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Divergent Abduction Model and Its Convergent Interaction in Knowledge Production

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Abstract

To date, the abductive is maintained as a method by which premises or isolated conjectures are generated from deductive and inductive methods, whose basis is convergence and divergence, respectively. The vast majority of authors do not relate the abductive method to the scientific method. Starting from a descriptive methodology and deductive analysis, the objective of the work is to propose a new pattern of extended use of the abductive method and its interaction with the inductive method based on divergence and, in this way, schematically and organically achieve a convergent procedure of support for the production of new knowledge. In this chapter, a model is established integrating the abductive n times with the divergence, and, logically, unifying and integrating are reduced until reaching a solution by convergence and, in this way, to achieve alternative processes of preparation and academic training to support and comply with the requirements of promotion and doctoral thesis in relation to generating new knowledge, as established in the rules that govern it in Venezuela.

Keywords: abductive divergence, abduction, convergence interaction

1. Introduction

The production of knowledge has always been a necessity, and it is the final fruit of research and education. The search for knowledge has a very clear objective and concludes in the contribution that occurs when there is an invention or an innovation, but, when analyzing the different countries, the difference between being and not developing depends on how their level is in science and technology. Venezuela as a country has three major problems: the low production of knowledge, the syndrome of anything but thesis in doctoral studies, and the elimination of the requirements of having a doctorate for promotion to the last categories in some universities. Starting from this problematic, the present chapter is developed in which, centered on a deductive documentary methodology, a conceptual framework of abduction and divergence is defined, which are integrated to establish a convergent model of knowledge production with its corresponding stages. In Venezuela, there is a legislation published in the Official Gazette [1] that states in article 26: "Doctoral studies are aimed at training for the realization of an original work that constitutes a significant contribution to the knowledge of a specific area of knowledge." To illustrate, in Venezuela, historically, the doctorate consists of constructing an original contribution relevant to science, for which the generation of knowledge

is mandatory in the doctorate; the rest of the Venezuelan legislation speaks and defines research but without involving it with patents, and, although there are universities that are generally responsible for educating and training researchers, only the doctoral thesis at the graduate level is developed with the aim of generating new knowledge. Additionally, in Venezuela, there is a National Universities Law published in Official Gazette N° 1.429 of September 8, 1970, in article 87 which establishes that they are ordinary members of teaching and research staff, instructors and assistant, aggregates, associates, and full professor, known as the ranking or location of teachers according to the merits and time spent on average of 4 years in each category. To ascend from one level to another in the universities is defined in article N° 89 which says: "The Ordinary members of the teaching and research staff will be located and will rise in the ranks according to their credentials or scientific merits and their years of services. To ascend from one category to another in the ranking, it will be necessary, in addition, to present for the consideration of a jury appointed for that purpose an original work as a credential of merit." The important thing of this article is that the work of promotion to ascend to the different levels of the ladder must be original; but as time went by and after 24 years, a modification to the Law of Universities published in Official Gazette No. 35, 708 of May 11, 1995, called Standards on the Teaching and Research Staff Scale of National Universities, and in article N° 5, it establishes: "The work of promotion required by the Law of Universities must be original, novel and untold published during the time in which the teacher remained in the previous ladder to which one aspires"; this article introduces and raises the requirement that, besides being original, must comply with being novel, which leads to new verifiable knowledge worldwide, and the unpublished is that it has not been published previously; the legislators seek to establish the obligatory nature of the ordinary teachers of the universities, to produce new knowledge on the frontier of science, which in practice is invention and innovation.

After an analysis of the problematic, the most important of the writing is the divergent adductive model of n hypotheses, all with the same probability, where infinite conjectures of a fact or event are defined, and then from a convergent step-by-step process, look for the possible solution, and in the end, a general model that integrates both approaches in a single scheme is presented.

2. Cause of Low Production of Knowledge

There is a great variety of problems related to the low production of knowledge in Venezuela, the most outstanding being:

- The percentage of students who graduate from doctorates as a source of knowledge production is approximately 10% compared to the income, which defines that there is a low efficiency in this schooling in Venezuela; this oscillates between 0 and 15% per year, with a unique atypical value of a University with a 95% ratio of graduates of the total income. Everything is based on the information provided by the universities to the National Graduate Advisory Council [2]; the cause is known as everything except thesis [3], which means finishing school and doctoral thesis project, but it does not end with the delivery and public defense of the said thesis.
- The actors that are required to produce knowledge are university teachers, and they are not fulfilling their task. By law they are obliged to investigate and, also, to climb the ladder in the categories of associate and holder; they must have a doctorate, but, in the great majority of the universities of the country,

an exceptionality persists so as not to fulfill the requirement of the title of doctor [4], which increases inefficiency and allows people to reach the highest levels of teaching without academic credentials. The experts in generating patents par excellence are the university professors, but if these do not fulfill their obligations, they do not possess the experience to support others, which turns into a vicious circle.

- It does not exist an orientation, models, or patterns adapted to our reality that supports the generation of knowledge, being tutors who should have a high level of expertise and experience in the subject of doctoral thesis, publication, incubation, prototypes, and patents and their inclusion in the application to solve problems. The different methodologies known worldwide are not giving real benefits in Venezuela, and both the level of scarcity of financial resources for research projects and low salaries become factors of low motivation; all the above is reflected in the world records which places Venezuela among the group with the lowest number of patents per year.

3. Objective

Define a basic model of abduction and divergence interaction that allows systemically to model with the variables involved in a convergent sequential pattern to increase knowledge production in Venezuela.

4. Methodology

The research is based on a study and analysis of the information developed in other areas of knowledge and its application in the subject, to relate them to the dynamics over time of the problem and the generation of knowledge; starting from the use of a descriptive methodology, of deductive analysis with emulation of different sciences, the convergence and divergence engineering is established as a tool to model the scope of knowledge generation. The research begins by locating and studying the sources of information to subsequently analyze and interpret in a critical and separate way the ideas surrounding the topic, to relate them as variables that intervene in a basic model of knowledge generation.

5. Theoretical support

Abduction is a term from the Latin *abductio* and is composed of the words *abs*, from *afar*, and *ducere*, to carry. The movement by which a member or an organ moves away from the median plane divides the body in two symmetrical parts. “The abductor is the muscle that serves for abduction” is a type of reasoning that from the description of a fact or phenomenon offers or arrives at a hypothesis, which explains the possible reasons or reasons for the fact through the premises obtained. Charles Sanders Peirce calls it a conjecture [5]. That conjecture seeks to be, at first sight, the best explanation or the most probable one.

Abductive thinking or reasoning is a type of reasoning that from a fact or phenomenon is reached a hypothesis, which explains the possible reasons or reasons for establishing a premise called conjecture. That conjecture seeks to be, at first sight, the best explanation or the most probable one. Aristotle investigated seductive reasoning in his *First Analytics*. According to Aristotle, abductive reasonings

are syllogisms where the premises only give a certain degree of probability to the conclusion. According to Peirce, abduction is something more than a syllogism: it is one of the three forms of reasoning together with deduction and induction. Charles S. Peirce (1903) [5] defines abduction: "Abduction is the process by which an explanatory hypothesis is formed, it is the only logical operation that introduces a new idea." Abduction can be understood as a form of logical inference. In abduction to understand a phenomenon, a rule that operates in the form of hypotheses is introduced to consider the possible result as a particular case within that rule; in other words, in the case of a deduction, a conclusion is obtained of a Premise "p," while abductive reasoning consists of explaining "c" by means of "p" considering p as explanatory hypothesis [6]. Abduction is characterized, then, as a creative process, as it generates the new ideas, while the deduction derives knowledge from the one that has already been validated previously, and the induction, for its part, is limited to checking it in. Abduction, allows the identification of indications to which something corresponds and the reasons for their appearance, from which a series of consequences can be extracted.

Divergence is a word that comes from Latin "divergens" which means divergent. It means action and effect of diverging, progressive separation of two or more lines or surfaces; diversity of disagreements, diversity of opinions, as an example we have in mathematics the divergence of a vector field on a surface and the infinite series that does not converge [7].

Divergent thinking: Throughout history there are many treaties that established the classification of productive thinking in two groups: divergent and convergent. Divergent thinking is pointed by the authors as a generator of different solutions to a problem, in different directions, seeking the best; confronting the new and with a tendency to creativity and ingenuity, it has also been called lateral thought, by De Bono in 1970, as well as holistic thinking defined by Jan Smuts in 1927, in which the analysis is of the whole and not of its parts, including as a term "see the forest and not the tree." There is a mechanism associated with creativity, which is retrospective perception and intuition; according to the story, it is established that the great discoveries have been produced by changes of schemes through casual observations, accidents, errors, and humor. Río Pérez, in 2002, characterized the creative thinking of an individual and related it to the intellectual structure of the subject, their characteristics, and their mental capacities [8]. At the beginning, human development focused on intelligence, knowledge, memory, and logical or convergent thinking, and, later, divergent production was incorporated [9]. The production of knowledge, in the first instance, is the interaction of vertical and lateral thought closely linked, where lateral thinking is the one that increases the efficiency of vertical thinking.

6. Case study

To define the case study, it is formulated in the Seminar on Management in Science and Technology, of the Doctorate of Management of Research and Development, during the academic periods of the second of 2011 to the first of 2014, with an average of seven students, belonging to the Area of Management of Research and Development, of the Commission of Postgraduate Studies of the UCV, to which a question was posed to the trainees: Is there a ticket on the floor? Unknown, what do you think about it? Do you formulate all the hypotheses related to the case? **Table 1** shows the relation of the number of students and the total of hypotheses that they managed to define for 5 min, which is an application of establishing premises when an event occurs, with a total of 40 curative participants during six semesters.

People	Hypothesis
1	1
18	2
15	3
2	4
3	5
1	6

Table 1.
Relationship and participants responses.

The challenge was to produce the greatest number of hypotheses; in many cases, the abductions are but the spontaneous conjectures of reason. In order for these hypotheses to emerge, the imagination and instinct must compete. Abduction is like a flash of understanding, a jump over the known; for abduction, it is necessary to leave the mind free. Based on the same events, then the students are illustrated with a variety of hypotheses of equal probability; out of a total of 100, there are at least 35 equally likely assumptions and they are:

- It's false?
- Is the evil?
- Will it be paving?
- Is it terror?
- What brought a bird?
- Will it be a student?
- Will it be a professor?
- Will it be a pump?
- Will it be a joke, with a hidden camera?
- Will they be filming?
- Will you have owner?
- Is it good luck?
- Will it be embraced?
- Will it have poison?
- Will it have a bar code?
- Will it have GPS?
- Will you have intelligent chip?

- Will it be an alarm activator?
- Will you be in a research?
- Will it be a hologram?
- Will it be mine?
- Is it a projection?
- Will it be contaminated from drug?
- Is it a transparent touch screen?
- Is it an optical illusion?
- Will it be printed on the floor?
- Is it glass?
- Will it be plastic?
- Is it a photo?
- Is it a joke?
- Is it a proof of ethics?
- Is it a proof of honesty?
- Is it a proof of success?
- Is it a proof of education?

7. Model of generation of knowledge

Starting from the definition of abduction and divergence [10], the model will be presented in five parts to increase understanding; each phase will have a comment and the basis of the construction. The first phase consists of applying abduction infinitely starting from a central axis and according to the abduction capacities; a scenario will be produced in which all the hypotheses are distributed, and it is illustrated in **Figure 1**. In a broad way, it is possible to name this new concept as “Conductive Abductive Model of Infinite Conjectures and Hypotheses” considering itself as a novel contribution that aims to broaden the scope of the traditional abductive method defined by Pierce.

The second step, once infinite hypotheses are defined, is to order all of them according to some preestablished macrovariables, which will depend on the experience and training of each person; however, part of these may be:

- Morals, ethics.
- Cultural, habits, customs.

- Formation, education instruction.
- Family, society, country.
- Science, technology,
- Invention, innovation.
- Sentiment, intuition, religion, creed.
- Development, underdevelopment, poverty, wealth.
- Link, irreality, fiction, superstition, reality.
- Heat, threat, insecurity.
- Equipment electrical, mechanical, communications.
- Defense, protection, integrity.
- Politics, government, doctrines.
- Experience, techniques, tools, skill, etc.

The hypotheses are grouped according to each variable, which is illustrated in **Figure 2**.

In the third phase of the model, we seek to establish the different relationships between the hypotheses and their relationship with the variables to which they are associated, which is presented in **Figure 3**, and, in this way, a new group of integrated hypotheses is established and selected according to the different preestablished criteria, which gives a new higher level, in which at least 30% less participate, reducing the total number of hypotheses.

The fourth phase of the model is presented, which combines and establishes a process of integration, simplification, and reduction until it reaches at least one, two, or three possible solutions with characteristics; theoretical logics that are novel are presented in **Figure 4**. In this figure, the convergent model is characterized, from the general to the particular, from the very broad to the simple.

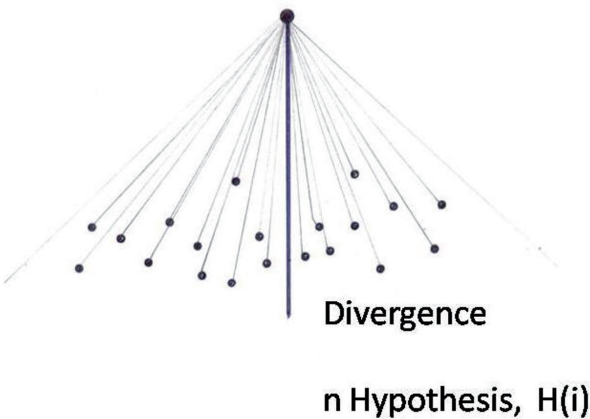


Figure 1.
Infinite application of abduction.

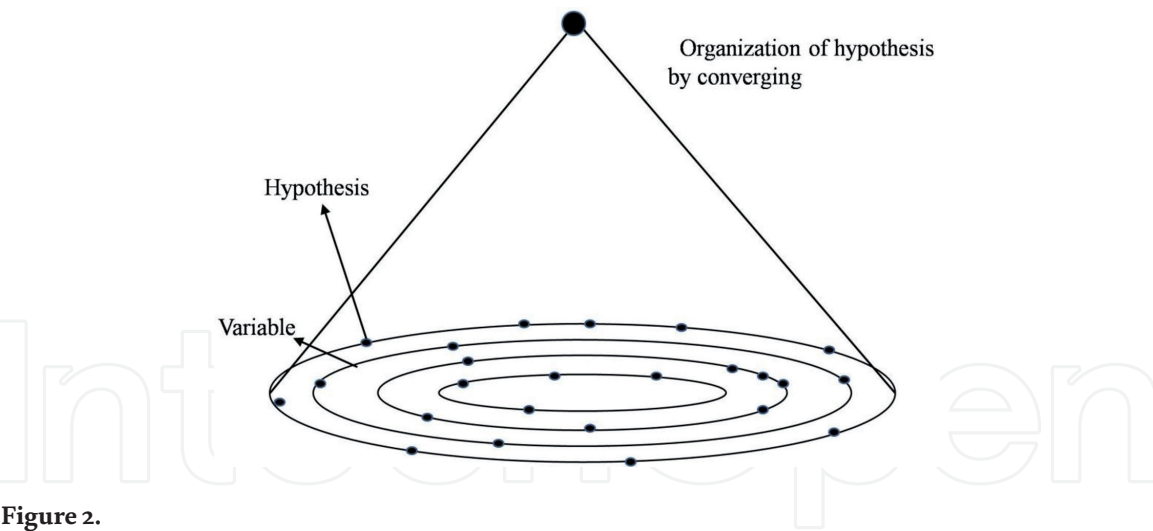


Figure 2.
Association of hypotheses in variables.

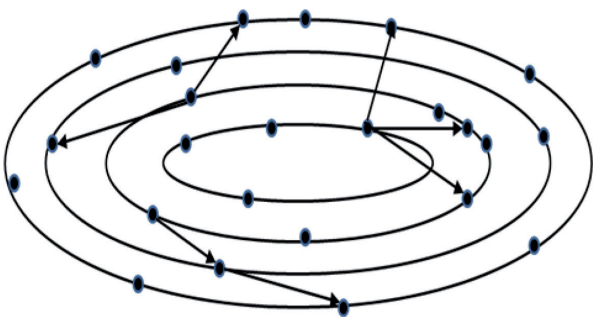


Figure 3.
Relationships and links of the hypothesis with others and the new preset variables.

The model has been illustrated in three initial figures, to explain the divergence of n abductions and the convergence of these in a certain pattern or technique; harmonizing the four previous figures integrated into a final model is presented in **Figure 5**, and it is called Integrated Model of Generation of Knowledge, which is characterized by the following:

- Everything begins with a problem and ends with one or several novel solutions that depend on the cognitive capacity of each actor.
- From a problem, infinite hypotheses are generated producing a three-dimensional divergence, and the size, range, spectrum, and novelty will be proportional to the total skills of the individual involved, and the farther they can go in different directions, the closeness to produce new knowledge it will be greater.
- Having as origin, divergent model in two or three dimensions the only way to reach a defined point as a solution to the problem is to apply a convergence, which requires ingenuity and engineering; as an organized and systematic procedure, it will be specific to each actor if based on their experiences, schooling, logic, and reasoning.

In the field of engineering, specifically the area of networks, a simile could be proposed, the distribution and water collection system, in the understanding that we start from a drinking water dam; as a starting point, we will make a distribution system in such a way that we start with pipes of high diameter to reach the smallest as a sink and start at a point and takes the water to infinite points, achieving and

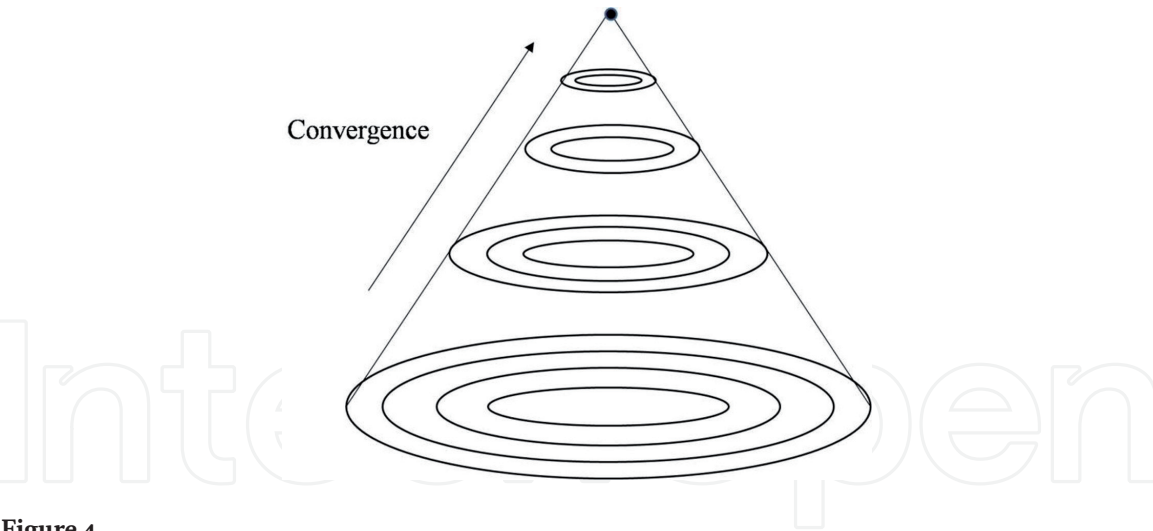


Figure 4.
General model of knowledge production.

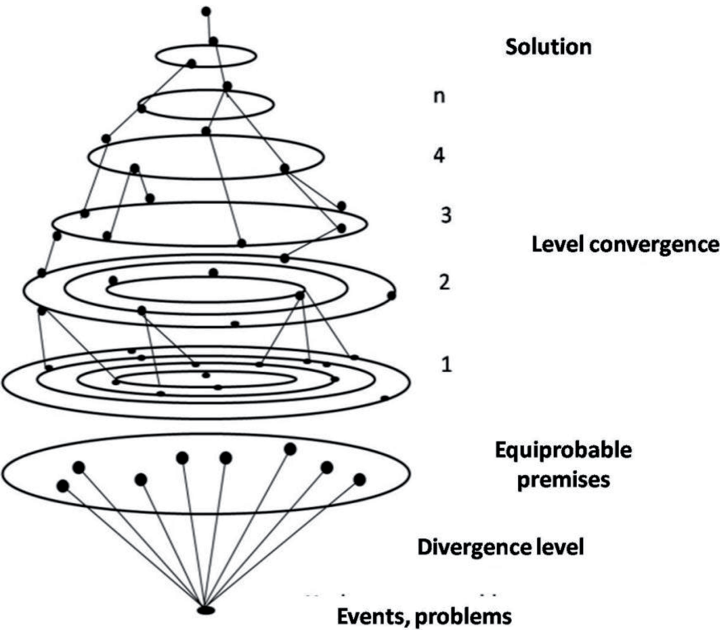


Figure 5.
Integrated generation of knowledge model.

applying a divergent system; once the water is used, it is transformed into waste or wastewater, which must be channeled and taken to a sewage treatment plant and then incorporated into the dam or river, starting from infinite points and reaching one, which is a convergent system. This comparison is a way of understanding how the model of generation of raised knowledge works, part of a point called fact or event, and of producing infinite hypothesis, and then convergence starts, simplifying until arriving at a point as final selection of hypothesis.

8. Conclusions

- In this work, we present a novel contribution that aims to redefine the traditional abductive method, called “Conductive Abductive Model of Infinite Conjectures and Hypotheses.”
- The proposed model is a new approach that integrates the scientific method with the modified abductive method, establishing a new sequential form to search for and obtain alternatives in the generation of new theories by convergences.


- The model of divergent abduction linked to the convergent process of selection is transformed into a procedure to generate and produce new knowledge, which contributes to improvement for graduate students, which, using the model, guides them to success and search for new theories.
- The model systematized as part of a seminar, in the schooling of doctoral studies, can be the basis for training the students and strengthening their skills for knowledge production.
- The model achieved is novel, but its deduction was obtained with the same principles set out in this work.

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