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A POPPERIAN CRITIQUE OF JEAN- CLAUDE PASSERON'S 'SOCIOLOGICAL REASONING'

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Abstract: In the book: “*O Raciocínio Sociológico: o espaço não popperiano do raciocínio natural*”, french sociologist Jean-Claude Passeron states that the structural use of natural language in the social sciences creates what he calls “sociological reasoning”, a necessary method based on natural reasoning where the “demarcation” and “falsifiability” of Popper and the “paradigms” and “normal science” of Kuhn would not be possible. This article proposes to analyze the empirical foundations of three statements deduced from the propositions that make up the French author’s thesis, namely, that each science has its own language from which its specific type of knowledge and empirical evidence derives, that the use of natural language prevents the creation of “paradigms” and the accumulation of knowledge in sociology and, finally, that the use of natural language favors the carrying out of observations and prevents the carrying out of experiments. The fact that such statements are logically deducible from Passeron’s propositions allows their empirical relevance to be tested using a method inspired by Karl Popper’s ideas, consisting, in this case, in the presentation of empirical examples that contradict them. The results allow us to conclude that if there are difficulties in social sciences, especially in consolidating paradigms, in accumulating knowledge and in carrying out experiments, such difficulties cannot be attributed to the use of natural language.

Keywords: Passeron. Popper. Social Sciences. Kuhn. Sociological Reasoning. Epistemology.

INTRODUCTION

The book “*O Raciocínio Sociológico – o espaço não-popperiano do raciocínio natural*”, by Jean-Claude Passeron, it is, above all, a libel in defense of the epistemological value of the social sciences. But the work is also a theory about the epistemological and methodological possibilities of the social sciences, especially those that the author calls “historical” and “general”, like sociology, anthropology, and history itself.

Developing the defense, Passeron states that the social sciences are already carried out in the only way in which they can be carried out ¹, that any theoretical or technological advances will not alter the essence of its current approach, and that the characteristics of the social sciences are already final, and not part of an evolutionary process that could alter their methods and scope.

Developing the theory, the author exposes his vision about the essential characteristics of the social sciences, by virtue of which it is possible to identify their differences compared to the natural sciences and establish their specific method. Passeron states that social sciences use natural language, unlike natural sciences which extensively use artificial languages², and that the object of social sciences is always inserted in a historical context, delimited in time and space, which is never repeated with all its characteristics and variables in another place or moment, completely different from the object of natural sciences. These two characteristics – natural language and historical context – combine

1 In relation to the aspect that interests this article, this only way concerns the privileged use of natural languages in the social sciences.

2 Although the use of the expressions “artificial language” or “artificial language” in reference to formal systems, or symbolic systems, such as mathematics, geometry and logic, is questionable, they were maintained for two main reasons: first, because they are the expressions used by Passeron in the text under analysis (see PASSERON, 1995, p. 470), and, secondly, because they establish a dichotomy, quite interesting for the objectives of the present work, with the expressions “natural language” and “natural language”, also used by Passeron. Languages or natural languages would be those used by human beings in their usual communication with other human beings and through which they are able to make descriptions about the world that surrounds them and narratives about lived or observed experiences. This succinct explanation is sufficient for the reader to understand the argument presented in this article.

to create what Passeron calls “sociological reasoning” or “natural reasoning”, defined as a way of explaining historical and social reality that uses contextualized concepts, methodologically controlled metaphors and comparisons, and empirical vulnerability based on broad and systematized observations, but valid only in certain space-time contexts.

Consequently, Passeron states that there exists in the social sciences a non-Popperian space, that is, an area of human knowledge where the central points of Karl Popper’s philosophy of science - but in the end, and for other reasons, also of Thomas Kuhn³ – would not be applicable. In this sense, Popper’s “demarcation” and “falsifiability”⁴ and Kuhn’s “paradigms” and “normal science”⁵, ideas that both philosophers once stated were applicable to all sciences⁶. would not apply to social sciences.

If Passeron is right, sociology would have already reached its maturity with a specific approach of the historical social sciences - consisting of “natural reasoning” or “sociological reasoning” -, which would definitively rule out the hypothesis of the uniqueness of the scientific method and position the scope of validity of Popper and Kuhn’s ideas only in the natural sciences.

It cannot be said that the position defended by the French author – which he constructed throughout the 1980s – has prevailed. As pointed out by Roberto M. Ferreira “(...) since the 90s, perhaps unhappy with the results of

3 The debate between Karl Popper and Thomas Kuhn is broad and there is no point in revisiting it here. The reasons why Passeron’s theses oppose both will be clarified throughout this article.

4 Popper himself seems to agree with Passeron’s statement, since he proposed two specific methods for the social sciences, situational analysis and gradual action social engineering, which are quite different from the method he proposed for the natural sciences, resulting from demarcation. However, Popper’s reasons for this are very different from those presented by Passeron. This article analyzes a specific set of reasons presented by Passeron.

5 Kuhn also seems to agree with Passeron’s statement, but the reason for this comes from a disagreement between the two: Kuhn believed that the social sciences had not fully developed, and for that reason alone they had not yet reached the paradigmatic stage of normal science. As already stated in the previous note, this article analyzes a specific set of reasons presented by Passeron.

6 Examples of these statements can be found in POPPER, 2007, p. 35 (“I call the demarcation problem the problem of establishing a criterion that enables us to distinguish between empirical sciences, on the one hand, and Mathematics and Logic, as well as ‘metaphysical’ systems, on the other”) and KUHN, 2009, P. 31 (“the acquisition of a paradigm (...) is a sign of maturity of any scientific field”).

the interpretative turn, the number of authors that have once again defended the possibility of methodological unitarianism”, which “implies refusing the supposed epistemological specificity of the object of social sciences” has been growing” (FERREIRA, 2008: 19):

This article is a small part of this debate. In broad terms, it is about the specificities of the methods to be used in the social sciences in relation to those usable in the natural sciences, and, in specific terms, it analyzes the validity of the retro mentioned statements of Popper and Kuhn about the social sciences.

As already said, it is clear from Passeron’s text that “sociological reasoning” is shaped from two main characteristics. The first, that it must necessarily be constructed in natural language. The second, that it necessarily refers to objects inserted in spatially and temporally delimited (historical) contexts. The argument developed here is restricted to analyzing the first of these aspects and, in particular, some of the consequences that Passeron claims arise from the use of natural language in the social sciences.

ABOUT THE POSSIBILITY OF CRITICIZING PASSERON’S PROPOSITIONS THROUGH EMPIRICAL REFUTATION

Since Passeron intended to exclude Popper and Kuhn from the game of social sciences, it is fair to use the arguments of at least one of them to try to get them both to return. To this

end, the methodological option of analysis and criticism of Passeron's theses, relating to the consequences of the use of natural language by social sciences, will be inspired by Popper's ideas of empirical refutation, as briefly described below.

The French author's construction is philosophical - a critical exercise to be examined and criticized and not to be refuted - and, therefore, it may not be entirely correct to use, as an instrument of criticism, a method created to test scientific theories. On the other hand, and when constructing his propositions, Passeron apparently crossed the sometimes-tenuous border between metaphysical assertions and empirical assertions. If this is true, as we will try to demonstrate later, his propositions become empirically criticizable.

In other words, and as will be described in detail below, it is the logical form in which a large part of the propositions presented by Passeron were written that allows the method of empirical refutation, inspired in Popper's ideas, to be used here. In other words, what makes it possible to empirically criticize the propositions presented by Passeron does not reside in the understanding that they are "scientific" or that the author constructed them with that intention, and it also does not depend on the concepts of scientific theory or scientific explanation constructed by Popper, but rather the fact that they are logically and empirically refutable.

The Popperian empirical refutation method can be logically described (or is logically grounded) through *modus tollens* as follows (POPPER, 2007, p. 80):

- if a conclusion "p" is deducible from the system of statements (propositions) "t",
- and if "p" turns out to be false,
- then "t" will be necessarily false.

To advance in our critical analysis of Passeron's propositions, it is necessary, then,

to obtain the deducible consequences of his propositions that will be used here. Due to the restriction established on the scope of this work, consequences related exclusively to the use of natural language by social sciences must be analyzed.

The first of these consequences can be extracted directly from Proposition 1: "Empirical sciences are languages of description of the world that must produce a particular type of knowledge with the empirical proofs that the logical structure of these languages makes possible and necessary" (PASSERON, 1995, p. 400). If, as Passeron states, "empirical sciences are languages of description of the world" and if these languages produce "a particular type of knowledge" arising "from the logical structure of these languages", what will determine the possible empirical proofs in their scope, then **each science must have its specific empirical evidence, language and type of knowledge** (first consequence).

The second of these consequences can be extracted from the combination of sub propositions of Proposition 1, already mentioned, and of Proposition 2: "There does not and cannot exist a unified protocol language of the empirical description of the historical world" (PASSERON, 1995, p. 405), which are sub proposition 2.4: "Sociology, like history or anthropology, in its final statements, can only be spoken in natural language" (PASSERON, 1995, p. 422), sub proposition 1.2.1: "A high degree consensus carried out in a group of specialists and related to a high degree of stabilization of a language for describing the world defines a scientific 'paradigm'" (PASSERON, 1995, p. 403) and sub proposition 2.1: "Sociology doesn't take, and isn't able to take, the form of cumulative knowledge, that is, a knowledge whose accumulated parts are organized by a theoretical paradigm" (PASSERON,

1995, p. 407). If each science has its specific language (already mentioned proposition 1), if the specific language of sociology is natural language (proposition 2.4), if only a “high degree of consensus achieved in a group of experts”, which depends on “a high degree of stabilization of a language”, makes it possible to define a scientific paradigm (proposition 1.2.1), and if “sociology cannot (...) take the form of a cumulative knowledge” organized “by a theoretical paradigm” (proposition 2.1), then **it is the use of natural language, always “unstable”, that prevents the stabilization of scientific language and, consequently, the constitution of “paradigms”, the realization of normal science and the accumulation of scientific knowledge in the social sciences** (second consequence).

The third and final consequence can be extracted from the combination of Propositions 1, already mentioned, and 3: “The empirical proof of a theoretical proposition can never in sociology take on the logical form of ‘refutation’ (‘falsification’) in the Popperian sense ” (PASSERON, 1995, p. 426) with sub propositions of proposition 2, namely the retro mentioned sub proposition 2.4 and sub proposition 2.2: “The vulnerability and, therefore, the empirical relevance of sociological statements cannot be defined except in a situation of partial survey of information about the world that is the one of the historical observation – never that of experimentation” (PASSERON, 1995, p. 409). If the types of empirical evidence to be used in a given science are determined by the language used in it and its respective logical structure (proposition 1), if “sociology (...) can only be spoken in natural language” (proposition 2.4), if “the empirical relevance

⁷ By empirical confrontation we mean here the search for an occurrence in the real world declared impossible by the consequence arising from Passeron’s propositions. If this occurrence is found, then the refutation will have occurred. The logical-empirical method used here is based, as already highlighted, on Popper’s ideas, whose essential aspects are being observed here: the deduction of consequences from a system of propositions; the possibility of a prior description, in the abstract, of one or more occurrences that refute these consequences; the observation or verification, in concrete terms, of the refuting occurrence predicted in the abstract; and the possibility of the observation of this occurrence being reproducible.

of sociological statements” can only be achieved through “observation (...) never through experimentation” (proposition 2.2), and if “the empirical proof of a theoretical proposition (...) in sociology” cannot “take on the logical form of ‘refutation’ (‘falsification’) in the Popperian sense” (proposition 3), so it is because **the use of natural language in a given science prevents the carrying out of falsifying experiments and observations in the Popperian sense** (third consequence).

After having clarified how the empirical refutation occurs in its logical structure and the way in which the three consequences that are subjected to criticism were deduced from Passeron’s theory, it remains to be clarified how these consequences will effectively be subjected to empirical confrontation.⁷

Almost all of Passeron’s propositions express existential impossibilities, since they are constructed with expressions such as “never” (proposition 1.1, 2.2, 3, 3.1.1), or “none” (proposition 1.1.1, 3.1), “ does not and cannot exist” (proposition 2), “does not and cannot take” (proposition 2.1), “cannot” (proposition 2.2, 2.2.1, 2.2.2), “can only” – in the sense of “cannot be other than” (proposition 2.2.3, 2.4), “not capable of” (proposition 2.3), or “must always be” – in the sense of “cannot fail to be” (proposition 2.4.1) (PASSERON, 1995, pp. 400 to 461). It can be stated, therefore, that Passeron’s propositions are constructed in the form of negatives of strictly existential statements, in the generic form “there is not and there will never be...”. The retro mentioned proposition 2.1, for example, can be written in the form “there is not and there will never be a cumulative knowledge in sociology organized by a theoretical paradigm”.

ABOUT THE USE OF LANGUAGES IN THE DIFFERENT SCIENCES

As said, Passeron states that each science has a language that is characteristic of it, from which the type of knowledge produced in that science and the type of empirical proof used in it is a necessary consequence, in other words, that each science has its language, its type of knowledge and its specific empirical proofs.

Throughout his text, the author attributes very specific characteristics of formal sciences and physics to the natural sciences, according to him necessary consequences of the use of artificial languages, and attributes specific characteristics of history to the social sciences, according to him necessary consequences of the use of natural language⁹, and in this dichotomous context he develops his argument.

In order to appreciate the empirical relevance of the French author's statement, it is necessary to escape this extreme dichotomous positioning, which creates a bias tending to remove all other sciences from the field of analysis, and present and analyze examples of other sciences, other than the two mentioned, such as, for example, biology (as a natural science) and economics (as a social science) analyzed below, and cognitive psychology (as a human science), analyzed further in another section of this article.

In relation to Biological Sciences, it is possible to observe that areas of knowledge related to physical chemistry, metabolism and genetics have an advanced degree of use of artificial languages in the construction of knowledge related to them. On the other hand, knowledge related, for example, to pathology and physiology, as will be seen later, is almost entirely constructed in natural language.

Logically analyzing universal statements, Popper had concluded that they are equivalent to denials of strictly existential statements, that is, that every universal statement corresponds to a denial of a strictly existential statement of equivalent logical meaning, and vice versa (POPPER, 2009, p. 72). In fact, it is easy to see that expressions such as “does not and cannot”, taken from the already mentioned proposition 2.1, express a universal statement. The statement “all swans are white” can be written in the form “a swan doesn't have and cannot have a color other than white”.

Popper explains that both types of statements, strictly universal and negative of strictly existential, “precisely because they act” towards “the non-existence of certain things or states of affairs, proscribing or prohibiting, so to speak, these things or states of affairs”, become logically refutable by a singular existential statement (POPPER, 2009, p. 72). Empirically, the prohibition of swans to be of colors other than white can be falsified by the simple presentation of a swan of any other color, a presentation that can be expressed in the form of singular existential statements, such as, for example, “here is a black swan”⁸.

Just like propositions, the consequences deduced from them are also negative forms of strictly existential statements, which means that to refute a consequence it is necessary to oppose a singular existential statement. Thus, in order to test the empirical relevance of the consequences of Passeron's propositions, which prohibit certain occurrences, examples will be presented that demonstrate that the consequences that Passeron's propositions state are impossible have already occurred.

⁸ The method of empirical refutation used here does not require carrying out experiments directed by propositions that are intended to be refuted. Observations directed by the propositions that are intended to be refuted have equal value, both logical and empirical. This is fully compatible with Popper's ideas that inspire the form of analysis used here.

⁹ See footnote, number 2, retro.

These statements are valid for descriptions and for explanations regarding the constitution and functioning of living beings in zoology, botany, and medicine.

An interesting aspect to be raised refers to the fact that Ecology uses natural language and artificial languages (statistics and geometric graphics) in the description of the most varied environments - which concern the natural world and which, despite this, concern to different spatial contexts -, demonstrating the extreme flexibility in the use of languages by scientists.

The most striking example of the use of natural language in natural sciences is perhaps in the Theory of Evolution – a structuring theory of all contemporary biology, which has ramifications and consequences in practically all its subareas -, which was entirely constructed in natural language, as can be easily observed when examining the book: *On The Origin of Species*, by Charles Darwin (DARWIN, 2006).

Given these examples of the use of natural language in the natural sciences, it is worth giving an example of the intensive, and even structural, use of artificial languages in the social sciences. Among these, the Economy is probably the one that has reached the greatest degree of formalization. The curves that demonstrate the graphical analysis of correlations between different concepts are famous in Microeconomics, such as supply and demand curves and the respective rules for the displacement of these curves, or for price elasticity of demand, or to demonstrate concepts as marginal revenue (FRANK, 2012, pp. 82/82, 103 to 105, 243/244, respectively). However, this entire analysis can also be carried out in an algebraic way, showing proportions and quantitative relationships even more clearly (FRANK, 2012, pp. 93 and 94). Although these relationships are most used in Microeconomics, this type

of formalization and the use of graphs to demonstrate correlations are also widely used in Macroeconomics, such as, for example, demand curves for labor in relation to product prices (FRANK, 2012, pp. 488 and 489).

The best example of the structural use of artificial languages in the human sciences is perhaps found in Econometrics. The various possible definitions of this area of knowledge refer to the need to “give empirical support to the models constructed by mathematical economics”, or to quantitatively analyze “concrete economic phenomena, based on the simultaneous development of theory and observation, related by appropriate inference methods”, so that “econometrics can be defined as the social science in which the tools of economic theory, mathematics and statistical inference are applied to the analysis of economic phenomena” (GUJARATI, 2000, Introduction, p. XXVI).

It is possible to observe, from these examples, that the sciences are not specific languages for describing the world, as Passeron stated in his mentioned Proposition 1, that is, that each science has its specific or characteristic language. On the contrary, the examples examined indicate that sciences are descriptions of the world carried out in the various available languages, artificial and natural, which are used apparently based on the needs of scientists, the availability of tools and the compatibility between language and the specific object of study., among other possible aspects.

Regarding the statement that the predominance of one or another language determines the type of knowledge to be produced and the type of proof to be used in a given science, the following two sections present examples of how the constitution of paradigms, the realization of normal science, the accumulation of scientific knowledge, the construction of direct experiments or

the seeking of direct observations that aim to promote the empirical confrontation, all of them with the exclusive use of natural language, is totally possible.

ABOUT THE POSSIBILITY OF CONSOLIDATING PARADIGMS IN NATURAL LANGUAGE

As already pointed out, Passeron states that natural language, always “unstable”, prevents the stabilization of scientific language and, consequently, the constitution of “paradigms”, the realization of normal science and the accumulation of scientific knowledge.

It is demonstrated here, with at least two examples taken from biology (the second one from medicine, considered here as a subarea of biology), that the use of natural language does not prevent the consolidation of paradigms.

In his book, *On the Origin of Species*, Darwin did not use artificial languages (DARWIN, 2006, pp. 453 to 760). The entire theory was constructed, demonstrated and grounded exclusively on natural language, and became what is perhaps the example of a contemporary scientific paradigm with greater stability and wider acceptance.

Darwin supported his theory on three empirical pillars, namely (a) observations he made on the variety of domestic animals intentionally caused by breeders through the artificial selection of desirable characteristics (DARWIN, 2006, chapter I, pp. 453 to 476), (b) observations he made on the variety of wild animals, especially on his famous trip to the Galápagos Islands aboard the *Beagle*, which he attributed to natural selection (DARWIN, 2006, chaps. II to VIII, pp. 477 a 626), and (c) observations on geological records of

fossils (DARWIN, 2006, chaps. IX and X, pp. 627 to 669). The empirical observational base collected by Darwin was strong enough to support his theory, which was subject to subsequent reinforcement, whether through new observations and research, or through the evolution of related areas of knowledge, such as genetics. In any case, there seems to be no doubt that the paradigm created by Darwin had a direct influence, or even guided, much of the normal science carried out in the field of biology and, as a result, provided an enormous accumulation of knowledge, most of which produced in natural language.

Concluding the reasoning, regarding the Theory of Evolution, two things can be said: first, that nowadays there are no longer any scientists, especially biologists, who question their scientific status¹⁰; and, second, that there is no doubt that the Theory of Evolution has become a scientific paradigm in the Kuhnian sense (and this is what is discussed here up to this point).

Specifically regarding the possibility of carrying out experiments or observations in natural language, which meet the Popperian criterion of falsifiability, it is worth recognizing that ingeniously constructed experiments, whether in laboratories - such as that of Richard Lenski, and others, following 45 thousand generations of bacteria *Escherichia coli*, over 20 years, and its evolution in the face of intentionally provoked environmental contingencies¹¹ - or whether in the natural environment itself (or restricted natural environment) - like John Endler's with *Poecilia reticulata* and its evolution in the face of natural contingencies (predators and environmental changes)¹², both briefly described below - has systematically

10 See, for example: DENNETT, 1995, pp. 18-21

11 The results of the experiments by Lenski et al are described in DAWKINS, 2009, pp. 114-130, and were originally published in: *Proceedings of the National Academy of Science*, n° 91, 1994, pp. 6808-14, *apud* DAWKINS, 2009, p. 417.

12 Endler's experiments are described in DAWKINS, 2009: 130-136, and were originally published in the journals: *Evolution*, n° 34, 1980, pp. 76-91 e *Environmental Biology of Fishes*, n° 9, 1983, and in the book: *A Natural Selection in the Wild*, Princeton, Princeton University Press, 1986, *apud* DAWKINS, 2009, pp. 415-416.

corroborated deducible consequences of the Theory of Evolution. Regarding falsifying observations, Popper himself referred to “industrial melanism”¹³ through which one can observe natural selection occurring “before our eyes” (POPPER, 1995, p. 242).

Other areas of biology can also be considered Kuhnian paradigms. In medicine, Pathology, as “the study of structural and functional changes that occur in cells, tissues and organs resulting from diseases”, while “attempting to explain the reasons for the signs and symptoms that patients manifest”, providing “a basis rational for the clinical approach and treatment” (ROBBINS & COTRAN, 2005, p. 4); and Physiology, as a description “of the function of organisms, at the various stages of organization, from the subcellular level to the intact organism” (BERNE, 2004, p. xiii); They are almost entirely constructed in natural language, which can be observed from manuals used in teaching at medical universities regarding physiology and human pathologies. Even though, in terms of Physiology, the elucidation of homeostatic mechanisms requires an in-depth study of biochemistry, and, therefore, the partial use of artificial languages, this does not invalidate the statement of extensive use of natural language in this field of knowledge.

Such examples meet the necessary requirements to be considered as Kuhnian “paradigms”, that is, (a) they constitute a coherent body of scientific knowledge, (b) that enjoys the acceptance of the majority of the scientific community, with unanimity not being required, (c) that guides subsequent research, establishing the “puzzle” to be solved, and thus allowing the occurrence of “normal science”, and (d) that, in doing so, enables the accumulation of scientific knowledge and the progress of science (KUHN, 2009, Chapters 1, 2 and 3, and Afterword: 221 to 227).

13 Popper refers here to the famous observations that soot-colored moths were being naturally selected, as they enjoyed protection against predators provided by mimicry, in urban areas affected by industrial soot.

14 Article originally published in Science magazine, vol. 185, 1974, fully included in KAHNEMAN, 2012, pp. 524 to 539

The existence of these examples, among others, leads us to the conclusion that the exclusive use of natural language in the construction of a body of scientific knowledge does not prevent the emergence of paradigms, the realization of normal science and the accumulation of scientific knowledge, in the sense Kuhnian, contrary to what was stated by Passeron in his propositions.

ABOUT THE POSSIBILITY OF CARRYING OUT EXPERIMENTS IN NATURAL LANGUAGE

As pointed out, Passeron states that the empirical vulnerability of a science that uses natural language can only be based on observations, polls, investigations, etc. and never in intentionally carried out experiments.

The empirical contestation of such a statement requires that examples be pointed out that demonstrate the possibility of idealizing, carrying out and describing experiments, and subsequently recording and publishing their results, exclusively in natural language, and that this is already done in several sciences. Although Passeron indicates the existence of other factors that, combined with the use of natural language, may prevent or hinder direct experimentation in the social sciences, what is analyzed here is the statement that the “natural language” element is sufficient to prevent it.

Let us take as a first example the article Judgment under uncertainty: heuristics and biases¹⁴, authored by Kahneman and Amos Tversky, winners of the 2012 Nobel Prize in Economics for the development of decision theories. Right at the beginning of that article, the authors point out that “many decisions are based on beliefs regarding the probability of uncertain events, such as the result of an election, the guilt of a defendant or the future

exchange rate of the dollar”, and establish the problem at hand. be addressed in the article: “What determines these beliefs?”. They succinctly respond immediately, “people rely on a limited number of heuristic principles that reduce the complex tasks of evaluating probabilities and predicting values to simpler operations of judgment. In general, these heuristics are quite useful, but sometimes they lead to serious and systematic errors.” In the body of the article the authors describe “three heuristics that are employed to evaluate probabilities and predict values”, descriptions through which “the biases to which these heuristics lead are enumerated and the applied and theoretical implications of these observations are discussed” (KAHNEMAN, 2012, pp. 524 and 525).

The three heuristics analyzed by the authors are called “representativeness”, “availability” and “adjustment and anchoring”, whose respective biases are analyzed based on one or more direct experiments. Regarding the first heuristic, since we are not interested here in analyzing all of them, the authors analyze the bias described as (a) people’s insensitivity to the a priori probability of results, (b) insensitivity to sample size, (c) erroneous conceptions of possibilities, (d) insensitivity to predictability, (e) illusion of validity and (f) misconceptions of regression. For each of these points analyzed, the authors describe at least one direct experiment carried out by them or third parties. Describing all the experiments would be beyond the scope of the present work, therefore, and as an example, we will take one of the experiments described by the authors in relation to bias (b) insensitivity to sample size, which involved presenting 95 undergraduate students with the following question (KAHNEMAN, 2012, pp. 526 and 527):

A given city is served by two hospitals. In the largest hospital, about 45 babies are born every day, and in the smaller hospital, about 15 babies are born every day. As you know, about 50% of babies are boys. However, the exact percentage varies from day to day. Sometimes it can be higher than 50%, sometimes less. For a period of one year, both hospitals recorded the days when more than 60% of the babies were boys. Which hospital do you think recorded more of these days?

The biggest hospital. (21)

The smaller hospital. (21)

More or less equal (for example: within 5% of each other) (53)

Considering that the values in parentheses are the number of students who chose each answer, the authors point out that “the majority of participants judged the probability of obtaining more than 60% to be the same for the small and large hospital” despite sampling theory requires “that the expected number of days on which more than 60% of the babies are boys is much greater in the small hospital than in the larger one, as a large sample is less likely to deviate from 50%”, from which they conclude that “this fundamental notion of statistics is evidently not part of people’s intuitive repertoire” (KAHNEMAN, 2012, p. 527).

This experiment, as well as all others described in the mentioned article, was entirely designed, carried out (with the exception of elementary statistical operations) and described, and subsequently had its results recorded and published, entirely in natural language. It is, without any doubt, a direct experiment, and not a mere systematic observation, which can be reproduced anywhere in the world by other scientists and other institutions using other sample groups. It is easy to see that the authors’ “theory” – that human beings rely on a limited number of

heuristics to reduce complex judgment tasks to simpler tasks – and its specific component – some fundamental notions of statistics, including those arising from size of sampling, are not part of people’s intuitive repertoire – are empirically confrontable by this and other easily imaginable direct experiments.

It could be argued that, in this example, the consequence to be empirically refuted does not arise from a strictly universal statement, but rather from a numerically universal statement, since the set of human beings would be finite, limited to a certain space, and countable at a given moment in time. In this regard, it can be stated that the theory exposed by the authors in the article, as described in the immediately preceding paragraph, has a clear claim to be universal, in the sense of being applicable to all human beings, even if the totality of human beings is a numerical universality¹⁵ and that some people, due to professional training or life experience, are prepared to replace certain heuristics with real knowledge and, as a result, avoid certain biases. In this sense, Kahneman points out that, through the set of experiments, “systematic errors in the opinion of normal people” were documented and that he and Tversky located “these errors in the design of the cognitive mechanism” (KAHNEMAN, 2012, p. 16), which belongs to all human beings.

Regarding the scientific quality and impact of the article, the author himself (KAHNEMAN, 2012, p. 16) emphasizes that it “remains one of the most widely cited works in social science (more than three hundred academic articles made reference to it in 2010)” and that:

(...) Scholars from other disciplines have found it useful, and the ideas of heuristics and biases have been used fruitfully in numerous fields, including medical diagnosis, judicial analysis, intelligence and espionage, philosophy, finance, statistics, and military strategy.¹⁶

As a second example, now in the area of biology, the mentioned experiment by John Endler regarding the effects of natural selection on a fish popularly known as “guppy”, initially published through the article: *Natural Selection on Color Patterns in Poecilia reticulata* (ENDLER, 1980), is an excellent example of an experiment built in natural language with the aim of testing pre-established consequences of a theory also built entirely in natural language, the Theory of Evolution through Natural Selection.

The males of the fish species selected by Endler present strong and varied color patterns, and despite this, it was systematically observed that in rivers where there were no predators the colors of the males were intense and where there were strong predators the colors of the males tended to fade and become closer in pattern and tone to the gravel in the background. The causal explanation given by the Theory, and consequently its prediction, is that in an environment with predation, less showy males, which blend in better with the bottom gravel, have a greater probability of survival and, therefore, reproduction, making the “less flashy colors” characteristic to be transmitted predominantly to new generations; in an environment without predators, females’ preference for more colorful males, a phenomenon observed in several species, would lead to selection for reproduction based on this criterion, causing

15 It is Popper himself who states that “the question whether the laws of science are strictly or numerically universal cannot be resolved through argument. These are issues that can only be resolved by agreement or convention.” His preference is due solely to the fact that he considers it “useful and fruitful to view natural laws as synthetic and strictly universal statements”, taking into consideration, methodological aspects - in POPPER, 2009, chap. 13. Strict and Numerical Universality, pp. 66.

16 As examples of using Kahneman’s research in microeconomics, read about FRANK, 2012, Chapter, “Três Armadilhas de Decisões Importantes”, pp. 8 a 15.

the “more showy colors” characteristic to be predominantly transmitted to new generations.

Endler designed the experiment to confront the two criteria of natural selection and fully test theoretical predictions. He divided ten populations of fish into tanks that simulated the river from which they had been taken. In five tanks he prepared the bottom with fine gravel and another five with coarse gravel. The populations inhabited these tanks for six months without the presence of predators, after which it was observed that the number of colored spots on the males had increased explosively, exactly as theory had predicted.

Next, two tanks in each group differentiated by the type of material on the bottom received strong predators, two received weak predators and one did not receive any type of predator. After five and fourteen months, all tanks were registered and the results showed that:

a) in the four tanks with strong predators the number of colored spots on males dropped and the intensity of the colors reduced, becoming evident in the 5th month and even more so in the 14th month.

b) in the other six tanks, without predators or with weak predators, the number of spots continued to increase until it reached a plateau, demonstrating that, as weak predators do not impose a significant reduction in the number of males, the females' preference for “colors showier” had a greater influence on the transmission of this characteristic to new generations.

c) in tanks with predators, strong or weak, the coarse gravel at the bottom promoted larger spots while the fine gravel favored smaller spots, indicating that, even in the case of weak predation, mimicry protected animals that blended in better with the bottom of the tank, allowing

them, surviving in greater numbers, to transmit their characteristics to new generations.

d) in tanks without predators, coarse gravel promoted the appearance of smaller spots and fine gravel of larger spots, indicating that not only the colors, but also their contrast against the background, that is, the visibility of the colored patterns, favored selection for reproduction based on female preference.

Dawkins reports that, not satisfied with the results, Endler repeated the experiment, isolating sectors of a stream in which it was possible to reproduce the three situations previously described in natural conditions and repeated the measurements of the beginning and evolution of populations, obtaining the same results (DAWKINS, 2009, pp. 135 and 136). The two series of experiments confirmed all theoretical predictions.

Having examined these two examples of experiments, both constructed in natural language and intended to test consequences deducible from theories also constructed in natural language, the conclusion is once again contrary to Passeron's statements.

CONCLUSIONS

As it was seen, three consequences were deduced from Passeron's propositions and analyzed using a simplified procedure (presentation of contrary examples) inspired by the method of empirical confrontation proposed by Karl Popper.

The analysis of the first consequence demonstrated, through the examples presented, that there is no necessary correlation between science and specific language. In the field of natural sciences, the undisputed domain of artificial languages according to Passeron, we find the Biological Sciences which, despite being based on physics and chemistry and extensive use of quantitative

methods in their research, present extensive areas in which knowledge is constructed structurally and essentially in natural language. In the field of social sciences, also an undisputed domain of natural language according to Passeron, economics appears as a science that increasingly relies on mathematics and statistics, which have predominant and structural use in econometrics.

Passeron's proposition, which states that the sciences have, or use, languages that are typical to them, which determine their particular type of knowledge and the type of empirical proof that they will use, has thus been ruled out. In fact, the examples demonstrate the wide use of natural and artificial languages by scientists, perhaps in accordance only with the needs of their research, their experiments and their demonstrations.

The analysis of the second consequence, especially through the example of Darwin's Theory of Evolution through Natural Selection, demonstrated that the constitution of paradigms and the realization of normal science, in the Kuhnian sense, with the consequent accumulation of knowledge, exclusively in natural language is entirely possible. The examples from other areas of biology examined only reinforced this demonstration.

Passeron's propositions, which stated that the use of natural language - due to its ambiguities and polysemy, its indexation to an always changing spatio-temporal context, its low quantitative precision, etc. - makes it impossible to accumulate knowledge around a scientific paradigm structurally constructed with it, were also ruled out.

The analysis of the third consequence was carried out through two examples of experiments, one carried out in the area of cognitive psychology, the other in the area of evolutionary biology, which demonstrate that the construction of direct and classical

experiments, as well as the recording and publication of their results, in areas of knowledge also predominantly constituted in natural language, is fully possible.

Thus, Passeron's propositions that stated that the structural use of natural language by a certain science prevents the carrying out of direct experiments in natural language, restricting the typology of empirical evidence to be used in it to systematic observation, were also ruled out.

It can be concluded, therefore, that Passeron's statement, in the sense that the use of natural language in the social sciences creates a space in which the demarcation and refutation of a theory by experiments or empirical observations, affirmed by Popper, and the paradigms and normal science, affirmed by Kuhn, would have no place and must not be accepted, were all ruled out.

The analyzes carried out here do not affirm that Popper's demarcation criterion or Kuhn's paradigm and normal science are possible in the social sciences. This analysis would imply an extremely broad scope that is foreign to the present work. It is simply stated here that the use of natural language, by itself, does not exclude the possibility of Popper's and Kuhn's ideas to be valid also for the social sciences.

In the debate about the uniqueness of the scientific method, therefore, this article contributes only in the sense of leaving this possibility open, by removing the restrictions, related to the use of specific languages by the sciences as constructed by Passeron.

The fact that a paradigm has not yet emerged in sociology or that falsifying experiments are not widely used or accepted in this field of knowledge also does not mean, obviously, that they are not possible: what has not yet been carried out or has not occurred may yet come to be or to occur.

On the other hand, perhaps paradigms and experiments are not really possible

in the social sciences. By way of example, despite having affirmed the uniqueness of the scientific method, Popper himself recognized important differences between the natural sciences and the social sciences, such as, for example, the different possibilities of carrying out direct experiments (POPPER, 1980, chaps. 24 and 25) and of using quantitative methods (POPPER, 1980, p. 111), or, even, by conceiving situational analysis as a typical method of social sciences (POPPER, 1980, pp. 110 /111 and 116/117). In fact, it is possible

do say that Popper, with the evolution of his thought, had abandoned the demarcation as initially constructed (but this is not the subject of this article).

However, whatever the possible reasons for the Popperian demarcation and the Kuhnian paradigm not being possible in the social sciences, if this is ever demonstrated, the conclusion of this article is that the structural use of natural language in the social sciences must not be included among them.

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