to thought.

In his lecture about *Research Program of Modern Linguistics* (1988, p.35), Chomsky affirms the mind is a multifaceted scheme with interacting elements which is an individual phenomenon. Two people cannot have the same knowledge of language, not even twins who were born in and exposed to the same speech community. However, people can communicate and understand one another. Chomsky exemplifies it through the dialect spoken in Germany which can be understood by Dutch people, but it is not possible the other way around. This happens because "the language faculty determines a particular language" (1988, p.35) If a child is born in a Spanish community, he/she will not learn the standard Spanish, but a variable. This dialect is stored in our memory in an abstract way. The storing information process is given by mental representations constructions that reproduce the rules of some logical system of language. All human beings are capable of language intellectual achievement, even children who have Down's syndrome or deaf ones; though with many difficulties and limits and also in a slower pace. This happens because language faculty is as

the author describes, “capable of producing a rich, highly articulated and complex language on the basis of quite rudimentary data.” (1988, p. 40)

Then, Chomsky bases his explanation on a hypothetical situation, a Martian scientist studying how language (the chosen one was Spanish) acquisition works. So, he gives many examples of simple and more complex sentences, such as

a. *El hombre está en la casa*. (The man is at home.)
b. *El hombre está contento*. (The man is happy.)
c. *El hombre, que está contento, está en la casa*. (The man, who is happy, is at home.)

The Martian scientist observes that the Spanish word order is similar to the English one, because both of them are SVO languages. Afterward, he tries transcribing these sentences into the interrogative way by moving the verb to the beginning of the sentence

a. *Está el hombre en la casa?* (Is them man at home?)
b. *Está el hombre contento?* (Is the man happy?)
c. *Está el hombre, que contento, está en la casa?* * (Is the man, who happy, is at home?)

He realizes that sentence “c” was ungrammatical and like English, the main verb is supposed to move, not the one from the relative clause.

c. *Está el hombre, que está contento, en la casa*? (Is the man, who is happy, at home?)

The scientist gets surprised because he observed that children do not commit those kinds of mistakes; “the child knows without experience or instruction (...).” (1988, p.45) Subsequently, Chomsky reinforces the idea of ‘biological endowment’ of the brain, this equipment children have to base their knowledge on declaring that language is an innate feature of the infant; we are born with a device for language which is called Language Acquisition Device (LAD). This argument emphasizes that Nativist theory explains Plato’s problem of how it is possible to know so much about language without having enough time to know all we know. Chomsky (1988, p. 62) claims that parameters of the language are fixed within experience and also that “from its principles we can deduce that the phenomena must be of a certain character.” In other words, no matter how different languages can be from one another, they must have the same origin since all of them have some similarities.

Brown (2000, p. 25) states the child is free to construct grammars because this is the way she/he conceives data. He also acknowledges that the infant’s grammar is “at any stage, systematic.” In effect, we are always trying our own hypothesis through the speech faculty; our language improves and gets similar to adult like not only because we imitate it, but because we are constantly “revising, reshaping, or sometimes abandoning it.” (Brown, 2000, p. 25) Linguists examined the process of building a grammar from early period called

“telegraphic” phase to more complex structures. Koch (1999, p. 46) points out that this construction is a creative process, and that learners “must understand and analyze the rules of the language to build their competence.” However, this happens without the individual’s perception and before the age of five.

Chomsky (1988, p.70) says that “the most crucial fact about language learning is that it proceeds on the basis of fairly simple data with no need for training or instruction or even correction of error on the part of the speech community” Through the following chapter, we will talk about a theory which holds that language learning is a matter of interaction with the speech community.

In this chapter, we pointed out the origins of the theory with Descartes, gave a couple of definitions and developed its main concepts. What it has been said here was that Nativism is based on (1) biological apparatus using the mind as its major instrument; (2) language being individual and genetic; (3) rules joint in a Universal Grammar which consists of the “core” grammar supporting all languages; and (4) each language having a set of its own rules called parameters

4. CONNECTIONISM

As it was said in the previous chapter, this paradigm is based on the importance of the environment when learning a language. In this chapter, I will show the origins of this paradigm, draw an outline comparing it to other hypotheses and explain the main concepts which build the Connectionism, such as its properties, connections and how the learning process takes place.

The idea of a connectionist system starts with Aristotle and his ideas of mental associations, that is, "memory is composed of simple elements linked or connected to each other via a number of different mechanisms", as Medler (1998, p.65) affirms. Many linguists think this paradigm is either an answer to Behaviorism or a more developed version of Associationism. Rossa (2004), compares the paradigm to Behaviorism theory and shows some crucial differences. While Behaviorism was worried about the dualism stimuli-response, Connectionism explains the mental process which neural synapses deal with information. Comparing it to Associationism, the cognitive theory improved and added more definitions and answered questions in a more practical way, according to Medler (1998). Connectionist system is a nonlinear[2], dynamical scheme[3], while in Associationism there is a linearity of events.

The model is as old as Innatism; however, it was not successful due to the fact that technology was too primitive. It is based on computational modeling, a simulation of cognitive development.

Connectionism is the way the brain works in terms of memory and cognitive aspects, as Söhngen (2004) says. She (2004, p.226) also affirms that learning is "the result of the strength among neuronal synapses." These neural synapses occur as a result of connections among units. Therefore, these units are organized in layers, not in accidental clusters. To generate a network, it is necessary the interaction among varied neurons. These networks, according to Stufflebeam (1997, p.03) "are conduits through which information flows between members of a network." The information reaches the neuron through chemical substances. In computer modeling, they take many computers and connect to each other creating a LAN (local area network). Inside this LAN, people share programs, internet and so on. Scientists prefer to illustrate the mechanism in a three-layered model, for the clearness of

[2] Nonlinear, in this context, means that we are not exposed to the environment and facts are not given by a sequence of stages; everything is presented to us as a whole and we have to filter what is more important to us.
[3] Dynamical schemes mean that signals are exchange in many directions, it is not a unilateral process.

the connections. Still, a network is not only interrelated groups; in short, it is an interrelated group exchanging information with one another. Figure 02 demonstrates such model.

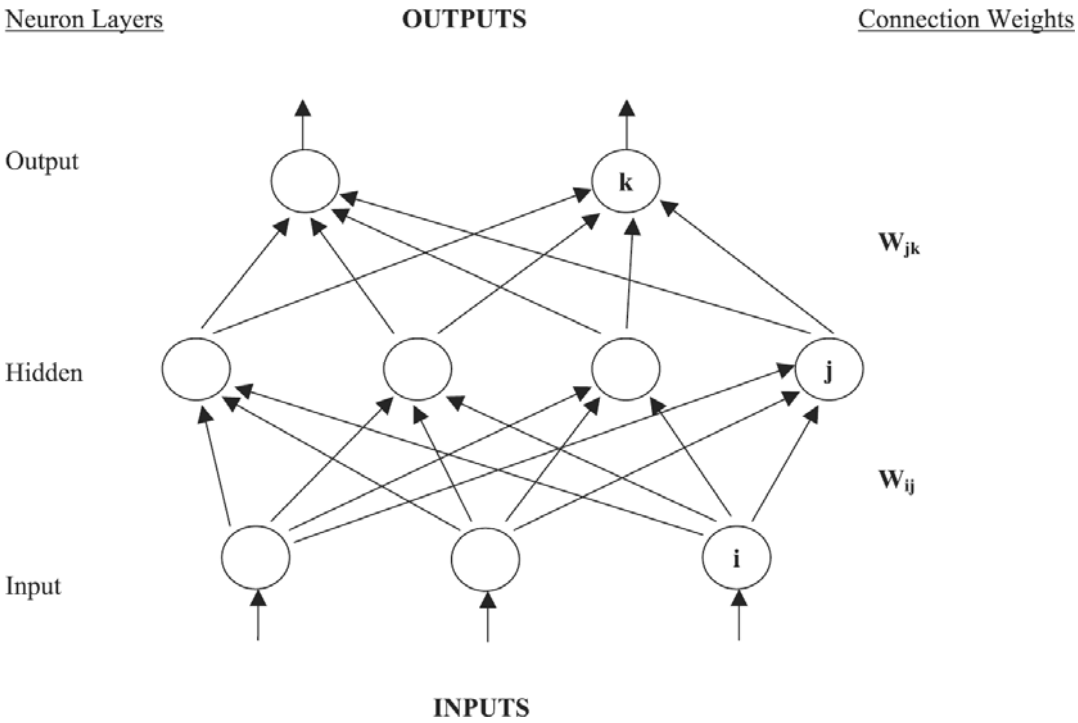

Figure 02 – Connectionist model
Source: http://www.emeraldinsight.com/fig/0240221006001.png

As we can see in the figure 02, the input layer receives the information (i) from the environment[4] and sends it through neurotransmitters to the hidden units (j). The second layer maps the kind of information creating "internal representation of the external world" and after, activates the output layer (k) which sends the 'transformed' information to other input units. Medler (1998, p.63) defines and explains the units mechanisms

> The neuron has six basic functional properties. It is an input device receiving signals from the environment or other neurons. It is an integrative device integrating and manipulating the input. It is a conductive device conducting the integrated information over distances. It is an output device sending information to other neurons or cells. It is a computational device mapping one type of information into another. And, it is a representational device subserving the formation of internal representations.

He sums up saying that our brain is an information processor; "it receives, stores, retrieves, transforms and transmits information." It is a never ending process since the output layer in A can be the input layer in B, or the output layer in B can be the input layer in C. As Elman (1996) remarks, "connectionist networks are self-organizing systems that learn how to

[4] Environment, in computer language, should be understood as the data given to the network for its learning.

solve a problem. (...) The unit feeds itself with its output." Given that the information never stops, the learning process is built by the strength of the connections; the more the child is exposed to a certain fact, the stronger the connection becomes. The system learns something when information and its desirable output are shown. So, this procedure is based on many attempts and comparisons until it finally reach the correct output. The child is exposed to, they listen and create patterns. They learn after several simulations, several connections and several epochs[5]. Children extract and catalog the patterns not only about languages, but also in all cognitive activities for we are born to recognize and arrange information through observation. The maturation of the brain makes children to produce language at the age of eighteen months because there are enough neural connections.

Indirect Learning

Proceeding Connectionist model, studies were performed in order to develop the concept of indirect learning, such as the case of anaphoric *one*, cited later in the chapter. The learning procedure is parallel and distributed; when there is aphasia, the neural networks will be reorganized and restarted. This "plasticity" is also mentioned in Cielo (2004, p.33); "there is plasticity and facts can be modified according to new experiences." Every time we learn something new, there is a change in the patterns of connectivity. The parallel learning argument proves that children do not learn one fact at a time, which is the reason why we can do more than one thing at the same time. Infants capture the pattern from the environment in which they are exposed to and then, make up probabilistic patterns. Learning is a matter of practice and with it; the interconnections get stronger due to repetition. There is a perfect example children go through; it is the past form of irregular verbs. Firstly, the child produces the verb *go* in the past as *went* because it is this way she perceives the language; the child, at this moment, is not aware of the production of the past form. After some time and after observing other forms of irregular verbs, the child starts producing *goed* instead of *went*. She developed a pattern which is not totally wrong since most past form of the verbs add *ed* into it, the child generalized a rule. After many epochs, the child will produce the correct past form because the correct connections were made.

[5] Epoch is a complete cycle in which the same network is presented many times until it gets the final and correct output.

The input is activated, the mapping is done and the target is reached (output). When this does not happen at first, the output serves as input and reproduces the synapse until it gets the expected form; we can say it is a constant training. Elman (1996, p. 49) says that “the unit feeds itself with its output (...). Connectionist networks are self-organizing systems that learn how to solve a problem.”

In her study about Indirect Evidence, Perfors et al. (2007, p.1) points out that “children are somehow able to make grammatical generalizations that are apparently unsupported by the overt evidence in their input.” When they internalize a certain structure, infants start reproducing more complex structures by associating the new fact with their previous knowledge and with what they can examine in society.

Perfors et al. (2007) demonstrate that a child can learn a structure without having an innate knowledge or, as the authors claim “without the allegedly necessary innate linguistic constraints.” (2007, p.2) They made a research about the learning of the anaphoric ‘one’; for instance, “*Here is a yellow bottle. Do you see another* ***one****?”* The particle can be understood differently in this sentence; either a yellow bottle or any other bottle. This question was asked to a certain number of children and all of them looked at the yellow bottle, not another one. Consequently, they wanted to make a deeper study about it. Several noun phrases were taken and were followed either by a complement in which the noun requires a continuation for instance, member *of congress* or by a modifier, in which we add an extra information (man *from Rio*). Their guiding question for this study was “Which of the constituents of the NP does anaphoric *one* take as its antecedent?” The results were the expected ones, the anaphoric *one* substitutes the NP followed by modifiers. They do not make the mistake of substituting the NP followed by the complement. They also observe that “the learner relies on indirect evidence.”

As Mitchell and Myles (1998, p. 79) say, “learners are sensitive to regularities in the language input and extract probabilistic patters”, in other words, knowledge is built by the strengthen of associative models. Elman (1996, p. 359) defines knowledge as “a specific pattern of synaptic connections in the brain.” He (1996, p.315) continues saying that “all learning involves some kind of change in patterns of connectivity”.

Therefore, Connectionism is based on simple scheme; the child, through one of the senses, perceives the information, it is sent to the brain and the brain creates patterns. If the pattern does not match with the expected output, it automatically begins the process again until it reaches the expected one.

From what we could see, the basic principles of Connectionism started with Aristotle and are studied in a multi-disciplinary field: philosophy, neurophysiology and computational systems. Consequently, there is much more to be studied about and explained since technology is evolving even more nowadays.

5. DISCUSSION

As we could see in the previous chapters, there are two major hypotheses concerning language acquisition nowadays: Nativism and Connectionism. Both have different ways of explaining facts, such as “the poverty of the stimulus”. While one bases its explanation on findings of neuroscience, the other uses an abductive theory. They started together in the 60s, but it is only now that Connectionism is getting successful due to the fact that technology is now evolving.

Nativism affirms that language comes from genetic cells, which is called *Language Acquisition Device* (LAD). This device is universal, not specific, containing all the grammatical rules common in all languages. This is the reason why children at the age of four know how to produce complex sentences just like adults; and they have been only exposed to language for four years. Chomsky claims that it is a short time for children to create intricate structures. He questions the poverty of the input and the richness of the output, not the process in between. Therefore, he claims that we are born with this ability of producing unknown sentences that we have never heard before. An example to support his idea is the fact that a poor child living under poor conditions where people usually do not have a good education can produce complex sentences. The only explanation for that is the LAD.

On the other hand, Connectionism is a paradigm that explains the cognitive process; it explains not only language acquisition, but also the process of learning such as riding a bike, walking, combing your hair. Consequently, we can take this paradigm to explain language acquisition since it reports the capacity of our brain cells to process information through chemical properties. In other words, this model works with the exposition to the environment together with the plasticity of the brain; because we are able to learn language without having explicit instructions about it. After 18 months, the child is able to start producing language because she can make around 100,000 connections a day, so she is mature and exposed enough to create sentences as the figure (03) bellow illustrates.

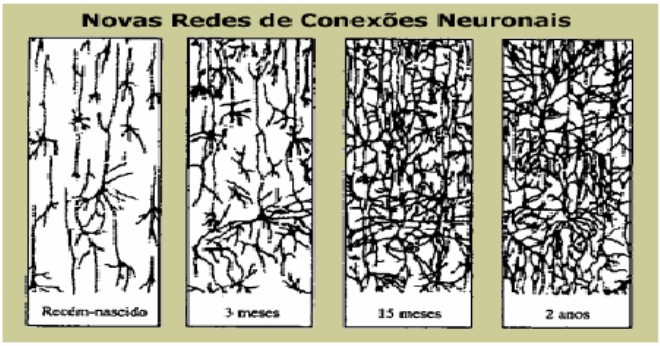

Figure 03 – Development of Neuronal Connections
Source: Greenfield (2000)

Figure 03 illustrates a computer simulation of our brain and this is what Connectionism is based on. This figure shows the maturation of our brain when we reach a certain age, in this case, the age of two. Connectionism works with what can be simulated inside the brain unlike Nativism, which bases the theory on hypothesized concepts. It states that knowledge is stored in the mind; while Connectionist paradigm affirms that information is stored in units or neurons and they are activated through synapses which are activated by one of the senses. This paper is about the poverty of the activation input and how children can produce with such barely information.

According to Lewis and Elman (2001, p. 01), the poverty of stimulus can be explained through indirect evidence and that Chomsky's UG "has been attributed with principles to account for properties of language that are demonstrably learnable from the statistical properties of the input." In short, Chomsky's theory cannot explain certain facts that Connectionism can. The objective of Lewis and Elman's study (2001, p. 01) was to prove that children can learn the aux – questions structure from the input available, which was something that Chomsky would affirm to be genetic, or "could not strictly be a matter of learning." Lewis and Elman (2001, p.02) claimed that

> Simple recurrent networks (SRNs) induce abstract grammatical categories (...) and generalizations such that words which have never occurred in one of these positions are nonetheless predicted to occur, if they share a sufficient number of abstract properties with a set of words which have occurred there.

What they want to say is that children can learn relative clauses and each time they hear it, the hidden units improve the concept since the complexity also increases. They (2001, p.05) concluded that "the network succeeds in generalizing to predict." They wrap-up their article saying that

> The fact that a neural network generalizes to make the correct predictions from input represented in this way, and modeled on child-directed speech – but limited to contain no data of what has been considered the relevant sort – shows that poverty of stimulus arguments must give greater consideration to the indirect evidence available to the child.

In other words, they claim that Connectionism can explain the poverty of the stimulus since it works with the maturation of the brain and deals with association. I agree with them because the paradigm has been able to answer some questions that Nativists have not. For instance, Nativism claims that the poverty of the stimulus relies on the language acquisition device, which is supposedly a genetical mechanism located in the brain. Nonetheless, some experiments with computers such as Perfors' – which we cited in chapter 4 – simulate the learning process we go through and what happens in our brain.

Medler (1998, p. 83) states that the "network has both plasticity and stability; new categories can be formed when the environment does not match any of the stored patterns." This is how Connectionism explains "Plato's problem", which for them, there is no such problem; it can simply be explained by the maturation of the brain and the associations we make everyday. As I said before, the child after 18 months knows a significant percentage of the words; when we are three years old we know 10,000 words vocabulary, while an adult knows 30,000. Consequently, four years is enough time for a child to learn; in short, Connectionists argue that what a child needs to know is available in the language they are exposed to since they can generalize concepts. This happens due to the fact that the learning process is not given by a module of the mind or local units; it is given by distributed neuronal synapses spread over our brain.

After this analysis between Nativism and Connectionism, I consider the Connectionist paradigm to be more pertinent when talking about the study of language acquisition. It explains facts through computer simulations, points out that learning is a simultaneous process and believes that experience strengthens the connections through gradual and interactive system. The model also offers tools for a better understanding of language cognitive aspects and it provides more consistent evidences. I think that Nativism was the suitable explanation for a time, but now other sciences and theories are being researched and they are well-supported by new technologies. Nowadays, people get interested and motivated when they have a support or something concrete in which they can rely on; and in Nativism we do not find this concreteness. I look for evidences and Connectionism was better at supplying them.

Therefore, it is important to say that both hypotheses made their contributions. They explained what they could for the time; however, technology is evolving and the tendency is to find out how things work. There is no right or wrong. Nowadays, with the help from machinery, it is becoming easier to discover facts that in the past they were unable to reach consent about it.

6. CONCLUSION

Researches made upon the topic discussed in this paper are of great value to language learning; the term ‘learning’ is used by Connectionists while Nativists prefer ‘acquisition’. Each has a way of explaining things, they do not complete each other, but they improve each other’s concepts. In the present work, we tried to explain the poverty of the stimulus taking two points of view, the Nativist and Connectionist one.

In the first chapter we talked about the poverty of the stimulus raised by Plato in one of his works, which questions our ability of knowledge. The intention was to show how the problem was originated. To follow, Nativism develops the concept and gives a solution to the problem which claims that children from all over the world speak at the age of 18 months because they have a language acquisition device. This mechanism restrains the rules of all languages, that is why children go through the same stage independently of culture and language. The goal of this chapter was to present an approach which supports the problem given by Plato. Opposing to Nativist argument, Connectionism says that children are able to produce language because of their exposure to the environment. Connectionists believe in networks of interconnected simple processing units; in other words, children absorb the information which is automatically represented in the hidden units. Therefore, there is no genetic device responsible for our language learning. The objective of this chapter was to show a different view of the same topic and how it explained facts.

Connectionism is still developing and there is much more to be discovered in terms of how we learn. We can not take the paradigm for granted since it is developing and also it is not the eternal truth. As we could see, there is no right or wrong concerning language learning, there are only different ways of explaining the same fact. Perhaps, in the future there will emerge another theory which will invalidate the studied ones in this paper, or supply one of them with examples and new data, but for now I conclude that Connectionism supports with more evidences the process of language learning.

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