

Los Themata en la Construcción Científica: Una Investigación sobre la Objetividad como Necesidad.

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Resumen:

El concepto de themata, desarrollado por Gerald Holton, se refiere a los principios fundamentales, a menudo implícitos, que guían las teorías y prácticas científicas. Este concepto epistemológico ha adquirido una importancia significativa en la historia y filosofía de la ciencia. Este artículo examina los themata en el contexto de los debates sobre la objetividad científica, partiendo de la idea de Holton de que los themata sirven como supuestos metafísicos subyacentes a la construcción del conocimiento científico, ya desde su fase naciente, sin perder necesariamente su influencia a lo largo del proceso. El análisis se centra principalmente, aunque no de forma exclusiva, en el tratamiento de la objetividad científica dentro del Círculo de Viena y en los debates entre Karl Popper y ciertos miembros de este grupo en torno a las concepciones de la objetividad científica. El artículo se propone desde el principio demostrar la relevancia de estudiar los themata de Holton en relación con el problema de la objetividad, y esclarecer la perspectiva elegida para abordar esta cuestión.

Palabras clave: themata, supuestos metafísicos, objetividad, Círculo de Viena, Karl Popper.

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The Themata in Scientific Construction: An Inquiry into Objectivity as a Necessity.

Abstract

The concept of themata, as developed by Gerald Holton, refers to fundamental principles, often implicit, that guide scientific theories and practices. This epistemological concept has gained significant importance in the history and philosophy of science. This article examines the themata within the context of debates on scientific objectivity, drawing on Holton's idea that themata serve as metaphysical assumptions underlying the construction of scientific knowledge, right from its nascent phase, without necessarily losing their influence throughout the process. The analysis focuses primarily, though not exclusively, on the treatment of scientific objectivity within the Vienna Circle and the debates between Karl Popper and certain members of this group regarding conceptions of scientific objectivity. The article sets out at the outset to demonstrate the relevance of studying Holton's themata in relation to the problem of objectivity, and to elucidate the perspective chosen to address this question.

Key Words: themata, metaphysical assumptions, objectivity, Vienna Circle, Karl Popper.

Les themata dans la construction scientifique : une enquête sur l'objectivité en tant que nécessité.

Résumé

Le concept de themata, développé par Gerald Holton, fait référence aux principes fondamentaux, souvent implicites, qui guident les théories et les pratiques scientifiques. Ce concept épistémologique a acquis une importance significative dans l'histoire et la philosophie des sciences. Cet article examine les themata dans le contexte des débats sur l'objectivité scientifique, en partant de l'idée de Holton que les themata servent d'hypothèses métaphysiques sous-jacentes à la construction de la connaissance scientifique, déjà à son stade naissant, sans nécessairement perdre leur influence en cours de route. L'analyse se concentre principalement, mais pas exclusivement, sur le traitement de l'objectivité scientifique au sein du Cercle de Vienne et sur les débats entre Karl Popper et certains membres de ce groupe concernant les conceptions de l'objectivité scientifique. L'article s'attache d'emblée à démontrer la pertinence de l'étude des themata de Holton par rapport au problème de l'objectivité, et à préciser la perspective choisie pour aborder cette question.

Mots-clés : themata, hypothèses métaphysiques, objectivité, Cercle de Vienne, Karl Popper.

Themata na construção científica: uma investigação sobre a objetividade como necessidade.

Resumo:

O conceito de themata, desenvolvido por Gerald Holton, refere-se aos princípios fundamentais, muitas vezes implícitos, que orientam as teorias e práticas científicas. Este conceito epistemológico adquiriu uma importância significativa na história e na filosofia da ciência. Este artigo examina os themata no contexto dos debates sobre a objetividade científica, partindo da ideia de Holton de que os themata servem como pressupostos metafísicos subjacentes à construção do conhecimento científico, já na sua fase nascente, sem necessariamente perderem a sua influência ao longo do percurso. A análise incide sobretudo, mas não exclusivamente, no tratamento da objetividade científica no seio do Círculo de Viena e nos debates entre Karl Popper e alguns membros deste grupo acerca das concepções de objetividade científica. O artigo pretende, desde logo, demonstrar a pertinência do estudo dos themata de Holton em relação ao problema da objetividade e clarificar a perspectiva escolhida para abordar esta questão.

Palavras-chave: themata, pressupostos metafísicos, objetividade, Círculo de Viena, Karl Popper.

The Themata in Scientific Construction: An Inquiry Into Objectivity as a Necessity*

Introduction:

Scholarly perspectives on debates surrounding objectivity are often contradictory, ranging from its outright rejection to its recognition as a matter of significant concern. Such is the current state of the discourse. For instance, while Ian Hacking¹ argued against discussing objectivity in void, stating this provoking injunction "Let's Not Talk About Objectivity," François Claveau² offered a contrasting view, urging, "Let's talk about objectivity...". This division aligns with Sandra Harding's insightful observation: "Worries about objectivity just won't go away."³ A similar conclusion can be drawn from a close reading of Gerald Holton's work. It is even imperative to approach Holton's themata within the framework of scientific objectivity, as called for by both the inherent nature of themata (an expression of the researcher's culture, beliefs or worldview, which influences and determines his endeavour) and the incisive criticism formulated by Stephen Toulmin⁴ in his review of Holton's work. In this review, entitled 'Science and Scientists: The Problem of Objectivity', Toulmin expresses his astonishment and regret over Holton's failure to explicitly address the issue of objectivity, which he views, in Holton's case, as an essential and unavoidable concern. Building on Toulmin's observations, this article aims to contextualise Holton's reflections by situating them within the intellectual environment that shaped his early philosophical ideas,

* (i) This paper is an edited chapter from my thesis (PhD). (ii) Quotations made in this work from books or articles written in French are my translations.

¹ 'Let's Not Talk About Objectivity', in *Flavia Padovani, Alan Richardson & Jonathan Y. Tsou (Eds.), Objectivity in Science: New Perspectives From Science and Technology Studies. Cham: Boston Studies in the Philosophy and History of Science, Vol. 310. Springer, 2015, 19–33.*

² 'Let's Talk about Objectivity: Historical and Philosophical Contributions: Flavia Padovani, Alan Richardson and Jonathan Y. Tsou (Eds): Objectivity in Science: New Perspectives from Science and Technology Studies. Cham: Springer, 2015', *Metascience* 25, no. 2 (2016): 297–300.

³ Sandra Harding, *Objectivity and Diversity. Another Logic of Scientific Research* (Chicago and London: University of California Press, 2015), ix.

⁴ Stephen Toulmin, 'Science And Scientists: The Problem Of Objectivity', *Minerva* 12, no. 4 (1974): 522–529, <http://www.jstor.org/stable/41806228>.

particularly the influence of the Vienna Circle, even though Holton eventually distanced himself from this school of thought⁵.

Consequently, this article intends to examine the ways in which Holton's themata, viewed as the metaphysics underpinnings of science, engage with the broader discourse on scientific objectivity, encompassing both the positions put forth by the Vienna Circle and subsequent work on the subject. This perspective is based on the assumption that, insofar as the themata have metaphysical implications, any inquiry into the objectivity of scientific investigation pertaining to them would be devoid of sufficient depth and relevance if not conducted within the context of the major works of the Vienna Circle, as well as the discussions between Popper and the Vienna Circle, where, historically, the fate of metaphysics appeared to be at stake. In this article, we will work to demonstrate that Holton's themata offer a key perspective on the critical issue of objectivity in science. Far from being a peripheral concern, objectivity stands as "the question par excellence of science".⁶ We will start by looking, within the scope we have set at different approaches that have helped clarify what "scientific objectivity" really means. Then we will explore whether it is possible to identify the essential factors that make up the full concept of objectivity in science.

I. Objectivity in Debate: From the Vienna Circle to Popper's Approaches and Challenges

In the formulation of the title of this section, the expression "from the Vienna Circle to Popper" might raise questions about the nature of the gap it may account for. Is it in terms of chronology? Certainly not, as the Circle (1922–1938) and Popper (1902–1994) are contemporaneous in the sense that Popper's thought "was developed in Vienna in the early 1930s in a critically close relationship to that of the Circle".⁷ Indeed, the difference lies in philosophical positions on two levels. The *first level* concerns the conceptions, already

⁵ Gerald Holton, 'Perspectives on the Thematic Analyses of Scientific Thought', *Victory and Vexation in Science: Einstein, Bohr, Heisenberg, and Others*, 2005, 2, <http://nrs.harvard.edu/urn-3:HUL.InstRepos:37894289>.

⁶ Emmanuel Malolo Dissaké, 'L'objectivité-Pureté, Le Cercle de Vienne et Son Opposition Officielle', *Maât - Revue Philosophique Africaine*, no. 2 (2000): 65.

⁷ Dominique Lecourt, *La Philosophie Des Sciences*, Que Sais-Je? (Paris: PUF, 2001), 70.

numerous within the Cercle itself, of *what to credit as the foundation* of science and which firmly establishes and distinguishes it as an enhanced and so-called objective knowledge. Thus, the relevance of claiming objectivity for science is inseparable from foundational logic. In this vein, Carnap's proposal of *protocol statements* was one of the most discussed issues within the Circle.

These protocol statements, which are nothing other than the sensory experiences of the knowing subject, are elevated by Carnap to fundamental, pure, reliable statements exempt from confirmation. Their purity ensures the purity of science, and since they constitute the foundation of science, their certainty guarantees the certainty of science. It is in this way that they make the sought-after objectivity-purity effective. Otto Neurath, for his part, refutes the status accorded to protocol statements by Carnap in the name of the verification criterion⁸. In place of protocol statements, he proposes "language itself as the essence of the dialogue of subjectivities"⁹ as the foundation of science, thereby defining objectivity by communicability guaranteed by the physical language: a sensible language shared by all, freed from metaphysical obscurities¹⁰. Yet, Neurath's effort ultimately leads to a relative objectivity (linked to a specific era and culture)¹¹. Dissatisfied with Neurath's solutions and "the objectivity of scientific discourse",¹² Schlick places the foundation of science in basic statements, which he distinguishes from protocol statements: the latter relate to experimental observations, while the former constitute the points of tangency between scientific language and empirical reality¹³. According to Schlick, this should result in a real objectivity¹⁴.

The bottom line is that the various internal disputes within the Vienna Circle over the foundation of science did not result in a clear-cut victory for any one approach. For Popper – and this is where *the second level* of difference comes in – it is precisely because the very object of this research lacks relevance: a foundation that secures knowledge is simply

⁸ Jean-François Malherbe, *Épistémologies Anglo-Saxonnes* (Namur/Paris: Presses universitaires de Namur/Presses universitaires de France, 1981), 56–57.

⁹ Malolo Dissaké, 'L'objectivité-Pureté, Le Cercle de Vienne et Son Opposition Officielle', 77.

¹⁰ Malolo Dissaké, 'L'objectivité-Pureté, Le Cercle de Vienne et Son Opposition Officielle', 78.

¹¹ Malolo Dissaké, 'L'objectivité-Pureté, Le Cercle de Vienne et Son Opposition Officielle', 88–89.

¹² Pierre Jacob, 'Controverse Entre Neurath et Schlick', in *Le Cercle de Vienne. Doctrines et Controverses*, ed. Jean Sebestik and Antonia Soulez (Paris: L'Harmattan, 2001), 211.

¹³ Cf. Malherbe, *Épistémologies Anglo-Saxonnes*, 58.

¹⁴ Cf. Malolo Dissaké, 'L'objectivité-Pureté, Le Cercle de Vienne et Son Opposition Officielle', 89.

impossible to find because of the dynamic nature of knowledge¹⁵. "By arguing that the distinctive feature of scientific knowledge is neither certainty, verifiability, nor security, but rather its growth, Popper replaces the static perspective with a dynamic and evolutionary conception of knowledge."¹⁶ Having elucidated the second level of the gap between the Vienna Circle and Popper, it is important to note that neither the irrelevance of the search for a foundation (Popper's thesis) nor the notable internal divergence within the Vienna Circle regarding what this foundation might be implies that nothing concrete can be derived from the Circle about the objectivity of science. The brief survey conducted in this section shows that it would be a mistake not to note that "the Circle did not have a single position regarding objectivity".¹⁷ In fact, we must recognise that a *fundamental requirement* was nonetheless identified and commonly shared by the members of the Circle to determine the objectivity of science.

This fundamental requirement is to link *science and language*¹⁸ (this is the notion most common to all logical positivists) and then hold that three points, which clarify each other and establish scientific objectivity as a "methodological concept" (we will return to this expression later), flow from this connection. Thus, for logical positivists, the three points to hold to speak properly of the objectivity of science would be as follows: (*i – a definition as a starting point*) science is a set of intersubjectively validated statements (laws, theories) about the world; (*ii—a consequent action implied*) the purification of ordinary language through its logical analysis, crystallised in the proscription of metaphysics from the discourse of science; (*iii—two conditions that confer objectivity on scientific theories*) *first*, the statements of this discourse must be expressed in a common language (a conventional system of signs understood by all scholars) to hold the same value everywhere; *second*, these statements must aim for neutrality (independent of the subjects who make science, thus free from subjectivity) and meet both *validity* criteria (internal coherence) and *truth* criteria (correspondence between statement and facts).

¹⁵ Cf. Emmanuel Malolo-Dissaké, *Grammaires de l'objectivité Scientifique. Au Coeur de l'Épistémologie de Karl Popper*, ed. Dianoia (Chennevrières-sur-Marne, 2012), 272.

¹⁶ I Malolo Dissaké, 'L'objectivité-Pureté, Le Cercle de Vienne et Son Opposition Officielle' 82.

¹⁷ Malolo Dissaké, 'L'objectivité-Pureté, Le Cercle de Vienne et Son Opposition Officielle', 65.

¹⁸ Francesco Barone, 'La Polémique Sur Les Énoncés Protocolaires Dans l'épistémologie Du Cercle de Vienne', in *Le Cercle de Vienne. Doctrines et Controverses*, ed. Jan Sebestik and Antonia Soulez (Paris: L'Harmattan, 2001), 182 & 186.

In essence, this general conception that outlines and guarantees the contours of scientific objectivity is not a point of arrival but a programme to be realised since, in reality, it is a norm to be satisfied. This is what we meant earlier by "objectivity is a methodological concept". In other words, objectivity is not given; logical positivists consider it established and recognise it as such if the discourse through which the theory claiming objectivity is rendered communicable to all, that is, if it is susceptible to having a communal basis. By "communal basis", we mean the *concordance of different subjectivities* – what is called intersubjectivity¹⁹. Science and discourse necessarily meet objectivity in intersubjectivity. Any blurring at this level becomes a *de facto* threat to the objectivity of knowledge²⁰. This is a concern to be taken seriously; and importantly, this concern dates to Heraclitus (576 - 480 B.C.), according to Irene Papadaki²¹, who observes:

[Heraclitus] was the first to distrust sensory perception [...]. His texts show the contradictory possibilities offered by language interpretation, the plurality of meanings in discourse, and the need for us to protect ourselves from the possibilities offered by language; our relationship with language must be vigilant, active, and exploratory.

Henri Poincaré²² observes the same scepticism – though he laments its excessive nature – in M. Le Roy: "the intellect deforms all it touches, and that is still more true of its necessary instrument 'discourse.'" The logical positivists' caution regarding the discourse of science and philosophy can be seen as following in the wake of these lines of thought, which explains their keen interest in language²³.

All in all, the utility of *logical analysis of language* is measured by the need for clarity that the discourse of science demands in order to be valid as "the only sensible language from the standpoint of knowledge",²⁴ in opposition to metaphysics, critical philosophy, and

¹⁹ Cf. Bruno Jarroson, *Invitation à La Philosophie Des Sciences, Coll. Sciences Points* (Paris: Éditions du Seuil, 1992), 125.

²⁰ Daniel Andler, Anne Fagot-Largeault, and Bertrand Saint-Sernin, *Philosophie Des Sciences I, Coll. Folio/ Essais* (Paris: Gallimard, 2002), 220.

²¹ Konrad Lorenz and Karl Popper, *L'avenir Est Ouvert, Coll. Champs* (Paris: Éditions Flammarion, 1995), 97.

²² *The Value of Science*, trans. George Bruce Halsted (New York: Dover Publications INC., 1958), 112.

²³ See for example: Pierre Wagner, ed., *Les Philosophes et La Science, Coll. Folio/ Essais* (Paris: Gallimard, 2002), 246–47.

²⁴ Barone, 'La Polémique Sur Les Énoncés Protocolaires Dans l'épistémologie Du Cercle de Vienne', 182–83.

Kantian apriorism as containing metaphysical nonsense²⁵, "assertions that are not verifiable".²⁶ By *verifiable*, we mean "what can be related (directly or indirectly) to publicly attestable perceptions."²⁷ This means that *a statement is meaningful or falls within the domain of meaning* "if there are possible circumstances that, if realised, would allow us to determine whether the statement is true (if it is true) or false (if it is false)".²⁸ Thus, verification, which is also a criterion of scientificity (determining what belongs to science) for logical positivists, testifies to the fundamentally public nature of science, and on closer inspection, also refers to the communicability of science. Indeed, as a potential site of mutual control, verification is part of the discursive enterprise of validating theories and, as such, refers to an intersubjective practice that is the a priori underpinning of communication understood as a (critical) dialogue with the other. "Through language, we make theory open to *criticism*."²⁹

Thus, *scientific objectivity* can be said to be linked to *communicability*, both as its foundation and as a notion equivalent to it. Poincaré³⁰ expresses this succinctly: "no discourse, no objectivity". The same holds for Schlick³¹, for whom "all knowledge is communicable, and all that is communicable is knowledge", and communicability is, by definition, "what can be [...] expressed by symbols, whether they are words of language or other signs." This elucidates the appropriate conception of the notion of "communicability" and the specific means through which it can reliably achieve its intended purpose. However, the question remains: what, then, is the most reliably communicable material? This is ultimately the real question, and its answer is far from being a trivial task within the Circle, where it is known that "the adherents agreed on a certain number of ideas while reserving the

²⁵ Barone, 'La Polémique Sur Les Énoncés Protocolaires Dans l'épistémologie Du Cercle de Vienne', 183. Regarding Kant, Popper believes that he 'was mistaken in thinking that an a priori truth, that is, a truth not derived from our experience, was certain and given' (cf. Konrad Lorenz and Karl Popper, *L'avenir est ouvert*, op. cit., p. 83, and also p. 38).

²⁶ Barone, 'La Polémique Sur Les Énoncés Protocolaires Dans l'épistémologie Du Cercle de Vienne', 185.

²⁷ Soler Léna, *Introduction à l'épistémologie. Nouvelle Édition Revue et Augmentée [d'un Chapitre]* (Paris: Ellipses, 2009), 99.

²⁸ Wagner, *Les Philosophes et La Science*, 290.

²⁹ Lorenz and Popper, *L'avenir Est Ouvert*, 49 [Highlighted by the author].

³⁰ *The Value of Science*, 136.

³¹ 'Le Vécu, La Connaissance, La Métaphysique', in *Manifeste Du Cercle de Vienne et Autres Écrits*, ed. Antonia Soulez (Paris: PUF, 1985), 183.

right to dissent and even to openly criticise when new propositions failed to gain their approval".³²

Carnap's tireless effort to find this "material" of choice, along with the contributions of Neurath and Schlick, illuminate this right to critique and constitute the main paths to be followed in understanding how scientific objectivity materialises within the Circle. With terms like "tireless effort" and "contributions of", one cannot assert objectivity as an inherent attribute of science but rather as an issue that distinguishes this form of knowledge. In this regard, we subscribe to the idea that "the objectivity of science promoted by the Circle is primarily the *necessity of a purity of science* that would be achieved through a tabula rasa, grounding objectivity in the empirical",³³ that is, in what can be deduced from facts through a legitimate logical process.

From this perspective, in an approach that can be described as refined by criticism, Carnap, faithful to the empiricist tradition and his project of constructing a unified system of science (physicalism), situates the foundation of scientific objectivity in "the formal relations and structural formulas that allow the transition from one original experience to another".³⁴ This option for "structural objectivity", as named by Lorraine Daston and Peter Galison³⁵, reflects, on the one hand, *a renunciation of lived experience due to its hermetically subjective nature*³⁶ and, on the other hand, presents structures as *the only way to break out of the private mental world of individual subjectivity*.³⁷ With "structures", objectivity claims to be defined as the result of an approach finally freed from the self ("from subjective conviction"³⁸) and capable of "being controlled and understood by anyone".³⁹ This is an ideal

³² Malolo Dissaké, *L'objectivité-Pureté, Le Cercle de Vienne et Son Opposition Officielle*, 66.

³³ Jean-Paul Kamahe, 'La Science Au Risque de La Philosophie Du Langage Chez Thomas Samuel Kuhn. Vers Une Approche Institutionnelle de l'objectivité Scientifique?' (Université Catholique de l'Afrique de l'Ouest/Unité Universitaire à Abidjan (UCAO/UUA), 2014), 134 [The italics are the author's own].

³⁴ Malolo Dissaké, *L'objectivité-Pureté, Le Cercle de Vienne et Son Opposition Officielle*, 87.

³⁵ Lorraine Daston and Peter Galison, *Objectivity* (New York: Zone Books, 2007). See Chapter V, where the authors trace the origins of structural objectivity to the physicist and physiologist Hermann von Helmholtz, whose work had a significant impact on logicians, mathematicians, physicists, and philosophers.

³⁶ Lorraine Daston and Peter Galison, *Objectivity* (New York: Zone Books, 2007), 284.

³⁷ Lorraine Daston and Peter Galison, *Objectivity* (New York: Zone Books, 2007), 254.

³⁸ Karl Popper, *The Logic of Scientific Discovery*, ed. Routledge, *The Logic of Scientific Discovery* (London and New York, 2005), 92, <https://doi.org/10.4324/9780203994627>.

³⁹ Karl Popper, *The Logic of Scientific Discovery*, ed. Routledge, *The Logic of Scientific Discovery* (London and New York, 2005), 92. It is important to clarify, in order to avoid any confusion, that Popper himself rejects the idea of justification or verification of scientific theories, favoring instead the concept of intersubjective

that runs through the various approaches to scientific objectivity among the logical positivists of the Vienna Circle.

Indeed, following the lineage of the ancestors of logical empiricism, notably Ernst Mach and Bertrand Russell, among others, for whom science is "a given system of propositions and relations",⁴⁰ Carnap initially believed it was possible "to isolate and place at the foundation of the sciences a set of absolutely irrefutable observational statements".⁴¹ "This programme was accomplished through 'protocols' [sometimes wrongly translated as 'protocol statements'], which are records of raw experimental results on which the combinatorial power of logic works."⁴² Schematically, this record, presented in written form (to compensate for possible memory failures), mentions: a perceptual experience (identifiable), an indication of time (historically situated experience), a location (the experience is localised), as well as references related to the author (the person who conducted the experiment)⁴³. This method, which Carnap calls "methodical positivism," is criticised for "leading all knowledge to the individual psychism of the immediate contents of consciousness".⁴⁴ Neurath acknowledged the illusion of hoping to reach the fact through a "protocol".⁴⁵ If it is sensationalism (knowledge is determined by sensations) that is thus called into question, physicalism (taking the physical world as the basis of knowledge) through which Carnap passes before relying on structures is, in turn, considered a doctrine that gives little consideration to scientific reality⁴⁶.

Conversely, with the primacy of structures, Carnap took a significant step in the conception of scientific objectivity by finding a less problematic empirical foundation than the principle of observational statements, whose existence remained the great question that had to "mobilise epistemologists and divide logical positivists themselves".⁴⁷ While it is true that, unanimously among authors who opt for structural objectivity, only structures can be

testability, as can be read on p. 22 of the same book cited here. In this regard, he distinguishes himself from the logical positivists of the Vienna Circle.

⁴⁰ Jean Ullmo, *La Pensée Scientifique Moderne*, coll. Cham (Paris: Flammarion, 1969), 89.

⁴¹ Léna, *Introduction à l'épistémologie. Nouvelle Édition Revue et Augmentée [d'un Chapitre]*, 100.

⁴² Ullmo, *La Pensée Scientifique Moderne*, 90–91.

⁴³ Cf. Léna, *Introduction à l'épistémologie. Nouvelle Édition Revue et Augmentée [d'un Chapitre]*, 100.

⁴⁴ Jean Ullmo, *La Pensée Scientifique Moderne*, coll. Cham (Paris: Flammarion, 1969), 88–89.

⁴⁵ Cf. Jean Ullmo, *La Pensée Scientifique Moderne*, coll. Cham (Paris: Flammarion, 1969), 98, footnote no. 2.

⁴⁶ Cf. Jean Ullmo, *La Pensée Scientifique Moderne*, coll. Cham (Paris: Flammarion, 1969), 89.

⁴⁷ Léna, *Introduction à l'épistémologie. Nouvelle Édition Revue et Augmentée [d'un Chapitre]*, 101.

shared by all minds regardless of space and time⁴⁸, it remains equally true that "this primacy of structure and form (objective as they are) obviously comes at the expense of the qualitative content of sensory data, which are said to be subjective".⁴⁹

In any case, with Carnap's "structuralist thesis",⁵⁰ there is an overcoming of subjectivity, or at least a "convenient integration" of it into the conception of objective knowledge. This step allowed by the "structuralist thesis" brings us closer to Popper⁵¹ and leads us to say in this regard, along with Jean-Paul Kamaheu, that "subjective experiences are the (primary) material of theories, which should themselves be objective, that is, discussable, criticisable, testable, not limited to subjective intuitions".⁵² Nevertheless, a logical positivist remains a logical positivist: if structural objectivity has the merit of breaking with solipsism to make room for intersubjectivity, which is the condition of possibility for objectivity, it remains that it, like sensationalism or physicalism, lacks a grip on objective reality.

There is no doubt about this distancing of logical positivism from the thing-in-itself. This is evidenced by the Vienna Circle Manifesto published by Neurath, Hahn, and Carnap: "A scientific description can contain only the *structure* (form of order) of objects, not their 'essence'".⁵³ Thus, by qualifying them as metaphysical, (logical) positivism refuses to take a principled position on questions such as: Does the real exist independently of the observation made of it (the realist option, which was Einstein's)? Or is the real reduced to the sum of observations (the idealist option, which was Bohr's)?⁵⁴ By continually expelling metaphysical being from science, one ends up distancing oneself from the scientific being of the thing itself, the fixed point, and support of phenomena⁵⁵. By embedding objectivity-purity in the battle against metaphysics, logical positivists allow the real to slip away and thus add to the mutilation of science, which, to satisfy the criterion of translatability, would have to be

⁴⁸ Cf. Daston and Galison, *Objectivity*, 294.

⁴⁹ Malolo Dissaké, 'L'objectivité-Pureté, *Le Cercle de Vienne et Son Opposition Officielle*', 87.

⁵⁰ Joëlle Proust, 'Empirisme et Objectivité', in *Le Cercle de Vienne. Doctrines et Controverses*, ed. Jan Sebestik and Antonia Soulez (Paris: L'Harmattan, 2001), 140.

⁵¹ Cf. Karl Popper, *Unended Quest: An Intellectual Autobiography*, 2nd ed., Routledge Classics (London and New York: Taylor and Francis, 2005), 159–60.

⁵² Kamaheu, 'La Science Au Risque de La Philosophie Du Langage Chez Thomas Samuel Kuhn. Vers Une Approche Institutionnelle de l'objectivité Scientifique?', 128 [emphasis by the author].

⁵³ Otto Neurath, *Empiricism and Sociology*, ed. Marie Neurath and Robert S. Cohen (Dordrecht-Holland/Boston-USA: D. Reidel Publishing Company, 1973), 309.

⁵⁴ Cf. Jarrosson, *Invitation à La Philosophie Des Sciences*, 127.

⁵⁵ Cf. Jean Ullmo, *La Pensée Scientifique Moderne*, coll. *Cham* (Paris: Flammarion, 1969), 95.

deprived of universal statements. This leads to the exclusion of natural sciences from the domain of science⁵⁶. Popper did not fail to point this out in his criticisms against the Vienna Circle⁵⁷. As far as he is concerned, objectivity-purity is also at the heart of his epistemology, and is achieved at the cost of annihilating the *knowing subject*⁵⁸, whose resistance leaves one doubtful as to the outcome of the undertaking. At the conclusion of a study on scientific objectivity in the heart of Karl Popper's epistemology, Dissaké⁵⁹ notes, and it is important to emphasise this, that "the fundamental question remains: is there, with Popper, a real possibility of achieving objectivity in the practice of science?"

The question seems to apply not only to Popper but to epistemology in general, where objectivity is in one way or another conceived as the result obtained at the cost of relentless efforts against "impure" components – metaphysical presuppositions, the knowing subject, lack of integrity (insofar as the ethical aspect of the question is concerned) – that serve to build science and ultimately prove indestructible and inherent modes of science's existence. In sum, the "price" to be paid for asserting the objectivity of science is exorbitant, even unsolvable, and raises an essential question aptly formulated by Dissaké: "if such factors [the 'impure' components] proved decisive, should we continue to say that science is objective?"⁶⁰ In other words, is scientific objectivity merely an ideal from which we must disillusion ourselves if we wish to be realistic (in the sense of considering reality and assessing it accurately)?

II. Scientific Objectivity: Between Value to be Denied and a Concept to be Purified

⁵⁶ Cf. Malherbe, *Épistémologies Anglo-Saxonnes*, 55.

⁵⁷ See for example: Karl Popper, *Conjectures and Refutations: The Growth of Scientific* (London and New York: Routledge, 2002) (Chap. 11. The Demarcation Between Science And Metaphysics), p.341-394.

⁵⁸ Karl Popper, *Objective Knowledge: An Evolutionary Approach*, Revised ed (Oxford: Clarendon Press, 1974) [see Chap. 3: Epistemology Without a Knowing Subject].

⁵⁹ *Grammaires de l'objectivité Scientifique. Au Coeur de l'Épistémologie de Karl Popper*, 372.

⁶⁰ Malolo Dissaké, *L'objectivité-Pureté, Le Cercle de Vienne et Son Opposition Officielle*, 82.

Objectivity constitutes one of the most contested epistemic values. Presented, even celebrated by some thinkers as what science and scientists bring best to the world⁶¹, it is, on the other hand, relegated by others to the rank of utopias pursued by science; and those who support such an idea are not necessarily the fewest or the most obscure of thinkers. Feyerabend, who has shown himself to be refractory to the idea of scientific objectivity to the point of regarding it as an inherently illegitimate claim⁶², was nonetheless correct when he stated that objectivity is *one of the fundamental claims that scientists make about their work*⁶³. It would be inappropriate not to specify that, in accordance with the rule of scientific practice, the objectivity thus claimed is first and foremost an ideal that becomes an achievement only through *peer critique*.

This practice, on which Popper agrees with the Vienna Circle as well as Holton, and which, moreover, is the uniformly accepted process for establishing the objectivity of a theory, refers to the *interplay of intersubjectivity* – which in reality operates on the basis of a double presupposition: *the principle of autonomy and the idea of a rigorous scientific method*. Indeed, we should say triple presupposition, since the *principle of autonomy* is a generic term that Feyerabend uses to designate both "the hypothesis of the relative autonomy of facts" and "the thesis of the progress or growth of knowledge", to which he associates the idea of *a rigorous scientific method* as the trio of decisive arguments in favour of objectivity in order to refute them⁶⁴. By classifying and clarifying the theses in favour of objectivity and by becoming an implacable critic of these theses, Feyerabend becomes a "site" to be explored to better appreciate, at least in a first approximation, the value of the arguments *for* and *against* scientific objectivity. In any case, it is certain that the author of *Against Method* sets us on the path of what we seek – whether his analyses seem credible or not. Indeed,

⁶¹ Alfred Kastler, Nobel Prize in Physics (1970), confidently asserts that 'what scientists bring to the world is their objectivity,' as cited by Jean-Marc Lévy-Leblond, *L'esprit de Sel: Science, Culture, Politique*, Coll. Points Science (Paris: Éditions du Seuil, 1984), 203. However, Lévy-Leblond diverges from this perspective, aligning himself with scholars such as Michael Polanyi, Thomas Kuhn, Imre Lakatos, and Paul Feyerabend, who challenge the validity of scientific objectivity as defended by logical positivists and figures like Karl Popper. For a comprehensive analysis of the opposition between these two camps, see Emmanuel Malolo Dissaké's *Grammaire de l'objectivité scientifique* (op. cit., pp. 82-125).

⁶² See Paul Karl Feyerabend, *Against Method. Outline of an Anarchistic Theory of Knowledge* (London and New York: Verso, 1993).

⁶³ Paul Feyerabend, *Farewell to Reason* (London: Verso, 1987), 5.

⁶⁴ Cf. Feyerabend, *Against Method. Outline of an Anarchistic Theory of Knowledge* (the first three chapters) ; and Malolo-Dissaké, *Grammaires de l'objectivité Scientifique. Au Coeur de l'Épistémologie de Karl Popper* (op. cit., pp. 88–93).

beginning an investigation into the correct conception of scientific objectivity with the refutation work carried out by Feyerabend⁶⁵ would be no less beneficial than what the purification of believers' faith owes to the challenges posed by atheists⁶⁶. As an aside, the comparison is not an exaggeration; it enables us to grasp the undeniable light that Feyerabend throws, despite his excesses, on "the fact that classically we have no good justifications for scientific objectivity"⁶⁷.

Concretely, "the assumption of the relative autonomy of facts",⁶⁸ as well as "the thesis of the progress or growth of knowledge", are, for Feyerabend, merely parades of scientism "from which scientific objectivity is quickly concluded".⁶⁹ Regarding the first element of the incriminated binomial, Feyerabend believes that taking the adequacy of theories with the facts they describe to declare the theories objective is perhaps not absurd but still too radical. The malady to be denounced lies here, but its root is to be found in this: the refuted inference rests on the objectivity of facts, which itself is founded on a refutable idea. This idea consists in believing that the scientist works with *raw facts* at his disposal, which are always "available for various manipulations and tests beyond changes in theories"⁷⁰. This autonomy, recognised by the philosophy of science to facts, is abusive and also suggests, notes Feyerabend, that scientific facts are "independent of opinion, belief, and cultural background"⁷¹. Yet, according to Feyerabend, the truth is that "science knows no 'bare facts' at all but that the 'facts' that enter our knowledge are already viewed in a certain way and are, therefore, essentially ideational"⁷². But indeed, if it must be acknowledged that "there is no fact in itself, only observed, chosen, and selected facts"⁷³, is that a sufficient reason to conclude, as Feyerabend did, that a theory confirmed by the facts proves nothing about its objectivity? We answer in the negative, referring to Stengers' fine formulation: "the paradox

⁶⁵ To better appreciate how Feyerabend allows us to perceive the objectivity of science in a more nuanced or implicit way, we refer to Malolo-Dissaké, *Grammaires de l'objectivité Scientifique. Au Coeur de l'Epistémologie de Karl Popper*, pp.88-93; which will serve as our guide.

⁶⁶ For the contribution of atheism to faith, see, for example, Marcel Neusch, *Aux Sources de l'athéisme Contemporain. Cent Ans de Débats Sur Dieu* (Paris: Éditions du Centurion, 1993).

⁶⁷ Malolo-Dissaké, *Grammaires de l'objectivité Scientifique. Au Coeur de l'Epistémologie de Karl Popper*, 93.

⁶⁸ Feyerabend, *Against Method. Outline of an Anarchistic Theory of Knowledge*, 26.

⁶⁹ Malolo-Dissaké, *Grammaires de l'objectivité Scientifique. Au Coeur de l'Epistémologie de Karl Popper*, 88.

⁷⁰ Malolo Dissaké, *L'objectivité-Pureté, Le Cercle de Vienne et Son Opposition Officielle*, 88.

⁷¹ Feyerabend, *Against Method. Outline of an Anarchistic Theory of Knowledge*, 11.

⁷² Feyerabend, *Against Method. Outline of an Anarchistic Theory of Knowledge*, 11.

⁷³ Jarrosson, *Invitation à La Philosophie Des Sciences*, 168.

of the scientific mode of existence is that the laborious nature of the construction does not contradict the quest for the 'truly true'.⁷⁴ "To be sure," she then goes on, "all experimental facts are 'artefacts', but it is precisely for this reason that they give meaning to the trials, whose vocation is to differentiate between artefacts: to disqualify those that will be said to be purely relative to the protocol that created them; to accept those that will be said to be 'purified'.⁷⁵ Dissaké⁷⁶ is right when he observes that "for the author of *Against Method*, the difficulties of objectivity arise here, as it were, from what Quine might have called *the ontological commitment* of theory". He then adds in the same passage: "whatever the degree, this commitment exists and is undeniable". Schopenhauer⁷⁷ expresses an equally incisive view of the looseness of the researcher's relationship to the facts when he contends that "no truth is more certain [...] and less in need of proof than this, namely that everything that exists for knowledge, and hence the whole of this world, is only object in relation to the subject, perception of the perceiver, in a word, representation".

As for "the thesis of progress or growth of knowledge", whose relevance presupposes the comparison of theories, Feyerabend raises against it the incommensurability of theories. From a logical point of view, competing theories cannot be compared since they invoke different concepts even if they relate to the same set of facts and problems⁷⁸. For Feyerabend, Lakatos perceived this well, as he did not provide a criterion for choosing between different research programmes⁷⁹. Feyerabend finds in this position the pretext to take upon himself the responsibility of declaring the choice between two theories subjective and science a knowledge that cannot be placed above others. This is why it is not feasible to align with his perspective. Due to *the ontological commitment of theories* advocated by Quine, as discussed

⁷⁴ Isabelle Stengers, *The Invention of Modern Science*, trans. Daniel W Smith (Minneapolis: University of Minnesota Press, 2000), 98.

⁷⁵ Isabelle Stengers, *The Invention of Modern Science*, trans. Daniel W Smith (Minneapolis: University of Minnesota Press, 2000), 98.

⁷⁶ *Grammaires de l'objectivité Scientifique. Au Coeur de l'Epistémologie de Karl Popper*, 89 [author's emphasis].

⁷⁷ *The World as Will and Representation, In Two Volumes : Volume I*, trans. E. F. J. Payne, 1st ed. (New York: Dover Publications, INC., 1966), [3].

⁷⁸ Cf. Jarrosson, *Invitation à La Philosophie Des Sciences*, 176.

⁷⁹ Cf. Jarrosson, *Invitation à La Philosophie Des Sciences*, 176.

by Dissaké above, "theories can in fact be put in competition at the level of facts, regardless of their own logical coherence"⁸⁰.

In the final analysis, the unlikely "scrupulous respect for the strict rules of method in the sciences"⁸¹ that Feyerabend puts forward to conclude that science is not objective helps us to understand that the interplay of intersubjectivity does indeed make mutual criticism a perfect ideal. But we must immediately recognise that without this ideal, the pursuit of knowledge would plunge into chaos, into anarchy. Indeed, critique is not the goal to be achieved by intersubjectivity, which makes it possible. The goal is "the agreement of rational subjects capable of understanding each other and arriving at the stable agreement on a problem, situation, or thing".⁸² However, the conditions (mutual critique, friendly-hostile collaboration [rivalry], competition, and tradition) of intersubjectivity, whose ambivalence is highlighted by Popper⁸³, sometimes have, to borrow Stengers's⁸⁴ words, "very little to do [...] with the ideal fiction of human protagonists looking into each other's eyes and together managing to bring out the values, presuppositions, and priorities that unite them beyond their conflicts, which henceforth become secondary". Between the ideal communicational community and the real scientific community, there is a gap with all the possible risks, including "the brutal law of the strongest", which some authors advance to justify the questioning of scientific objectivity⁸⁵; not to mention, in the same vein, the risk of *miscommunication* (similar to a "dialogue of the deaf")⁸⁶ that Kuhn presents as challenges faced by scientists operating under different paradigms⁸⁷. Consequently, it is easy to understand why Lakatos⁸⁸ could not help but echo Polanyi's ideas to reveal their relevance: "It is the jury of scientists which decides in each separate case and as long as scientific

⁸⁰ Jarrosson, *Invitation à La Philosophie Des Sciences*, 176.

⁸¹ Malolo-Dissaké, *Grammaires de l'objectivité Scientifique. Au Coeur de l'Epistémologie de Karl Popper*, 92.

⁸² Stengers, *The Invention of Modern Science*, 99.

⁸³ 'The Logic of Social Sciences', in *The Positivist Dispute in German Sociology*, ed. Theodor W. Adorno et al. (London: Heinemann, 1976), 97; For a discussion of this issue, see Malolo-Dissaké, *Grammaires de l'objectivité Scientifique. Au Coeur de l'Epistémologie de Karl Popper*, 153–80.

⁸⁴ *The Invention of Modern Science*, 100.

⁸⁵ Cf. *The Invention of Modern Science*, 3.

⁸⁶ Malolo-Dissaké, *Grammaires de l'objectivité Scientifique. Au Coeur de l'Epistémologie de Karl Popper*, 99.

⁸⁷ See Thomas S. Kuhn, *The Structure of Scientific Revolutions*, 4. ed. (Chicago: The University of Chicago Press, 2012), Chapter X: Revolutions as Changes of World View.

⁸⁸ *The Methodology of Scientific Research Programmes: Philosophical Papers. Volume 1*, ed. John Worrall and Gregory Currie (New York: Cambridge University Press, 1989), 176.

autonomy – and *eo ipso* the independence of this jury – is upheld, nothing will go very wrong."

The controversies, both broadly and specifically those analysed by Holton – such as the Millikan-Ehrenhaft dispute⁸⁹ and the Einstein-Bohr debates⁹⁰ – serve in his work to demonstrate the influence of thematic inclinations on scientific debates. In certain instances, because of extra-scientific reasons, the resolution of a scientific debate remains elusive, as exemplified by the prolonged Einstein-Bohr controversy over the acceptance or rejection of quantum mechanics. As David Kaiser⁹¹ highlights: "Their thirty-year debate was interrupted only by Einstein's death in 1955, rather than by any mutually agreeable solutions." These cases, stamped by personal engagements and worldviews of the disputants, underscore a significant observation, aptly captured by Stengers⁹²: "Scientists rarely look into each other's eyes. Rather, they turn their backs to each other, each in their own laboratory striving to invent the means of creating a fact that will silence their adversary." Nevertheless it is judicious to exercise some caution when categorising the triumph of Bohr's complementarity principle at Copenhagen as part of Stengers' line of reasoning, given that: "Bohr, Unlike Einstein, did discuss the bases for his judgement, and he carried the day."⁹³ However, there is no doubt that the EPR (i.e Einstein-Podolsky-Rosen) argument suggested by Einstein and his allies to support the thesis of the incompleteness of quantum theory is a perfect illustration of the desire to "create a fact that silences the opponent". "The argument appeared to be compelling, yet the response from Niels Bohr [...], the most prominent critic of Einstein (with whom he was also friends), lacked clarity."⁹⁴ Hegel's beautiful expression, "cunning of reason"⁹⁵, has proven to be accurate in this debate. With the benefit of the public character of the scientific enterprise, it is now clear that the EPR argument has been shown to be

⁸⁹ See Gerald Holton, *The Scientific Imagination*, ed. MA: Harvard University (Cambridge, 1998), 25–83 (Chap. 2).

⁹⁰ See Holton Gerald, *Thematic Origins of Scientific Thought: Kepler to Einstein*, Revised ed (Cambridge, Massachusetts and London: MA: Harvard University Press, 1988), 99–145, (Chap. 4: The Roots of Complementarity), <http://nrs.harvard.edu/urn-3:HUL.InstRepos:23975383>.

⁹¹ 'Bringing the Human Actors Back on Stage: The Personal Context of the Einstein-Bohr Debate', *The British Journal for the History of Science* 27, no. 2 (1994): 130.

⁹² *The Invention of Modern Science*, 100.

⁹³ Thomas S. Kuhn, *The Essential Tension: Selected Studies in Scientific Tradition and Change* (Chicago & London: University of Chicago Press, 1977), 337.

⁹⁴ Jarrosson, *Invitation à La Philosophie Des Sciences*, 122.

⁹⁵ Georg Wilhelm Friedrich Hegel, *The Philosophy of History*, trans. J. Sibree (Kitchener, Ontario: Batoche Books, 2001), 47.

unsubstantiated as a result of the combined efforts of John Stewart Bell (1928–1990) and Alain Aspect (1947–) between 1979 and 1982⁹⁶. To the best of our knowledge, no new articles or studies of note have emerged that successfully challenge the conclusions drawn from these pivotal experiments, which arguably marked a shift in the discussion moving away from philosophical debates toward a focus on empirical validation.

This episode in the history of science is rich in lessons that corroborate the ideas already developed in this work from controversies. The crisis caused by quantum physics has shed tangible and concrete light on the mode of constitution of intersubjectivity and its pivotal role in the apodictic foundation of the enterprise of scientific knowledge⁹⁷. It is noteworthy that Husserl does not address this subject in his work, which bears the evocative title *The Crisis of the European Sciences and Transcendental Phenomenology*. Another lesson to be drawn is that the refutations by which Feyerabend believes he has ruined the idea of scientific objectivity do not annihilate it but bring it back to the essence of what scientific objectivity is. In fact, Feyerabend reads science and the objectivity it claims through a lens characteristic of what is called in the world of scientists "social studies in science," "sociology of science", or "anthropology of science". In his view⁹⁸, "the only reliable approach is to abandon the reconstructions" (advocated by logicians) and to "restart the study of science from scratch", akin to the method of an anthropologist. "Only the anthropological method can lead to knowledge that is more than a reflection of wishful thinking,"⁹⁹ he argues. However, as Stengers notes, the authors who align with this field would "no longer denounce the numerous infidelities committed by scientists against their own norms of autonomy and objectivity, but consider these very norms to be empty, as if every science were "impure" by nature and not because of its deviation from an ideal".¹⁰⁰

⁹⁶ See, for example Jarrosson, *Invitation à La Philosophie Des Sciences*, 122–23; For further details, refer to Manjit Kumar, *Quantum: Einstein, Bohr, and the Great Debate about the Nature of Reality*, PDF (London: Icon Books, 2009) Chapter 14: For Whom Bell's Theorem Tolls.

⁹⁷ Cf. Andler, Fagot-Largeault, and Saint-Sernin, *Philosophie Des Sciences I*, 172.

⁹⁸ *Against Method. Outline of an Anarchistic Theory of Knowledge*, 191.

⁹⁹ *Against Method. Outline of an Anarchistic Theory of Knowledge.*, 202, footnote 111.

¹⁰⁰ Stengers, *The Invention of Modern Science*, 7.

With this illumination provided, we can, paraphrasing Bruno Latour¹⁰¹, assert that adding the word "relative"(in the sense of dependent on certain factors and not absolute) to the term "objectivity" is *neither a sin nor a crime nor a fall. It is an elevation*. The objectivity of science *thrives even more, becoming more rigorous and truthful, when it is understood as relative to the state of knowledge at a given time*. Reasonably, this should not justify a refusal of objectivity because theories, as Popper argues, are hypothetical; those that are reputed to be true are conjectures, never certainties established once and for all.

Another lesson to be drawn, which dispels the pessimism in which Feyerabend and Kuhn seem to plunge scientific objectivity by evoking beliefs and other worldviews that condition research, is that Holton aptly invites us not to lose sight of:

What does save science from falling victim to inappropriate presuppositions are of course the chastening roles both of the coordination with experiment and of the multiple cross-check of any finding by other scientists who may have started with quite different presuppositions.¹⁰²

This thesis invites us to two observations. The first is that Holton's *themata* and Kuhn's *paradigms* have markedly different relationships with objectivity criteria. In this vein, according to Holton, the subjective elements surrounding themata and even determining their nature are perfectly manageable by objectivity criteria. On the other hand, Kuhn does not display the same optimism regarding paradigms. These are, unlike themata, capable of challenging our supposed criteria of objectivity precisely because of their link with the subjective, which, on the one hand, is inherent to them (one adheres to a paradigm for obscure reasons)¹⁰³ and on the other hand, taints the practice of science (paradigm change or scientific progress is marked by ambiguity)¹⁰⁴. Consistent with himself, Kuhn concludes, according to Dissaké, that "objectivity is neither that of the fact nor that of the method; it is

¹⁰¹ *La Science En Action. Introduction à La Sociologie Des Sciences*, trans. Michel Biezunski, Coll. Folio/ Essaie (Paris: Gallimard, 1987), 17 [The italicized text originates from Latour].

¹⁰² Gerald Holton, *Einstein, History, and Other Passions : The Rebellion Against Science at the End of the Twentieth Century* (Cambridge, MA: Harvard University Press., 2000), 119–20, <http://nrs.harvard.edu/urn-3:HUL.InstRepos:23975375>.

¹⁰³ Malolo-Dissaké, *Grammaires de l'objectivité Scientifique. Au Coeur de l'Epistémologie de Karl Popper*, 96–99.

¹⁰⁴ Malolo-Dissaké, *Grammaires de l'objectivité Scientifique. Au Coeur de l'Epistémologie de Karl Popper*, 99–102.

the objectivity-decree of the scientific group that creates it."¹⁰⁵ But in reality, if Kuhn defines objectivity in this way, it is because he does not see how objectivity can be synonymous with neutrality, given that the paradigm imposes a vision and ways of doing things on the researcher, which he cannot escape unless he changes paradigms¹⁰⁶. The consequent question to ask is this: is objectivity synonymous with neutrality? The answer is negative. And we must add that the question itself denotes that Kuhn approached the problem of objectivity with a distorted mirror: scientific objectivity must correspond to neutrality. Kuhn corroborates a rarely articulated insight: "One sees only through concepts."¹⁰⁷ Before moving on to another point, it is worth emphasising, without going into detail here, the importance of distinguishing between *objectivity* and *neutrality*, as well as other concepts such as *truth*, *certainty* or *precision* often mistakenly confused with objectivity. These nuances, although subtle, are essential if we are to avoid confusion and better understand the specific nature of each term.

The second observation is that Holton's thesis brings us back to the accuracy of Arthur Fine's analysis, which can be summarised as follows:

Realism is dead. Its death was announced by the neopositivists [...] Its death was hastened by the debates over the interpretation of quantum theory, where Bohr's nonrealist philosophy was seen to win out over Einstein's passionate realism. Its death was certified, finally, as the last two generations of physical scientists turned their backs on realism and have managed, nevertheless, to do science successfully without it.¹⁰⁸

Indeed, the EPR paradox characterised Einstein's repugnance for quantum theory, which seemed to him to be in complete dissonance with his unshakeable attachment to the thema of *reality*. Themata, as metaphysical presuppositions, determine worldviews, and Einstein's *tribulations* in quantum physics show how "changing mirrors is painful"¹⁰⁹. In this

¹⁰⁵ Malolo-Dissaké, *Grammaires de l'objectivité Scientifique. Au Coeur de l'Epistémologie de Karl Popper*, 102.

¹⁰⁶ Malolo-Dissaké, *Grammaires de l'objectivité Scientifique. Au Coeur de l'Epistémologie de Karl Popper*, 102.

¹⁰⁷ Albert Jacquart and Jacques Lacarrière, *Science et Croyances*, Coll. Espaces Libres (Paris: Albin Michel, 1999), 10.

¹⁰⁸ Arthur Fine, 'The Natural Ontological Attitude', in *Scientific Realism*, ed. Jarrett Leplin (California: University of California Press, 1984), 83.

¹⁰⁹ Jacquart and Lacarrière, *Science et Croyances*, 12.

respect, Einstein underwent what Holton calls "thematic commitment",¹¹⁰ which manifests itself in a quasi-aesthetic judgement, and which Kuhn¹¹¹ accounts for by speaking of "leaders of scientific taste" – translated as "I like" or "I don't like" this or that theory. But beyond the Einstein-Bohr controversy, scientific controversies, in general, reveal a deeper paradox that concerned Kuhn¹¹², which Holton continually highlighted in his writings¹¹³ and is well formulated by Jean-Michel Berthelot¹¹⁴:

How can a community whose fundamental concern is to establish, in its field of activity – the production of knowledge – explicit, rigorous, and incontestable rules of decision be divided on the interpretation of its results? What kind of commitment does this reveal? Various *significant anecdotes* clearly place it on the side of affectivity.

By highlighting this type of commitment, which the researcher makes simply by conforming to his sensibility, Berthelot¹¹⁵ continues, Holton renews Bachelard's views, for whom the scientific mind resorts, in the elaboration of knowledge, to a symbolic background of knowledge whose deep sources are to be found in the scientist's affectivity and imagination. But where Bachelard¹¹⁶ stigmatises the symbolic background as an "epistemological obstacle" and a source of deviation for the scientist, Holton, on the contrary, presents themata, with their affective weight, as structuring metaphysical assumptions for thought and as constants of intelligibility for scientific activity. In this vein, themata constitute, despite their attachment to the researcher's intimate, affective values, a decisive touchstone for both the elaboration of scientific knowledge and the understanding of the mechanism that governs its construction.

¹¹⁰ Holton Gerald, *Thematic Origins of Scientific Thought: Kepler to Einstein*, 15.

¹¹¹ *The Essential Tension: Selected Studies in Scientific Tradition and Change*, 337.

¹¹² See *The Essential Tension: Selected Studies in Scientific Tradition and Change*, Chap. 3: Objectivity, Value Judgment, and Theory Choice.

¹¹³ See for exemple *The Scientific Imagination*, 6–7.

¹¹⁴ *L'Intelligence Du Social* (Paris: PUF, 1990), 150 [emphasis added]; One of these anecdotes can be found in Holton, *The Scientific Imagination*, 10.

¹¹⁵ *L'Intelligence Du Social*, 150.

¹¹⁶ See his book *The Formation of the Scientific Mind: A Contribution to a Psychoanalysis of Objective Knowledge*, trans. Mary McAllester Jones, Clinamen Series on Philosophy of Science (Manchester: Clinamen Press, 2002).

In fact, the truth to which Holton leads is expressed by Jean-Marc Lévy-Leblond¹¹⁷: the scientist cannot leave his metaphysical prejudices or his eminently culturally, philosophically, aesthetically linked intellectual resources at the door of his laboratory. Just as these elements can sterilise research work, they can also fertilise it (this is what Holton reveals about themata). Just as they justify the challenges to scientific objectivity, however decisive their action may be in the choice and construction of theories (Feyerabend, Kuhn), they can also be seen as agents in the service of scientific progress, provided they make contradictory debate possible (Popper). Upon closer reflection, the two components – the demands of rigour on one side and the presuppositions that are neither empirical nor necessarily logical on the other – together make research possible and favour scientific progress. In fact, epistemological conceptions, in their divergent nature, complement and converge toward a point that Meyerson has keenly observed in his numerous studies:

nowhere does this gap frequently perceived in epistemology works between what is properly scientific and what belongs to other domains of intellectual effort appear. It is therefore that, under its various forms, reason pursues, in reality, one and the same goal, which can only be knowledge and understanding¹¹⁸.

Meyerson recommends the need not to lose sight of the particular power that attaches to thought and enables it to use everything to produce knowledge, science. And, we might add without betraying him, this recourse to "everything" by thought should not justify a rejection of the objectivity of science without a "but..." – as the French physicist and philosopher Jean-Marc Lévy-Leblond has been so good at doing in his books¹¹⁹. In other words, it is useful to account for the opposition between epistemologists but, even more, to transcend their divergences and highlight the complementary and non-contradictory character of some of

¹¹⁷ Cf. *L'esprit de Sel: Science, Culture, Politique*, 204.

¹¹⁸ In *Essais* (1936); cited by Miguel Espinoza, *Théorie de l'intelligibilité*, 2e édition (Paris: Ellipses / Édition Marketing S.A., 1998), 67.

¹¹⁹ See for exaple: *L'esprit de Sel: Science, Culture, Politique; Or Aux Contraires. L'exercice de La Pensée et La Pratique de La Science* (Paris: Éditions Gallimard, 1996).

their conceptions. It is here that one discovers that the gap that approaches maintain between each other is not so irremediable¹²⁰.

Meyerson's argument has the advantage of capitalising on and summarising the essential aspects that need to be understood to gain an insight into the opposition raised against the genre of epistemology that has taken scientific practice as its subject of study. From this point of view, it is undeniably relevant. However, if we adopt Meyerson's idea, it is because we have first taken the trouble to analyse dispassionately the differences of opinion that fuel the debate on the objectivity of science. As a result, our endorsement of Meyerson in no way places us in the position of inconsistent allegiance to the "anything goes" principle advocated by Feyerabend¹²¹. If, however, there is an allegiance, it would be because by "anything goes" Feyerabend does not mean that all theories are good, but only that all methods are good for achieving the right result¹²². Reasonably, we had no choice but to analyse the representative conceptions of those who are *for* scientific objectivity and those who are *against* it. This work has allowed us to highlight what can be abandoned or questioned for a proper appreciation of objectivity, poised between denial and confirmation in the debates on scientific knowledge.

Conclusion

All in all, by invoking, following the logical positivists and Popper, authors like Feyerabend, Lakatos, Kuhn, and to some extent, Polanyi, or even "social studies in science", we believe we have summoned the representative poles of the debate and thus completed the tour of the question at hand. This is the goal, not to present a general review of the venues for discussing objectivity – this is far from being possible within the limits of an article. In this respect, it is not absurd at the end of this journey to argue that if it is evident that the theoretical constructions surrounding the idea of scientific objectivity reveal it more as an

¹²⁰ Similar ideas are found in Gerald Holton, 'Sur Les Processus de l'invention Scientifique Devant Les Percées Révolutionnaires', in *Science et Symboles. Les Voies de La Connaissance. Colloque de Tsukuba*, ed. Michel Cazenave (Paris: Albin Michel, 1986), 61.

¹²¹ *Against Method. Outline of an Anarchistic Theory of Knowledge*, Preface and throughout.

¹²² Jarrosson, *Invitation à La Philosophie Des Sciences*, 176.

ideal than an achievement, it remains true that through intersubjectivity, science can aspire to a "form of objectivity". The designation "form of objectivity" revisits the question of our ordinary representation of objectivity and at the same time signifies that scientific *objectivity is neither synonymous with truth nor certainty nor neutrality nor precision nor accuracy*¹²³ (a point that Ehrenhaft was blind to in his controversy with Millikan). Accepting these nuances has a dual interest: it allows us to discard the distorting mirrors and offers one that provides a much truer image of science and objectivity.

In any case, objectivity approaches each of these values (truth, neutrality, certainty, etc.) that science pursues but is reducible to none of them. They are all like fragments of objective knowledge. Ultimately, "objectivity is one epistemic virtue among several, not the alpha and omega of all epistemologies."¹²⁴ Furthermore, saying that scientific theories are objective should not overlook that objectivity remains, however, the object of science's relentless quest. Consequently, the formulation closest to the truth would be to say that the goal of science – what it pursues and wants to possess – is to build universally shareable and shared knowledge, objective knowledge. It is from this perspective of "unended quest"¹²⁵ and due to the community-communicational foundation of objectivity that it justifies science as not just controversies (unless they are seen as the driving force of research), but in a certain sense, the domain where agreements between researchers eventually come to be created. "Of course, all of this is far from being entirely positive, but it is part of this conflictuality that is operational and fruitful precisely because there is acceptance of the rule of the game, that there is this fundamental consensus of all those involved in the conflict."¹²⁶ In this respect, the epistemological anarchism advocated by Feyerabend reveals its limits and can even be perceived, contrary to what he thinks, as a hindrance to the growth of science.

In light of the aforementioned conclusions and the fact that some of the debates on objectivity discussed above took place in the context of a "struggle over the reception of

¹²³ Daston and Galison, *Objectivity*, 372.

¹²⁴ Daston and Galison, *Objectivity*, 372.

¹²⁵ As you may have noticed, the expression comes from the title of Popper's book : *Unended Quest: An Intellectual Autobiography*.

¹²⁶ Edgar Morin, *Science Avec Conscience. Nouv. Édit* (Paris: Editions du Seuil, 1990), 50.

quantum mechanics",¹²⁷ and given the significance that Holton ascribes to themata in these discussions, it can be concluded that scientific objectivity not only survived the "earthquake" caused by quantum theory, but also transcended the setbacks of the themata associated with it. From this perspective, it will not be about saying what remains of scientific objectivity but rather grasping its true measure from now on. The conclusion of this study substantiates the appropriateness of the title of the article with respect to the need for a rigorous examination of scientific objectivity in relation to Holton's themata "shown to play a dominant role in the initiation and acceptance or rejection of certain key scientific insights"¹²⁸. Far from weakening science, these concepts call for a profound questioning of the very foundations of its objectivity and reinforce the need for ongoing epistemological vigilance.

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¹²⁷ Eugène Emboussi Nyano, 'Norwood Russell Hanson : L'épistémologie de La Forme', in *N. R. HANSON, Modèles de La Découverte. Une Enquête Sur Les Fondements Conceptuels de La Science, Traduction et Présentation Par Emboussi Nyano* (Chennevière-sur-Marne: Dianoïa, 2001), XII.

¹²⁸ Holton Gerald, *Thematic Origins of Scientific Thought: Kepler to Einstein*, 1.

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