SUBJECTIVE AND OBJECTIVE CAUSALITY IN SCIENCE: A TOPIC FOR ATTRIBUTION THEORY?

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Resumen

El presente trabajo examina el *pensamiento* científico desde el modelo atribucional. Desde el punto de vista clásico, la *ciencia* fue definida como el producto de un conocimiento objetivo de una realidad externa que seguía sus propias leyes, independientemente del observador que trataba de descubrir sus secretos. Sin embargo, también es incorrecto considerar la ciencia como consecuencia de una mente totalmente irracional, completamente inmersa en los patrones atribucionales del investigador que a pesar de toda evidencia en contra, continúa sosteniendo los hechos que sus percepciones le permiten ver. La Teoría de la Atribución permite un cambio gradual del sistema de creencias o atribuciones de la gente en general y del científico en particular, cuando tales creencias prueban ser insuficientes o no funcionales para explicar un medio que está continuamente interactuando con el individuo y corrigiendo sus atribuciones. Obviamente se trata de un proceso lento, desde que implica ir cambiando y a veces sustituyendo creencias en forma parcial y no en forma completa o repentina. Esta perspectiva permitiría entender a la ciencia como una construcción que depende de un sistema de conocimiento. Este sistema estaría garantizado por la racionalidad a través de pruebas de contrastación y no es ni un sistema objetivo, aséptico y

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perfectamente racional ni el reino de la pura *irracionalidad* y *atribución*, indiferente a cualquier signo claro de disfuncionalidad.

Palabras clave: Ciencia - pensamiento - atribución - irracionalidad - constructivismo.

Abstract

This paper will examine scientific *thinking* from the attribution model. According to the classical view, science was defined as the product of objective knowledge of an external reality which followed its own laws, independently from the observer who tried to uncover its secrets. Despite that, it is also incorrect to understand *science* as the consequence of a totally irrational mind, completely immersed in the *attribution* patterns of the researcher who, against all evidence to the contrary, continues holding exclusively the facts which his perception allows him to see. The cognitive theory of attribution permits a gradual change from the belief or attribution system of people in general and scientists in particular, whenever such beliefs prove to be insufficient or non-functional for explaining an environment that is constantly interacting with the individual, offering feedback and correcting his attributions. It is obviously a slow process, since it implies changing and sometimes substituting beliefs, partially and not wholly or suddenly. This perspective would ground an understanding of science as a construction dependent on a system of knowledge. This system would be warranted by rationality through contrasting tests, and it is not an objective, aseptic, and perfectly rational system; nor is it the reign of pure *irrationality,* and attribution, reluctant to any clear signs of non-functionality.

Key words: Science - thinking - attribution - irrationality - constructivism.

This paper will examine scientific thinking from the attribution model as an alternative approach to an inquiry into the way irrationality seeps into science just as into any decision-making process.

Generally speaking, the basic activity of human beings is to perceive and know the world where he lives. In this sense, cognition is a defining characteristics of the human subject. He does not process information by merely storing it; he does so actively, organizing and codifying, and in general personalizing the information he receives. Human cognition is frequently far from logical and rational; very often reasoning is non-logical (Evans, 1972). It follows mental models rather than formal rules (Johnson-Laird, 1983). Mental models are dynamic and temporary representations based on our beliefs about the world; they become actual when we face particular projects or when we must solve problems (Gentner, & Stevens, 1983; Johnson-Laird, 1983).

Cognitive strategies are active processes of response and initiative to keep up acquired achievements and to be able to carry on our tasks, in spite of potential difficulties. Optimism, defencelessness, vigilance, avoidance, risk-taking and other strategies are used to preserve the subject's self-image and world-view. From this standpoint, cognitive strategies are a dense, and inextricable organization of ideas, feelings, images, activations, and actions (Cantor, & Zirkel, 1990).

Human knowledge is characterized by applying certain ways of processing information which are not strictly logical and rational. Although this does not imply falling into irrationality, human cognition typically makes use of systems that avoid the long process of deduction and inference, and chooses simpler systems. Cognitive heuristics are simple and easy rules of cognition which lead to a prompt solution of a given problem, although it is not always the strictly logical one (Huici, & Moya, 1994). Leyens, and Codol (1990) state that the very existence of cognitive heuristics indicates that human cognition is psychological rather than logical.

The theory of attribution has been developed within the context of this understanding of human knowledge. It origins lie in social psychology (Heider, 1958; Kelley, 1967, 1971) but it belongs in the area of personality psychology (Weiner, 1990), both as regards the functioning of the process and its consequences on the subject who does the attribution (Moreno Jimenez, & Peñacoba Puente, 1996). The theory of attribution in its wider sense refers to a person's will to understand the causes and implications of the events he witnesses and experiences.

Several years ago, Heider noted that our actions are controlled by our perception of an event rather than by what actually happens. In the words of Epictetus

> "People are not upset by facts, they are upset by their thoughts about facts" (quoted by Ellis, 1994, p. 85).

The core of the theory of attribution is to bridge the gap between the information that comes from the outside world and the meaning ascribed to it by the subject. Each person has his own mental image of real life, both global and partial: a construct. It discriminates within real life and, in that way, is no more cognitive than emotional or motive oriented (Kelly, 1995). The process of attribution includes personal differences, biases, and distortions; it is thus far from constituting a logical process. Biases in the attribution process indicate that the subject is not a logical processor of the information received; both rationalization and rationality play a role in it.

Kelly maintains that the operating principles of the plain man and of the scientist are identical: they both lay down hypotheses, work out verification experiments and modify their theories. Just as the scientist, the plain man observes -that is, he builds constructs about real life-; he creates theories (he therefore organizes his constructs in a consistent system of meaning); predicts and anticipates phenomena (in other words, he organizes his constructs in order to guide his behaviour and predict forthcoming events). If both scientists and plain men function in the same way, how far does the scientist refrain from making attributions regarding methodology and theories? In view of the paradigm developed at a given time and place, the kind of scientific literature consulted, the research team he belongs to, can we not rightly say that the scientist builds up a style of attribution which leads him to perceive some connections to the detriment of others? In other words, just as the life history of each individual leads him to develop a style of attribution in the face of events in general, would the researcher develop a scientific attribution style according to his scientific story?

The method chosen operates as a guarantee of scientific knowledge in so far as it allows for specifications of the conditions whereby connections are verified, or not. Is it chosen in absolute freedom? If the scientist attributes a trait of stability to a given phenomenon, for example, he will check results through a correlational method. On the other hand, if he attributes a variable property to it, he will prefer a method of analysis of variance.

Back in 1620, Francis Bacon had already referred to distortions in perception and knowledge. He thus indicated that human understanding pre-

sumes a greater order and similarities in objects than what it actually comes across; that once a statement has been established, it forces its own confirmation. And also that the scientist is willing to believe whatever he prefers. This tendency in human cognition could be prevented through the strict compliance of a series of formal procedures in evaluating the consequences of theories.

The notion of knowledge underlying the classical concept of science showed an *objective* researcher at the observation. According to this view of the cognitive process, perception reflects a reality that is independent from the observer. The aim of scientific research is to *discover* certain facts that presumes the existence of a reality outside the researcher, which must be apprehended through the senses, thus turning it into something that belongs to our knowledge. This classical science lies in a causal-linear model for its hypotheses.

With the development of Constructivism as a new theoretical model of the process of knowledge, there comes a change in the concept of science. If reality does not exist as an objective fact, but it is an individual construction that is co-constructed between the subject and his environment, the researcher is involved in the field of observation and, consequently, affects results through his personal viewpoint. This means that knowledge is enmeshed in subjectivity. No organism can manage to acknowledge, describe or copy reality. It can only build a model which somehow resembles it. An observer who is involved in the field of observation, influences the object by his very presence and he does so from his conceptual framework. He will only observe what his map allows him to pinpoint.

The constitution of individual, socio-cultural and psycho-familiar engrams favour the creation of a peculiar outline or map of what we term reality, which leads us to see *that* and not something else.

The objects of scientific research will vary according to the norms, guidelines, values and beliefs of a scientific society at a given point in time. If we think of the context where actions take place as a matrix of meanings, each scientific society will be able to insert a set of relevant components worth underscoring.

Kuhn (1962) from a socio-historical approach to science, has come to the conclusion that it is impossible to define objective criteria of rationality. At most, at a particular time in history and within a particular group of scientists, there may be a consensus on a paradigm or universally acknowledged scientific achievement. During a given period, scientists will refer to it when solving the problems they are faced with. Not only does a paradigm explain important variables, it also organizes our worldview, suggests what

data we are ready to choose, what inferences we are able to deduct from data and which of the various inferences will be tested.

Kuhn pointed out that scientists do not give up their paradigms easily. They only do it when one or several of the following kinds of reasons are present: when there is a relevant amount of empirical data that indicate that inferences drawn from the paradigm are false; whenever there is a logical inconsistency in connection with the paradigm; when the paradigm has no pragmatic value and fails at solving important problems, and whenever there is an alternative paradigm that proves better at accounting for empirical findings and solving problems (Di Giuseppe, 1991).

The history of changes in paradigms in science reveals that scientists were able to explain a wider range of natural phenomena, and even attaining a higher accuracy in those which they already knew about. Nevertheless, progress was only achieved when they managed to leave out the meanings, values, beliefs, and methodology previously acknowledged by the current paradigm and when new knowledge substituted them.

Thus, the onset of a new theory is heralded by a period of profound instability and insecurity. This is so because it becomes impossible to give satisfactory answers to the enigma posed by anomalies (judged as such by the previous paradigm). The failure of existent rules is the first step in the search for new ones.

This offers good proof that any observable *evidence* can be accounted for by accommodating to the hypotheses provided by whatever epistemological model has been chosen.

> "Part of the answer, both obvious and important, can be found by noting, in the first place, something that scientists never do, not even when they face grave and prolonged anomalies. Even if they start losing faith and, later on, consider other alternatives, they never give up the paradigm that has led them to a crisis. In other words, they do not take anomalies as negative examples, although that is precisely what they are, in the language of the philosophy of science" (Kuhn, 1973, p. 113).

The problem is that once the paradigm status has been reached; that is, a normative and systematic code has been adopted, a scientific theory can only prove that it is non-valid once an alternative candidate has been found to take up its place. The decision to reject a paradigm and admit its replacement simultaneously implies the decision to adopt another one. The judgement leading to this decision arises from comparing both models.

Models, insofar as they result from variables ruling various contexts, are determined by factors that range from social, political, and economic situations to culture itself. These factors forge the soil used to ground the new paradigms and question the dominant ones.

Coming back to the cognitive functioning of scientists, any new thought will have to adapt to a previous design of conceptual structures. This will preclude any new abstraction from generating a contradiction with whatever has been learnt before. If there is an anomaly, it is either justified within the old structure or old structures are modified.

Scientific knowledge, therefore, just as any other knowledge is a pattern which adapts to a previous conceptual model. It may be widened and redefined when interaction with other observers connects it to other maps based on different conceptual structures.

The cognitive theory of attribution includes the possibility of changing people's world theory. This implies that they can find models which respond more accurately to their welfare needs. With this approach and from his individual viewpoint, the researcher can surpass the vicious circle which would entrap science from a strict constructivistic perspective.

> "People cannot avoid working out theories on the world, their interpersonal relationships, and about themselves. These theories, patterns or paradigms can guide people to adequately cope with their environment or lead to deficient coping and psychopathology." (DiGiuseppe, 1991, p. 175).

At the same time, the theory presupposes an acknowledgement and refutation of disturbing beliefs (*irrational*), and their substitution for functional and more efficient ones. If we apply it to scientific knowledge, it allows for correction of the current attributive model and its replacement by a more efficient one.

Ellis (1994) states along this line, and from a critical constructivism, that although every theory, and even all facts, are human constructions, we can temporarily accept that for all practical purposes one piece of knowledge is probably better than another.

By now, nobody can deny that previous knowledge is part and parcel of perception, or state that we can work with *pure* observations, without a grounding theory. It is impossible to maintain that facts speak for themselves. Both problems: theory-biased observation and inductive inference, have led to a re-examination of justification criteria. In general, whenever an anomaly is found in a theory, scientists will try to find an account of the

flaw in auxiliary theories, rather than refuting the theory itself. From the standpoint of cognitive theory, in the event of disturbing beliefs or attributions; that is, when people tend to lose their perspective and expect things to be different from what they really are, the point is not to change the whole belief system, but only those beliefs that are judged to cause non-functional emotions or behaviour. In other words, there are no radical and absolute changes in someone's belief system whenever a case of non-functioning is perceived. The point is to modify some beliefs by pointing out their lack of logic or consistency, proving that things do not actually happen as the person believes they do, checking whether the belief is useless and finding a new one.

> "Cognitive theory suggests that the cognitive apparatus is not able to perceive (or *represent*) reality directly. There is an interaction between internal and external phenomena operating over the human nervous system. Therefore, human conscious experience does not unilaterally build the world (as might be maintained by radical social constructivism); it is the result of an interaction between the person and his or her environment." (Alford, & Beck, 1997, p. 42).

The fact that scientists do not immediately reject a theory when it proves insufficient for explaining things does not mean they are totally irrational in their backing up a particular paradigm. It does not imply, either, that there is no objective criterion to differentiate between science and pseudo-science.

According to Lakatos (1970, 1978), the progress of science should not be understood as a series of theories and verifications, or conjectures and refutations, but as the result of the progress of various research programmes, competing in the development of better theories. Each programme consists of a firm core or nucleus (formerly named *theory*) and auxiliary theories which act as a protective belt against any attempt to falsify the core. Auxiliary theories receive the first blows of contrasting tests; they will therefore be adjusted again and again and even substituted before even considering abandoning the programme and choosing a better one.

Lakatos' programmes of scientific research do not exhibit an immediate rationality in their methodology. Differentiation criteria are posited a posteriori but they do allow for an explanation of scientific revolutions without falling into irrationality. Be that as it may, there are no refutations without a better theory (Delgado, & Prieto, 1997).

Summing up, from the standpoint of the new epistemology of cognitive functioning as an attributive, constructive, interactive process between each person and his environment, it is impossible to continue accepting the classical view of science. According to this view, science was defined as the product of objective knowledge of an external reality which followed its own laws, independently from the observer who tried to uncover its secrets. Despite that, it is also incorrect to understand science as the consequence of a totally irrational mind, completely immersed in the attribution patterns of the researcher who, against all evidence to the contrary, continues holding exclusively the facts which his perception allows him to see. The cognitive theory of attribution permits a gradual change from the belief or attribution system of people in general and scientists in particular, whenever such beliefs prove to be insufficient or non-functional for explaining an environment that is constantly interacting with the individual, offering feedback and correcting his attributions. It is obviously a slow process, since it implies changing and sometimes substituting beliefs, partially and not wholly or suddenly. This perspective would ground an understanding of science as a construction dependent on a system of knowledge. This system would be warranted by rationality through contrasting tests, and it is not an objective, aseptic, and perfectly rational system; nor is it the reign of pure irrationality and attribution, reluctant to any clear signs of non-functionality.

References

Alford, B., & Beck, A. (1997). *The integrative power of cognitive therapy*. NY: Guilford Press.

Cantor, N., & Zirkel, S. (1990). Personality, cognition and purposive behavior. In L.A. Pervin (Ed.), *Handbook of personality*, *theory and research* (pp. 118-137). NY: Guilford Press.

Delgado, A.R., & Prieto, G. (1997). *Introducción a los métodos de investigación en psicología* [Introduction to the research methods of psychology]. Madrid: Ediciones Pirámide.

Di Giuseppe, R. (1991). A rational-emotive model of assessment. In M. Bernard (Ed.), *Using rational-emotive therapy effectively. A practitioners guide* (pp. 55-92). NY: Plenum Press.

Ellis, A. (1994). *Reason and emotion in psychotherapy. Revise and updated.* NY: Carol Publishing Group.

Evans, J.S.T.V.T. (1972). Interpretation and matching vias in a reasoning task. *Quarterly Journal of Experimental Psychology, 24*, 193-199.

Gentner, D., & Stevens, A.L. (1983). Mental models. Hillsdale: Lawrence Erlbaum Associates.

Heider, F. (1958). The psychology of interpersonal relations. NY: Wiley.

Huici, C., & Moya, M. (1994). La inferencia social [The social inference]. In J.F. Morales (Ed.), *Psicología social* (pp. 215-241). Madrid: Mc Graw Hill.

Johnson-Laird, P.N. (1983). *Mental models. Toward a cognitive science of language, inference and conciousness*. London: Cambridge University Press.

Kelley, H.H. (1967). Attribution theory in social psychology. In D. Levine (Ed.), *Nebraska Symposium of Motivation*. Lincoln: University of Nebraska Press.

Kelley, H.H. (1971). Causal schemata and the attribution process. In E.E. Jones, D.E. Kanouse, H.H. Kelley, R.E. Nisbet, S. Valins, & B. Weiner (Eds.), *Attribution: Perceiving the causes of behavior* (pp. 111-143). NJ: General Learning Press.

Kelly, G. (1955). *The psychology of personal constructs*. NY: Norton Company.

Kuhn, T.S. (1962). *The structure of scientific revolutions*. Chicago: University of Chicago Press.

Lakatos, I. (1970). Falsification and the methodology of the scientific research programmes. In I. Lakatos, & A. Musgrave (Eds.), *Criticism and the growth of knowledge* (pp. 91-196). Cambridge: Cambridge University Press.

Lakatos, I. (1978). *The methodology of scientific research programmes: Philosophical papers (Vol. 1)*. NY: Cambridge University Press.

Leyens, J., & Codol, J.P. (1990). Cognición social [Social cognition]. In M. Hewstone, W. Stroebe, J.P. Codol, & G.M. Stephenson (Eds.), *Introducción a la psicología social*. Barcelona: Ariel.

Moreno Jimenez, B., & Peñacoba Puente, C. (1996). El sujeto cognitivo [The cognitive subject]. In A. Fierro (Ed.), *Manual de psicología de la personalidad* (pp. 87-112). Barcelona: Paidós.

Weiner, B. (1990). Attribution in personality psychology. In L.A. Pervin (Ed.), *Handbook of personality. Theory and research* (pp. 235-260). NY: Guilford Press.

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