

Friedrich A. Hayek, Karl R. Popper, and the Epistemic Role of Fallible Knowledge^a

Friedrich A. Hayek, Karl R. Popper, e o papel epistêmico do conhecimento falível

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Abstract: Friedrich A. Hayek's intellectual journey explores how subjective, tacit, and dispersed human knowledge is created, discovered, and shared in an open society characterized by extended division of labor and impersonal social cooperation. In the effervescent 1930s, Hayek reformulated the standard neoclassical equilibrium analysis by introducing the epistemic notion of fallible knowledge. In the 1940s and 1950s, this concept became central to his methodological concerns about the limits of scientific knowledge in the social sciences in general, and in political economy in particular. In this essay, we argue that the intellectual connection between Hayek and his close friend, the Austrian-British philosopher of science Karl R. Popper — debated and reverberated in historiographical controversy by Terence W. Hutchison and Bruce Caldwell — becomes clearer if we emphasize the fundamental epistemic idea of knowledge fallibility in both authors.

Keywords: Friedrich A. Hayek. Karl R. Popper. Fallibilism. Knowledge. Critical Rationalism.

Resumo: A trajetória intelectual de Friedrich A. Hayek explora como o conhecimento humano subjetivo, tácito e disperso é criado, descoberto e compartilhado em uma sociedade aberta caracterizada pela ampla divisão do trabalho e pela cooperação social impessoal. Nos efervescentes anos 1930, Hayek reformulou a análise de equilíbrio neoclássica padrão ao introduzir a noção epistêmica de conhecimento falível. Nas décadas de 1940 e 1950, esse conceito tornou-se central em suas preocupações metodológicas sobre os limites do conhecimento científico nas ciências sociais em geral e, em particular, na economia política. Neste ensaio, argumentamos que a conexão intelectual entre Hayek e seu amigo próximo, o filósofo da ciência austro-britânico Karl R. Popper — debatida e repercutida na controvérsia historiográfica por Terence W. Hutchison e Bruce Caldwell

Editor responsável: Ivan Colangelo Salomão

^a Submissão: 22/02/2021 | Aprovação: 20/02/2022 | DOI: 10.22456/2176-5456.111686

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— torna-se mais clara se enfatizarmos a ideia epistêmica fundamental de falibilidade do conhecimento presente em ambos os autores.

Palavras-chave: Friedrich A. Hayek. Karl R. Popper. Falibilismo. Conhecimento. Racionalismo Crítico.

JEL: B25. B31. B41.

1. Introduction

From technical economic theory to theoretical-physiological psychology and social philosophy, the intellectual contributions of the Austrian political economist and social philosopher Friedrich A. von Hayek are remarkably wide-ranging. However, despite the breadth of his interests, a single thread unites Hayek's research program—the problem of human knowledge. This central issue arises from the epistemic understanding that individual knowledge is subjective, dispersed, and tacit. Therefore, if humans are ignorant and fallible, how can we coordinate our varied actions based on personal and subjective interpretations of external reality? For Hayek (1937), the social coordination problem is a necessary logical outcome of recognizing the fallibility of human knowledge. Without this premise, there would be little reason to worry about how to coordinate human actions across different contexts and institutional structures. If all agents had perfect objective knowledge — as assumed in standard neoclassical general equilibrium theory — the social coordination problem would be irrelevant. Indeed, the problem is solved by definition, *ex hypothesi*. Assuming *ex ante* what should be explained *ex post* bypasses the real issue. Ultimately, the social coordination problem is a problem of knowledge and its inherent limitations, reflecting the philosophical view that human knowledge is fundamentally fallible and limited.

This essay is divided into two parts. First, we discuss the epistemic notion of fallible knowledge as the central element of Hayek's research program. This epistemic dimension gives life to the social coordination problem, marks the change of Hayek's interests to methodological questions in the late 1930s, and is the background for his planned *tour de force* in reconstructing the history of the rise and decline of reason and its power as an epistemic motto in the 1940s, the so-called Abuse of Reason Project. The intrinsic limitations of human knowledge are also connected to his views on theoretical psychology. In his groundbreaking book *The Sensory Order: An Inquiry into the Foundations of Theoretical Psychology* (1952), Hayek argued that the human brain is a classificatory connectionist apparatus that can only fully comprehend phenomena with a lesser degree of complexity than itself. This has significant implications for our ability to understand, explain, and predict phenomena in systems of higher complexity, which he defined as the minimum number of dependent variables needed to replicate the phenomena. This perspective is also evident in Hayek's later methodological writings from the 1950s

and 1960s, where his philosophical skepticism and pessimism about the epistemic possibilities of human knowledge, especially in the social sciences, shape his methodological thinking (e.g., see O'Driscoll, 1977; Caldwell, 1988, 1997; Kirzner, 1988; Paqué, 1990; Boettke, 1998, 2000, 2002; Vaughn, 1999a, 1999b).

The second part of this essay presents a new interpretation, based on the central epistemic notion outlined in the first part, of the intellectual relationship between Hayek and his lifelong friend, the Austrian-British philosopher of science Karl R. Popper. According to Popper ([1935] 1959), scientific theories cannot be definitively proven to be true or false. However, every theory must start with a set of basic propositions (i.e., hypotheses) that are relatively simple and atomic. From these propositions, falsifiable predictions can be deduced, which can then be tested empirically. While these fundamental hypotheses cannot be conclusively proved, verified, or confirmed through any empirical test, they undergo an ongoing and endless process of validation or survival, ultimately based on probability. There exists an epistemic asymmetry between verifiability and falsifiability due to the logical hypothetico-deductive structure of universal statements concerning the causal mechanisms of the external world. In science, we can only disprove certain propositions; we can never confirm them. As a result, Popper dedicates a significant portion of his epoch-making 1935 book *Logik der Forschung* (translated as *The Logic of Scientific Discovery*, [1935] 1959) to discussing probability, particularly a modified version of the frequency theory of probability.

Apparently, Hayek (1955, 1964b) accepts Popper's philosophy of science straightforwardly, suggesting that a theory is considered scientific if it necessarily carries the hypothetico-deductive method and is potentially falsifiable through empirical tests. In addition, Hayek endorses the Popperian claim that a greater degree of empirical falsifying content is desirable in the scientific procedure of discovery towards the growth of knowledge. However, Hayek argues that the introduction and application of the Popperian approach to essentially complex phenomena, such as the social and economic ordinary business of life, is delicate and not trivial to say the least. The complexity of a phenomenon is defined by the minimum number of explanatory variables needed to reproduce the qualitative patterns of the analyzed object. In the case of complex phenomena, the capability for empirical predictions of competing scientific theories, as well as the margins for

falsifying tests, are significantly constrained. These phenomena possess inherently less testable empirical substance.

In this context, Hayek argues that the only type of prediction feasible is pattern prediction, which is limited in its exactness and has reduced empirical content. In this sense, Hayek identifies a dilemma between the pursuit of greater empirical content that can be falsified through empirical testing and the real scientific explanatory progress achieved in theories of complex phenomena. The trade-off between aiming for explanatory power and greater falsificationist testing implies that as we advance our understanding of the causal relationships governing complex phenomena, the interactions among these elements become increasingly intricate, cumulative, and complex, thereby making them much harder to test. This interpretation casts doubt on Hayek's strict adherence to the standard Popperian falsificationist philosophy.

In *The Politics and Philosophy of Economics: Marxians, Keynesians, and Austrians* (1981, p. 212-40), the British historian of economic thought and methodologist of economics Terence W. Hutchison argues that there is a methodological U-turn in Hayek's famous November 1936 presidential address to the London Economic Club, "Economics and Knowledge" (1937). According to Hutchison, Hayek abandoned his early methodological apodictic (i.e., the Aristotelian self-evidently true propositions in contraposition to dialectical propositions and counter-propositions, *theses* and *antitheses*) and aprioristic view and moved to Popperian falsificationism. Hutchison contends that Hayek derived his view of a priori and apodictic philosophy of science from his ten-year mentor, the Austrian political economist and philosopher Ludwig E. von Mises (1949), and his teacher at the University of Vienna, the Austrian political economist Friedrich von Wieser (e.g., 1893).

This statement sparked a heated debate between Hutchison (1981, 1992a) and fellow historian of economic thought Bruce J. Caldwell during the late 1980s and early 1990s, which both authors continued to revisit in subsequent years (cf. Hutchison, 2009, p. 307-8; see also Scheall, 2015). In a series of articles, Caldwell (1988, 1992a, 1992b, 1994a, 1994b, 2001, 2006, 2009) argues that Hayek did not accept the Misesian-Wieserian apriorism and that, in the subject of social science and the philosophy of economics, Popper did not have a significant intellectual influence on Hayek's writings on these themes. In historiographical terms,

Caldwell's position is largely supported by primary archival and textual evidence from Hayek, as discussed below.

However, a more general epistemic element shared by Hayek and Popper was not emphasized in this Hutchison-Caldwell debate or in the secondary literature on these authors. Through correspondence, primary texts, and the secondary literature, we advance and support the hypothesis of a philosophical meta-connection between Hayek and Popper. We utilize Caldwell's (1991) insight, which resolved the apparent contradiction referred to by D. Wade Hands (1985, 1992) between the recommendations of Popper N (from natural sciences, falsificationist) and Popper S (from social sciences, situational analyst) within the critical rationalism framework. The falsificationist, natural science philosopher—Popper N—is the absolute expression of his 1935 *magnum opus*, *Logik der Forschung* (1935), and is reaffirmed, developed, and summarized in his book *Conjectures and Refutations* (1965). Popper N primarily addresses the problems of the growth of knowledge related to induction and the criteria for demarcating (natural) science from metaphysics, developing implications for his falsificationist methodology based on bold hypotheses (conjectures) and rigorous testing (refutations).

On the other hand, Popper (1967, 1976a) actually wrote about the methodology of social sciences, particularly economic theory, stressing the importance of situational logic in individual action and social understanding. These writings have direct philosophical implications that contradict Popper N's recommendations, i.e., that we should always aim for conjectures and refutations in the strictly falsificationist dynamics. However, according to Caldwell (1991), these two apparently contradictory methodologies professed by the same author — i.e., Popper N and Popper S — can be reconciled in a common denominator within the rationale of a non-justificational philosophy of criticism based on critical rationalism and its optimal procedure of dealing with intrinsic fallible knowledge possessed by humans.

In this essay, we aim to better understand the methodological connection between Hayek and Popper, which was the point of historiographical controversy between Hutchison and Caldwell. To this purpose, we trace a fallibilist epistemic motto in Hayek since the 1930s and use Caldwell's (1991) resolution of the tensions within Popper's philosophy, particularly regarding what Hands (1985) referred to as Popper N and Popper S. We argue that the methodological positions of Hayek and

Popper can be best understood and clarified if we emphasize the fallibility of knowledge as the general philosophical shared element, carefully documented below in Hayek's case and argued by Caldwell and many others scholars in Popper's case—such as Lawrence Boland's (1994) Socratic Popper. Apart from this introduction and concluding remarks, the essay is structured into four sections. In the second section, we discuss Hayek's epistemic view in "Economics and Knowledge" (1937). The third and fourth sections focus on Hayek's methodological development, particularly concerning the Abuse of Reason Project and his theory of complex phenomena. Finally, in the fifth section, we outline the epistemic connection between Hayek's research program, based on the knowledge problem, and Popper's philosophy of critical rationalism.

2. Hayek's Epistemic Fallibilism

In his November 1936 presidential address to the London Economic Club entitled "Economics and Knowledge" ([1937] 1948), published in the February 1937 issue of *Economica*, Hayek marked a turning point in his research program by establishing his epistemic fallibilism to the social coordination problem. As Hayek (1983, p. 425-6) recalls in an interview,

Yes, it was really the beginning of my looking at things in a new light. If you asked me, I would say that up till that moment I was developing conventional ideas. With the '37 lecture to the Economic Club in London, my presidential address, which is "Economics and Knowledge," I started my own way of thinking. Sometimes in private I say I have made one discovery and two inventions in the social sciences: the discovery is the approach of the utilization of dispersed knowledge, which is the short formula which I use for it; and the two inventions I have made are denationalization of money and my system of democracy. It was [sic] several ideas converging on that subject. It was, as we just discussed, my essays on socialism, the use in my trade-cycle theory of the prices as guides to production, the current discussion of anticipation, particularly in the discussion with the Swedes on that subject, to some extent perhaps [Frank H.] Knight's *Risk, Uncertainty and Profit* [1921], which contains certain suggestions in that direction—all that came together. And it was with a feeling of a sudden illumination, sudden enlightenment, that I wrote that lecture in a certain excitement. I was aware that I was putting down

things which were fairly well known in a new form, and perhaps it was the most exciting moment in my career when I saw it in print.

In another place, Hayek ([1994] 2008, p. 79) recollects that,

It was still more or less an accident when in 1935, in editing various essays on socialist planning, I contributed myself two fairly long essays to it. But I got increasingly interested in the philosophical and methodological questions which, I came to be more and more convinced, were ultimately responsible for some of the current political differences. The decisive step in this development of my thinking was the paper on “Economics and Knowledge,” which I read in 1936 as the presidential address to the London Economic Club. Together with some later related papers reprinted with it in *Individualism and Economic Order* [1948], this seems to me in retrospect the most original contribution I have made to the theory of economics.

In this pivotal essay, Hayek ([1937] 1945, p. 33) formulates the fundamental philosophical problem to be developed not only by economics but by all the social sciences — the problem of knowledge. His goal is to investigate “the role which assumptions and propositions about the knowledge possessed by the different members of society play in economic analysis.” This refers naturally to the extent to which the standard neoclassical equilibrium theoretical apparatus can supply us with any causal structure about what happens in the real world. Hayek asserts that mere tautologies, that is, logical transformations of the pure logic of choice that neoclassical equilibrium analysis consists of, can be modified into a theory capable of making causal empirical statements about the external world. The condition for this status modification relates to filling the formal tautological propositions with an *epistemic learning mechanism* of how knowledge can be created, discovered, acquired, communicated, and maintained. In this context, Hayek ([1937] 1948, p. 33, f.n. 1) mentions in a footnote on the first page of his article Popper’s then-recent book *Logik der Forschung* (1935) for the first time, arguing that the conclusions of this causal-genetic approach — as the Austrian economist Hans Mayer (1932) called — are in principle capable of verification “[o]r rather falsification” by empirical testing.

Hayek states that some attempts to go beyond formal equilibrium analysis have run into the problem of predicting reality conditions over time, that is, of intertemporal expectational coordination. There is, in this sense, an intimate connection with intertemporal equilibrium issues that Hayek worked on as a business cycle theorist (e.g., see Hayek, 1928, 1931a, 1931b, 1933, 1935). In this context, Hayek ([1937] 1948, p. 35) connects the knowledge problem, predictions, and the concept of equilibrium with dynamic questions related to business cycle theory, which was his main interest. “The situation here seems to be that before we can explain why people commit mistakes, we must first explain why they should ever be right.” This is exactly what he did in his work on industrial fluctuations and business cycle theory in the late 1920s and 1930s (for instance, see Telles, 2022, 2023).

In his work on business cycle theory, Hayek described the emergent coordination properties of a decentralized market economy, which is supported by a heterogeneous capital structure within a specific institutional framework, namely, the market price system. He explained that disruptions caused by information failures, exacerbated by monetary policy disturbances, are responsible for the business cycles observed in a modern fractional reserve banking system, leading to waves of booms and busts. The concept of dynamic intertemporal equilibrium can only be clearly defined by considering assumptions and hypotheses related to individuals' expectations and foresight. However, applying the tautological system of pure logic of choice to a societal equilibrium involving multiple interdependent individuals presents serious challenges. There is a logical leap from understanding equilibrium as that of an isolated individual to envisioning a scenario with various individuals who possess subjective, dispersed, and tacit knowledge. Social equilibrium cannot simply be derived from the simple horizontal sum of the many individuals' equilibria.

As Hayek ([1937] 1948, p. 35) writes,

I have long felt that the concept of equilibrium itself and the methods which we employ in pure analysis, have a clear meaning only when confined to the analysis of the action of a single person, and that we are really passing into a different sphere and silently introducing a new element of altogether different character when we apply it to the explanation of the interactions of a number of different individuals.

Before we discuss the inadequate application of the individual equilibrium tautological concept in analyzing social equilibrium, it is important to clarify the meaning of equilibrium in this first context. Propositions about equilibrium refer to the relationship between means and ends. An individual is considered to be in equilibrium when their actions (means) are consistent with one another and align with a common plan aimed at achieving a specific goal (i.e., an end, the *desideratum*). Individual knowledge is defined by each person's subjective perception of reality and the facts presented to them. As Hayek ([1937] 1948, p. 36) writes, the knowledge possessed by an individual is "all facts given to the person in question, the things as they are known to (or believed by) him to exist, and not in any sense objective facts. It is only because of this that the propositions we deduce are necessarily *a priori* valid, and that we preserve the consistency of the argument."

In this context, objective knowledge of the external world is not accessible to individual agents. Instead, individuals only have access to subjective knowledge, shaped by their unique mental perceptions and beliefs. This subjective knowledge is what is considered when defining the means and ends of their actions. Consequently, an individual's action plan may turn out to be incorrect. However, it is the subjective beliefs that enable the possibility of an *a priori* individual equilibrium. If the subjective data of the individual—thus his/her action plan—proves itself to be wrong, the individual's equilibrium will be disrupted. Therefore, Hayek ([1937] 1945, p. 36-7) concludes that "the equilibrium relationship comprises only his actions during the period which his anticipations prove correct." Since an equilibrium is a relationship between actions and it is a construction that takes place over time, "it is obvious that the passage of time is essential to give the concept of equilibrium any meaning."

In summary, individual equilibrium is defined by the consistency between the actions of a coherent individual plan molded by subjective individual knowledge. In the case of more than one individual, however, different individual agents will have different plans. With a plethora of individuals, there will be varying, competing, and conflicting subjective expectations about external reality, which will inform different action plans. As a result, these different action plans will, to some extent, conflict with each other. An individual action plan will necessarily need to coordinate itself with the plans of other individuals and the external world. For all aggregate action plans to be accomplished, they must first be compatible with one another. In social

equilibrium, Hayek ([1937] 1945, p. 38) argues that the subjective expectation of an agent is regarded as an external and objective fact by another agent, “since some of the ‘data’ on which anyone person will base his plans will be the expectation that other people will act in a particular way, it is essential for the compatibility of the different plans that the plans of the one contain exactly those actions which form the data for the plans of the other.”

The social coordination problem derived from incomplete knowledge is supplanted by the standard neoclassical equilibrium theory, which assumes *ex ante* by hypothesis that all facts are objectively and equally given to all individual agents, in the same manner that this data is supposed to be given to the observing political economist. This passage constitutes the *non-sequitur* by which the transition of an individual's tautological equilibrium (where the knowledge is purely subjective and the actions subjectively consistent) occurs for societal equilibrium (where the subjective expectations of a given individual introduce an additional element). As Hayek ([1937] 1948, p. 38-9) sustains:

There seems to be no possible doubt that these two concepts of ‘data’, on the one hand in the sense of the objective real facts, as the observing economist is supposed to know them, and on the other in the subjective sense, as things known to the persons whose behaviour we try to explain, are really fundamentally different and ought to be kept carefully apart. And, as we shall see, the question why the data in the subjective sense of the term should ever come to correspond to the objective data is one of the main problems we have to answer.

With the compatibility of aggregate intra-plans, the external world can either harmonize with this set of plans or not. In the first scenario, the action plans can be successfully implemented, resulting in social equilibrium. In the second scenario, action plans that are consistent with one another may not align with the external world and will need to be revised. If there is no prior intra-coordination of action plans, no possible set of external data can be compatible with all plans, meaning there is no equilibrium at any given moment. In this sense, we can rescue the foresight question raised earlier. Social equilibrium means that different individuals have predictions “in a special sense” that are correct. This means that equilibrium, in this context, refers to accurate predictions of the actions of other agents and the external objective reality. As Hayek ([1937] 1948, p. 42) writes, “[c]orrect foresight

is then not, as it has sometimes been understood, a precondition which must exist so that equilibrium may be arrived at. It is rather the defining characteristic of a state of equilibrium.”

According to Hayek, while the concept of equilibrium is grounded in strong premises, its legitimacy arises from the implicit assumption by political economists of a tendency toward this equilibrium state of affairs. Nevertheless, this is essentially an empirical matter. In Hayek’s view ([1937] 1945, p. 45, emphasis in the original), therefore, this is “an assertion about what happens in the real world which ought, at least in principle, to be capable of verification. [...] The only trouble is that we are still pretty much in the dark about 1) the *conditions* under which this tendency is supposed to exist, and 2) the nature of the *process* by which individual knowledge is changed.”

Indeed, all such profound complications in theorizing social coordination processes by different institutional arrangements are left aside when perfect and objective knowledge is previously assumed, as in the standard neoclassical general equilibrium theory. Perfect knowledge effectively nullifies the real philosophical problem to be explained by economic science because it essentially assumes its own resolution. To assume perfect knowledge, in Hayek’s view, is to assume as given the *conditions* and *process* by which it should be explained how useful knowledge is discovered, acquired, and communicated. It is to fall into a fallacy of *petitio principii*. Any explanation of a supposed tendency (or lack thereof) toward equilibrium must begin with an understanding of the learning process of ignorant individual agents. In this context, the hypotheses introduced to explain causal learning processes have their nexus regarding the connection between subjective and external worlds. These additional supplementary hypotheses are naturally selective and less general, marking a departure from the pure rationalistic thinking of the pure logic of choice in individual equilibrium. The simple exercise of reason is insufficient to provide us with a dynamic causal-genetic learning mechanism. Hayek ([1937] 1948, p. 50) argues that the *a priori* approach is invalid in the sphere of subsidiary hypotheses for particular, contingent, and mutable conditions in time and across space.

Each individual’s subjective knowledge is dispersed; for instance, agent A does not have access to the local, tacit, and conjectural knowledge that agent B possesses. Different individuals hold varied subjective perceptions and types of knowledge. Hayek ([1937] 1948, p. 50) refers to the notion of “relevant knowledge”

for each particular person in a specific situation. Given that knowledge is dispersed and differently demanded in each particular situation of time and place, the problem of the division of knowledge arises, analogous to the Smithian division of labor. However, Hayek notes that “while the latter has been one of the main subjects of investigation ever since the beginning of our science, the former has been as completely neglected, although it seems to me to be the really central problem of economics as a social science.”

According to Hayek ([1937] 1948, p. 50-2),

The problem which we pretend to solve is how the spontaneous interaction of a number of people, each possessing only bits of knowledge, brings about a state of affairs in which prices correspond to costs, etc., and which could be brought about by deliberate direction only by somebody who possessed the combined knowledge of all those individuals. And experience shows us that something of this sort does happen, since the empirical observation that prices do tend to correspond to costs was the beginning of our science. But in our analysis, instead of showing what bits of information the different persons must possess in order to bring about that result, we fall in effect back on the assumption that everybody knows everything and so evade any real solution of the problem. [...] that is, the general question of why the subjective data of different persons correspond to the objective facts. Our problem of knowledge here is just the existence of this correspondence which in much of current equilibrium analysis is simply assumed to exist.

The process through which uninformed agents learn to coordinate their plans, as well as the impact of this learning on tendencies toward equilibrium, is subject to empirical investigation. However, Hayek ([1937] 1948, p. 55) emphasizes that this does not imply that an empirical research program could help to clarify the *theoretical* causal relations related to tendencies toward equilibrium. The scope of empiricism is quite circumscribed, with a low probability of teaching us something really new in theoretical terms. What is crucial is “at what point our argument, when it is applied to phenomena of the real world, becomes subject to verification.” Therefore, by rejecting the empiricist-inductivist program and recognizing the limitations of the pure logic of choice, Hayek moves beyond the dichotomy of empiricism and rationalism — i.e., the discovery and absorption of knowledge

through sensible experience versus through reason. Both methods are fallible and incomplete — this is what Rogerio P. Andrade (2004, p. 140) referred to as “incurable ignorance.”

The statement of the problem of coordinating human subjective, dispersed, and tacit knowledge emerges in Hayek’s research program within the domain of the illegitimate neoclassical transposition of the pure logic of choice into the logic of societal equilibrium. This introduces two previously non-existent elements for equilibrium. The knowledge of subjective expectations of the action plans of each agent and the need for coordination of all individuals’ actions with the objective external world, thus verifying their feasibility. The tendency toward equilibrium can only be meaningfully understood when considering the contextual institutional mechanisms of acquiring, transmitting, and storing knowledge within which exchange processes and social interactions occur. The institutional environment can lead to the compatibility of the intra-aggregate plans (subjective expectations of each individual) and real-world checking coordination (coordinated plans’ adjustment to the external reality). In assuming perfect knowledge, neoclassical economics hides the true epistemic problem of economic science.

Nevertheless, despite his criticism of the standard neoclassical economic theory as a whole, Hayek ([1937] 1948, p. 54) sees the discipline of political economy as the branch of knowledge that has made the greatest progress on the fundamental problem of all the social sciences. In his view, “economics has come nearer than any other social science to an answer to that central question of all social sciences, how the combination of fragments of knowledge existing in different minds can bring about results which, if they were to be brought about deliberately, would require a knowledge on the part of the directing mind which no single person can possess.” In Hayek’s opinion, the failure of the profession is methodological. The underestimation of the unavoidable imperfection of human knowledge is a particular methodological notion that was derived from a more general epistemic philosophical tradition regarding the power of reason and knowledge in society, to which we now turn.

3. Reason, Scientism, and Methodology of Complex Phenomena

In order to investigate the causes that had led the profession to engage in serious theoretical misunderstandings, During the controversial debates about the

feasibility of rational economic planning under socialism in the 1930s and 1940s, particularly as the editor of *Collectivist Economic Planning: Critical Studies on the Possibilities of Socialism* (1935), Hayek gradually recognized that the fundamental difference between his position and his critics essentially stemmed from methodological differences (e.g., see further Hayek, 1983, p. 150-1, 273-5, 383, 423, 425-6; [1994] 2008, p. 79-80, 147-8). As Hayek ([1994] 2008, p. 79-80) recalls, in the early 1930s, he perceived

[t]hat certain new insights which were known on the Continent had not reached the English-speaking world yet. It was largely Mises and his school, but also certain discussions by [the Italian economist Enrico] Barone and others, which were then completely unknown to the English-speaking world. Being forced to explain this development on the Continent in the introduction and the conclusion to this volume, which contains translations, I was curiously enough driven not only into political philosophy but into an analysis of the methodological misconceptions of economics. [...] My way from there was largely around methodological considerations... I think the decisive event was that essay I did in about 1937 on 'Economics and Knowledge.'

You know, the planning book had a curious effect on my thinking, because it was the thinking on the planning problem which drew my interest to the methodological problems, to the real problem of the philosophical approach to the social sciences. It was quite unexpected. I first intended to publish merely a collection of translations of the things which had remained unknown in English literature, when I was told that I had to write an explanation of the environment in which the discussion had taken place (Hayek, 1983, p. 423).

Indeed, in his famous 1945 article on "The Use of Knowledge in Society" ([1945] 1948, p. 89), Hayek asserts that the widespread failure among the economics profession to perceive and recognize the fundamental knowledge problem is "clearly due to purely intellectual, and more particularly methodological, differences." He illustrates this point with the example of a theorist of the stature of the Austrian economist and social philosopher Joseph A. Schumpeter, who also fell into the ambiguity trap of the term "datum." This case reveals not just a simple particular misinterpretation or theoretical mistake, but suggests a profound

methodological disruption within the mainstream neoclassical equilibrium theory approach. Therefore, Hayek ([1945] 1948, p. 91) argues that “there is something fundamentally wrong with an approach which habitually disregards an essential part of the phenomena with which we have to deal: the unavoidable imperfection of man’s knowledge and the consequent need for a process by which knowledge is constantly communicated and acquired.”

In this context, in the late 1930s and early 1940s, Hayek embarked on a major historical-methodological project to explore the causes that had led the profession to engage in serious theoretical misunderstandings in the controversy on the possibility of rational economic calculation in socialism. This endeavor, known as the Abuse of Reason Project, marked a definitive departure for Hayek from technical economics (e.g., see Telles; Angeli, 2021). Unfortunately, he was never able to fully execute his grand original conception of this project, which aimed to reconstruct the history of ideas and methodology since the eighteenth century.

However, he did outline its initial structure, which was to be divided into four parts. The first part was outlined to be (i) a study of the eighteenth-century individualist theories. Hayek’s preliminary results on this theme were delivered as the twelfth Finlay Lecture at the University College, Dublin, in December 1945 and published as “Individualism: True and False” (1946) (e.g., see Nolan, 2013). The second part aimed to investigate (ii) the intellectual sources of the hostility toward the philosophy of individualism. The third part was structured to examine (iii) how this hostility, rooted in the rise of reason, historically developed in countries such as France, Germany, and the United States. Parts (ii) and (iii) resulted in the publication of “The Counter-Revolution of Science” (1941), “Scientism and the Study of Society” (1942-44), and “Comte and Hegel” (1951). Finally, the fourth part was envisioned as a (iv) discussion of the abuse and decline of reason under authoritarian and centrally planned regimes in the twentieth century, from which Hayek’s most well-known and arguably controversial book, *The Road to Serfdom* (1944), originated (Hayek, [1952] 1979, p. 10-1; see also Caldwell, 2004a, p. 240-1). This book was Hayek’s Second World War grand effort and was originally published in March 1944.

In the first part of the project regarding different individualist theories, Hayek ([1946] 1948, p. 8-9) distinguishes historically between two strands of individualism that are often viewed as a single philosophical tradition: false

individualism, which derives from Cartesian rationalism and the French Enlightenment, and true individualism, which derives from the Scottish Enlightenment. The key distinction lies in the role of reason. True individualism is characterized by its humility, as it acknowledges that society is the product of human action rather than a design conceived entirely by humans. Thus, civilization is the result of human action but not from human design *in toto*. As Hayek writes in *The Constitution of Liberty* (1960, p. 60), “civilization was the accumulated hard-earned result of trial and error; [...] it was the sum of experience, in part handed from generation to generation as explicit knowledge, but to a larger extent embodied in tools and institutions which had proved themselves superior—institutions which we might discover by analysis but which will also serve men’s ends without men’s understanding them.” Hayek ([1941] 1952, [1951] 1952) also outlines the emergence of the intellectual *hubris* from the use and abuse of “Reason” with a capital “R.” He identifies thinkers such as the French political and economic theorist, Henri de Saint-Simon, the French philosopher and founder of the doctrine of positivism August Comte, and the German idealist philosopher Georg W. Friedrich Hegel as having significantly influenced this tradition.

As Hayek ([1946] 1948, p. 8-9) writes, the difference between the two types of individualism is as follows.

It is between a view which in general rates rather low the place which reason plays in human affairs, which contends that man has achieved what he has in spite of the fact that he is only partly guided by reason, and that his individual reason is very limited and imperfect, and a view which assumes that Reason, with a capital R, is always fully and equally available to all humans and that everything which man achieves is the direct result of, and therefore subject to, the control of individual reason. One might even say that the former is a product of an acute consciousness of the limitations of the individual mind which induces an attitude of humility toward the impersonal and anonymous social processes by which individuals help to create things greater than they know, while the latter is the product of an exaggerated belief in the powers of individual reason and of a consequent contempt for anything which has not been consciously designed by it or is not fully intelligible to it.

Indeed, in Hayek's view (1946, p. 8-9), true individualism in the Scottish Enlightenment philosophical tradition arises from a method "which regards man not as a highly rational and intelligent but as a very irrational and fallible being, whose individual errors are corrected only in the course of the social process, and which aims at making the best of a very imperfect material." One of the most damaging consequences of the rise of Reason is its significant influence on the philosophy of science. Hayek ([1942-4] 1952, p. 26) argues that, in reaction to medieval scholastic thinking, idealism and anthropomorphism, the developing of "modern Science has been to get down to 'objective' facts, to cease studying what men thought about nature or regarding the given concepts the true images of the real world, and, above all, to discard all theories which pretended to explain phenomena by imputing to them the directing mind like our own." The major contamination of scientific precepts by the rise of Reason is embodied in what Hayek ([1942-4] 1952, p. 24) called scientism. Scientism is the transposition of methods from the natural sciences into areas of knowledge where such methods were not originally generated. It is the simple and lavish copy of the scientific method of the natural sciences, in particular, Newtonian mechanical physics.

In Hayek's ([1942-4] 1952, p. 24) view, it is "an attitude which is decidedly unscientific in the true sense of the word, since it involves a mechanical and uncritical application of habits of thought to fields different from those in which they have been formed. The scientistic as distinguished from the scientific view is not an unprejudiced but a very prejudiced approach which, before it has considered its subject, claims to know what is the most appropriate way of investigating it." Scientism is the stance of the Reason of "men of science." Scientism manifests in three main strands: physicalism, collectivism, and historicism. Moreover, the tyranny of the slavish imitation of the method and language of Science was advocated by natural scientists who followed the Popperian falsificationist scientific method *de jure* but not necessarily *de facto*, as Hayek (1967, p. vii) reminds us of Popper's remarks in *The Poverty of Historicism* (1957). Interestingly, the difference between what the men of science *de jure* recommend and what they *de facto* do is not in the original text of the first part of "Scientism and the Study of Society" (1942), but was added in the 1952 book collection edition of *The Counter-Revolution of Science* (1952) due to Karl Popper's critique in *The Poverty of Historicism* (1957) (see also Hayek, 2010, p. 36-7).

Hayek ([1942-4] 1952, p. 49-50) asserts that subjective, dispersed, and tacit human knowledge is inseparable from the very facts and methods of social phenomena, since “the concrete knowledge which guides the action of any group of people never exists as a consistent and coherent body. It only exists in the dispersed, incomplete, and inconsistent form in which it appears in many individual minds, and the dispersion and imperfection of all knowledge are two of the basic facts from which the social sciences have to start. What philosophers and logicians often contemptuously dismiss as a ‘mere’ imperfection of the human mind becomes in the social sciences a basic fact of crucial importance.”

In denouncing scientism, Hayek ([1942-4] 1952, p. 86) raises the central idea of his methodological position, which will result in the formulation of explanations of principle and pattern predictions. He argues that because of the internalization of structures with greater complexity than our own cognitive classification systems, it becomes logically impossible to provide detailed explanations or specific predictions regarding certain phenomena. A classificatory system can only classify and make sense of phenomena that have a lower degree of complexity, meaning that human knowledge, by its very nature, cannot fully explain the intricate structures, patterns, and orders that exceed our own cognitive capabilities. Thus, Hayek advances an ontological pessimistic view on the nature of human knowledge (for a further discussion on Hayek's ontological turn, see Lewis, 2014, p. 196). According to Hayek ([1942-44] 1952, p. 73-4),

The inevitable imperfection of the human mind becomes here not only a basic datum about the object of explanation but, since it applies no less to the observer, also a limitation on what he can hope to accomplish in his attempt to explain the observed facts. The number of separate variables which in any particular social phenomenon will determine the result of a given change will as a rule be far too large for any human mind to master and manipulate them effectively. In consequence, our knowledge of the principle by which these phenomena are produced will rarely if ever enable us to predict the precise result of any concrete situation.

Hayek emphasizes that human knowledge is constrained by the complexity of phenomena that our neural classification systems can comprehend. Drawing from his psychological neural connectionist theory, he underscores his pessimistic and restrained ontological and epistemic viewpoint that our understanding of the

world is significantly more limited than what scientism and the man of science assume. The unrealistic expectations that scientists have for “scientific” knowledge can lead to misguided and pretentious assertions about what scientific understanding can reveal and the extent to which experts’ policy recommendations are valid.

4. Theory and Method in Complex Phenomena: Explanations of Principle and Pattern Predictions

In the 1950s, Hayek consolidated his philosophy of science through the publication of “Degrees of Explanation” ([1955] 1967) and “The Theory of Complex Phenomena” ([1964] 1967). In these works, Hayek accepted the Popperian hypothetico-deductive method and falsificationism as a *prima facie* valid framework. However, he severely restricted the capacity for explanation, prediction, and control in theories related to complex phenomena. His reflections on these topics, as seen above, were initially developed in the late 1930s and 1940s, largely in response to debates regarding the feasibility of rational economic calculation in a society with a socialist property rights structure of the means of production. This reaction was encapsulated in his ambitious Abuse of Reason Project.

In his article “Degrees of Explanation” ([1955] 1967), Hayek generally endorsed the hypothetico-deductive method and the Popperian system of falsificationism, asserting that science is fundamentally deductive. He argued that there is no way to circumvent the Humean problem of induction and justify the inductive logical leap by assuming the future will resemble the past. In the early eighteenth century, in Book 1, Part III, section 6 of *A Treatise of Human Nature* (1739), the Scottish philosopher David Hume demonstrated that there is no rational basis for assuming causality in unobserved things based on previous observations. This is the “problem of induction” that leads to essentially circular reasoning. Therefore, scientific laws are an exclusive product of the human mind and creative processes, and their conclusions are inherently prohibitive in nature. Scientific theories yield predictions that rule out the occurrence of certain events but can never be definitively verified or confirmed; they can only be corroborated or not yet falsified through experience. Consequently, scientific reasoning involves formulating hypotheses, deductively assessing empirically testable consequences, and attempting to falsify those conclusions. In this context, Hayek ([1955] 1967, p. 4, f.n. 2) carefully

states that what follows in his notes is “little more than an elaboration of some of Popper’s ideas, particularly of his conception of degrees of testability and his ‘relativisation’ of his falsifiability criterion.” Thus, his criticisms are “directed solely against certain positivist and operationalist interpretations of the ‘hypothetico-deductive’ thesis but not against Popper’s or similar variants.”

According to Hayek ([1955] 1967), the historical evolution of the scientific method has been heavily influenced by the remarkable success of the physical sciences, leading to what he termed scientism—an uncritical imitation and emulation of these methods by the social sciences. However, he argued that scientism fails to recognize the specific and non-universal characteristics of natural and, in particular, physical sciences. A distinctive feature of physical sciences, as illustrated by classical Newtonian mechanics, is the relatively small number of significant variables necessary to describe a phenomenon. For example, such sciences can effectively explain the effects of forces on the motion of macroscopic objects (matter), like planets, stars, and galaxies. Essentially, this is the field of celestial mechanics. This creates a *quasi*-closed system of causal relationships. No real system can be fully closed, but the low number of dependent variables gives an extraordinary control and observational power over all the determinants of the object of study. In contrast, social sciences are inherently more complex due to the multitude of variables and interrelationships involved. Attempts to use the methods of natural sciences in these areas often overlook the complex nature of their subjects, thereby denying the essence of their scientific inquiry.

In Hayek’s view, these specific aspects of physical sciences are an ontological condition of these particular phenomena. Indeed, even the classical mechanics perspective, which treats these sciences as closed systems studying statics, kinematics, and dynamics, does not fully consider the relativistic and quantum effects that revolutionized modern physics in the twentieth century. However, despite this limitation, these concepts conquered the hearts and minds of social scientists, social engineers, and philosophers of science. This influence led to significant epistemic shifts regarding the application of natural science methods to social and complex sciences. Moreover, the specific characteristics of physics as a natural science also impact the nature of its predictions. Predictions involve using general laws to derive specific assertions about whether something will or will not happen. This idea is encapsulated in the “if-then” structure, which is linked to the

conditions necessary for the realization of the hypothesis in a particular time and place. In classical Newtonian mechanical physics, for instance, the “if-then” relationship is generally satisfied without much difficulty, as the number of dependent variables involved is small and relatively easy to measure and control. However, this ease is not the case outside of natural sciences.

In complex phenomena, where multiple variables are interdependent and influenced by what is taken as exogenous factors, we cannot observe or control a *quasi*-closed system. Instead, we often rely on the *ceteris paribus* clause – e.g., as used in economic theory – to eliminate potential interferences *a priori*. In practice, this *ceteris paribus* clause rarely holds true in the empirical world. Thus, it is very difficult to systematically test specific results derived from general laws by empirical observations in these phenomena. The difficulty in making specific predictions does not hinder our ability to understand complex phenomena, which can still be explained to some degree and predicted.

When we make predictions, the empirical features of the real world may display some, but not all, of the multidimensional properties we wish to examine. Each property may be observable to varying degrees in relation to its theoretical model. In complex phenomena, the actual adherence of a scientific property’s ideal theoretical model might not be precisely measurable and often exists within intervals of noise or error, similar to challenges found in modern quantum physics. In complex scenarios, we cannot discern, merely through empirical observation, the diverse causal-genetic arrangements linking initial conditions to the observable realities studied by scientists. The observable outcomes manifest in various ways, complicating attempts to reconstruct them into a simple “if-then” structure typical of a *quasi*-closed system. Instead, we translate complex phenomena into simpler, more manageable terms of causal relationships that aim to internalize the key ideal properties of the complex in a comprehensible manner. While we may never be entirely certain which of these properties contribute to the observable complexity, empirical feedback can help us decide which conditional relationships are more or less suitable in specific cases. Therefore, the conditional structures we consider appropriate for explaining complex phenomena should not be judged solely by their predictive power since we cannot control all the variables at play. Nonetheless, these structures typically imply testable empirical consequences in some manner.

For Hayek ([1955] 1967, p. 11),

The mechanism which we believe to have produced the observed phenomena will be capable of producing some further results, but not others. This means that if what we have observed of a given complex of events is due to the assumed mechanism, that complex will also possess certain other characteristics and not be capable of definite other kinds of behaviour. Our tentative explanation will thus tell us what kinds of events to expect and which not, and it can be proved false if the phenomena observed show characteristics which the postulated mechanism could not produce. It will thus give us new information by indicating the range of phenomena to expect.

This procedure differs from the supposed pure method applied to natural sciences, where we test different newly invented hypotheses. Instead, we select aspects we already know and deem relevant, attempting to infer their causal applicability. The answer depends on how the observed complex system behaves according to our deductive framework when the properties we consider to be causes of the phenomenon are present. The classic example of such an explanation of principle, as Hayek ([1955] 1967) pointed out, is the Darwinian theory of natural selection. The Darwinian theory of biological evolution states that biological species evolve through marginal and incremental inherited genetic variations in genotypic and phenotypic traits transmitted from parents to offspring. These individual variations and their ontogenetic development are subject to selection through the struggle for existence among organisms, both between and within species, in the competition for scarce resources. Therefore, traits are selected because they increase the individual's ability to compete, survive, and reproduce — thereby transmitting the selected genes through future offspring.

Indeed, regarding the field of evolutionary biology, Popper (1976, p. 168) considers the Darwinian evolutionary theory to be an application of what he called the analysis of situational logic. Moreover, he goes further, saying that it is possible to “explain the strange similarity between my theory of the growth of knowledge and Darwinism: both would be cases of situational logic” (Popper, 1976, p. 169). Darwinian evolution does not predict which types of organisms will be favored in a specific space-time context, nor is it based on new hypotheses tested through empirical observation. Nonetheless, it delineates the dimensions of action, permissiveness, and prohibitions regarding empirical stylized facts. The theory

cannot be tested at every logical step of its fundamental and subsidiary hypotheses. Its purpose involves applying theoretical deductions from general premises to particular factual cases. This approach explains and predicts general classes of phenomena united by shared characteristics while prohibiting certain qualitative transformations. The theory is evaluated based on the degree of imperfect corroboration.

The explanation that Hayek focuses on is exemplified by constructing models — logical structures that represent only parts of the main properties of the phenomena in question. In complex sciences, these models will inevitably include variables that cannot be directly observed or quantified, such as those in the functional forms of simultaneous equations. Hayek ([1955] 1967, p. 14-15) emphasizes the value of these models, stating that, “although they do not enable us to predict that such and such a specific event will occur at a particular time and place,” if the causal mechanisms within the model are accurate, it can make certain predictions or prohibit behaviors regarding the observable structures it describes. The observable structure will allow certain types of actions while prohibiting others. If the expectations generated by the model remain consistent and non-contradictory over time, “there is good reason to regard the model as exhibiting the principle at work in the more complex phenomenon.”

As we incorporate into the model our knowledge of the explanatory factors contributing to the intricate phenomenon, while remaining unaware of other variables, our conclusions and predictions will pertain only to some general properties of that pattern. This presents a dual challenge regarding the observation and measurement of the complex phenomenon. As Hayek noted, scientism is precisely the submission of social sciences to the simple natural sciences’ scientific method. As Lord Kelvin famously stated, science is measuring and measurement is to know. Thus, according to the positivistic dictum, if we cannot measure it, then it is not considered science. Suppose we accept the positivist claim that science consists of measurement and control. In that case, it follows that complex social theory must focus not on its intricate and complex interrelations—which are unobservable and unmeasurable — but rather on what can be quantified and tested. According to Hayek ([1974] 1978, p. 24),

Unlike the position that exists in the physical sciences, in economics and other disciplines that deal with essentially complex phenomena, the aspects of the events to be accounted for about

which we can get quantitative data are necessarily limited and may not include the important ones. While in the physical sciences it is generally assumed, probably with good reason, that any important factor which determines the observed events will itself be directly observable and measurable, in the study of such complex phenomena as the market, which depend on the actions of many individuals, all the circumstances which will determine the outcome of a process [...] will hardly ever be fully known or measurable. And while in the physical sciences the investigator will be able to measure what, on the basis of a *prima facie* theory, he thinks important, in the social sciences often that is treated as important which happens to be accessible to measurement. This is sometimes carried to the point where it is demanded that our theories must be formulated in such terms that they refer only to measurable magnitudes.

In Hayek's view, highly complex propositions and theories lead to a broader permissiveness and flexibility in the predictions allowed by the proposed theory. However, it may be true that the theories that have greater practical value tend to be more generic and less falsifiable. When only complex general patterns are observable, the desire to make a theory more "scientific" can be misleading. The inherent limitations in prediction significantly diminish the power of human reason to control its environment. In an uncertain and provisional world, where the directions of action are not entirely predictable or measurable, our ability to plan and control effectively is compromised. As Hayek ([1964] 1967, p. 34) writes, "not only the ideal of prediction and control must largely remain beyond our reach, but also the hope remains illusory that we can discover by observation regular connections between the individual events."

The limitation of prediction implies a severe restriction on control and planning. Nevertheless, explanations based on principles and pattern predictions, which are founded on an understanding of causal relationships, prove to be extremely useful. They enable us to create the most favorable conditions for the effectiveness of specific actions. Hayek ([1955] 1967, p. 19) prefers the term cultivation rather than control, "cultivation in the sense in which the farmer or gardener cultivates his plants, where he knows and can control only some of the determining circumstances, and in which the wise legislator or statesman will probably attempt to cultivate rather than control the forces of the social process."

The scientific investigation of complex phenomena implies that we have to content ourselves with explanations of principle. These explanations tend to have less falsifiable empirical content and allow for more freedom regarding theoretical and empirical shortcomings. They are extremely difficult to refute based solely on experience, which opens the door for the existence of multiple competing theories that can be evaluated based on their persuasiveness and convincing power within the international scientific community. The theoretical progress of complex phenomena encapsulated in conjectures and refutations can be seen as slow, fallible, or even nonexistent. Since critical experience and empirical testing are often not feasible, experience alone is inadequate for resolving theoretical disputes, as Hayek ([1955] 1967, p. 19) sharply points out.

Because such theories are difficult to disprove, the elimination of inferior rival theories will be a slow affair, bound up closely with the argumentative skill and persuasiveness of those who employ them. There can be no crucial experiments that decide between them. There will be opportunities for grave abuses: possibilities for pretentious, over-elaborate theories which no simple test but only the good sense of those equally competent in the field can refute. There will be no safeguards even against sheer quackery. Constant awareness of these dangers is probably the only effective precaution.

In “The Theory of Complex Phenomena” ([1964] 1967), Hayek deepens and expands on the discussion above regarding pattern recognition, levels of complexity, and the trade-off between theoretical development and falsifiability in complex phenomena. He argues that in the scientific process of inquiry, it is a *sine qua non* condition to start with a hypothesis or vision about the phenomenon before conducting systematic observations of reality. For any answer to be sought, a specific question or hypothesis must be established. As we use our sensory perceptions to discern some pattern or order, questions naturally arise. It is the recognition by our sensory apparatus of a common element that leads to observable empirical regularities, generating a demand for explanations. Hence, all observation begins with some theory or hypothesis that our sensory organ recognizes in the external world.

Indeed, this point aligns with Schumpeter’s famous argument on the nature of scientific enterprise, in which he distinguished between vision and analysis. In his

monumental *History of Economic Analysis*, Schumpeter (1954, p. 41) explains that vision is the pre-analytical cognitive act of perceiving the object and the problem to be studied. Therefore, vision serves as the foundational substance that guides scientists in formulating their research questions and in the very search for their problems; it is a prerequisite for any analysis of the real world. As he writes, “[i]n order to posit to ourselves any problems at all, we should first have to visualize a distinct set of coherent phenomena as a worthwhile object of our analytic efforts. In other words, analytic effort is of necessity preceded by a pre-analytic cognitive act that supplies the raw material for the analytic effort.” For further discussion on the impossibility of an “atheoretical” empirical analysis, see Hayek ([1942-4] 1952, p. 111-138). Cf. Mark Blaug (1985, p. 115-116) regarding the “impurity” of scientific analysis.

According to Hayek ([1964] 1967), the recognition of a pattern implies that any theoretical effort will inherently pre-define a class or type of regular external order perceived by our sensory apparatus. The specific manifestation of these patterns will depend on the particular initial conditions of time and place. If the general causal law is correct, specific predictions will hinge on our ability to specify those initial marginal conditions. The description of an expected pattern is, *per se*, a manifestation of pattern prediction — whether falsifiable or not—under general conditions. Consequently, distinguishing between simple (natural sciences) and complex (social sciences) phenomena becomes important when considering different types of predictions. Hayek ([1964] 1967, p. 25) defines the complexity degrees of different types of patterns as “[t]he minimum number of elements of which an instance of the pattern must consist in order to exhibit all the characteristic attributes of the class of patterns in question.” It is noteworthy that many general laws of physics are relatively simple in terms of the variables necessary to reproduce a certain class of patterns. In classical mechanics, for instance, a straightforward mathematical formula comprising two or three variables can express a universal general law with considerable precision. The contrast with social phenomena is significant.

Hayek ([1974] 1978, p. 26) maintains that social sciences, “like much of biology, have to deal with structures of *essential* complexity, i.e., with structures whose characteristic properties can be exhibited only by models made up of relatively large numbers of variables. Competition, for instance, is a process which

will produce certain results only if it proceeds among a fairly large number of acting persons.” What sets relatively complex phenomena apart is the intersection of abstract models with the non-ergodic universe and its inherent Knightian uncertainty. In the case of relatively simple phenomena, these intersection points are few, allowing the desired pattern to be isolated more easily from other influencing variables. In complex phenomena, the multitude of interdependent components required to reproduce the pattern results in a complete inability to make detailed predictions. Additionally, many of its variables are essentially non-measurable. Nevertheless, complex theories still play a vital role through explanations of principles and pattern predictions. Pattern predictions arise from translating variables in algebraic models that are mostly qualitative and non-quantifiable; these models can provide insights into the qualitative structure of the complex manifestation. They enable us to predict certain general behavioral tendencies compatible with various situations and specific circumstances. Empirical predictions are falsifiable in principle but contain less falsifiable empirical content compared to theories that involve specific event predictions. Given the eminent complexity, any kind of prediction with greater falsifying content is fragile or empty.

As Hayek ([1955] 1967, p. 16) writes,

It is often not recognised that even the most formal system of equations can thus be used to make predictions and therefore will possess empirical content (though this content would be small), and that it will thus provide an explanation of the common features of a wide range phenomena — or an explanation of the principle of this kind of phenomenon. This needs to be stressed because of the widespread misconception that the value of such models rests entirely on our ability to specify the values of the variables occurring in them and that they are useless so long as we cannot do this. This is not so: such models are valuable on their own, irrespective of their use for determining particular situations, and even where we know that we shall never have the information which would make this possible. They still do tell us something about the facts and allow us to make prognoses.

In this sense, Hayek ([1974] 1978, p. 27-28) advocates for the use of algebraic theories and mathematics — without relying on numerical values, i.e., without attempting to measure econometrically the variables — as a valid tool for understanding the relationships and interdependencies among causal variables. He

makes it clear that he does not reject the mathematical method in economics:

I regard it in fact as the great advantage of the mathematical technique that it allows us to describe, by means of algebraic equations, the general character of a pattern even where we are ignorant of the numerical values which will determine its particular manifestation. We could scarcely have achieved that comprehensive picture of the mutual interdependencies of the different events in a market without this algebraic technique. It has led to the illusion, however, that we can use this technique for the determination and prediction of the numerical values of those magnitudes; and this has led to a vain search for quantitative or numerical constants. This happened in spite of the fact that the modern founders of mathematical economics had no such illusions.

In Hayek's ([1964] 1967, p. 29) view, there is a trade-off between the theoretical development of complex theories and their testability. For significant progress in understanding complex phenomena, it is necessary to move beyond the basic Popperian approach of seeking more theories that can be empirically tested and falsified. Although Hayek carefully stressed his acceptance of Popperian falsificationist philosophy (e.g., Hayek, [1974] 1978, p. 31-2), he emphasizes a real limitation of Popper's methodology in the context of complex phenomena. Specifically, he argues that the dynamics of falsification are quite weak in complex scenarios and that the advancement of these theories relies on recognizing this limitation. It is indispensable to expect a diminished empirical falsifying content in the scientific advance in complex sciences. "The advance of science will thus have to proceed in two different directions: while it is certainly desirable to make our theories as falsifiable as possible, we must also push forward into fields where, as we advance, the degree of falsifiability necessarily decreases. This is the price we have to pay for an advance into the field of complex phenomena."

According to Hayek ([1964] 1967, p. 39-40), the theory and methodology of complex phenomena ultimately highlight the fundamental importance of human ignorance regarding the world. His message is that "we take our ignorance more seriously. As Popper and others have pointed out, 'the more we learn about the world, and the deeper our learning, the more conscious, specific, and articulate will be our knowledge of what we do not know, our knowledge of our ignorance'. We

have indeed in many fields learnt enough to know that we cannot know all that we would have to know for a full explanation of the phenomena.” As the title of his Nobel Memorial Prize Lecture indicates, “The Pretence of Knowledge” ([1974] 1978), Hayek is deeply concerned with moving beyond the scientistic wave and exposing how fragile the foundation of much purported scientific knowledge can be. This misguided confidence may lead to harmful social and political consequences, including intellectual support for totalitarian regimes, which Hayek aimed to highlight in the second part of his Abuse of Reason Project. Acknowledging the limits of our scientific knowledge implies that we, as a scientific community, recognize a lesson in humility regarding our powers of explanation, prediction, and control over the external world and society (see also Hayek, 2013). Furthermore, allows us to recognize the evolutionary processes of coordination mechanisms that are embedded in formal and informal institutional structures that facilitate the creation, transmission, and storage of relevant knowledge, which ultimately result in a type of spontaneous social order derived from human actions but not from human design – what Hayek ([1946] 1948) defined as the essence of true individualism. As Hayek ([1974] 1978, p. 33) writes:

Of course, compared with the precise predictions we have learnt to expect in the physical sciences, this sort of mere pattern predictions is a second best with which one does not like to have to be content. Yet the danger of which I want to warn is precisely the belief that in order to have a claim to be accepted as scientific it is necessary to achieve more. This way lies charlatanism and worse. To act on the belief that we possess the knowledge and the power which enables us to shape the processes of society entirely to our liking, knowledge which in fact we do not possess, is likely to make us do much harm.

5. Hayek, Popper, and Fallibilism as an Epistemic Vision

In this section, we summarize the historiographical controversy between Terence W. Hutchison (1981, 1992, 2009) and Bruce J. Caldwell (1988, 1992a, 1992b, 1994a, 1994b) on the relationship between Hayek and Popper. We will identify the net results of the debate, particularly focusing on Caldwell’s (2004, 2006, 2009) most recent contributions to the subject. In these later works, Caldwell significantly altered his interpretation *vis-à-vis* his original evaluation of Popper’s influence on Hayek, and *vice versa*. We then present a new interpretation of the

intellectual relationship between Hayek and his lifelong friend Popper, grounded in the central ontological and epistemic concepts of fallible knowledge discussed in the previous sections. Utilizing Caldwell's (1991) resolution of the tensions within Popper's philosophy of critical rationalism—especially concerning what Hands (1985) referred to as Popper N and Popper S—we argue that the methodological positions of Hayek and Popper can be better understood and clarified by emphasizing the fallibility of knowledge as a general shared philosophical element in their research endeavors.

We have seen that Hayek considered himself a follower of Popper's philosophy of science and its critical rationalist approach to the growth of knowledge. This included acceptance of the hypothetico-deductive method and the criterion of falsifiability as demarcation between science and non-science. He also agreed that a higher falsification content in scientific theories is desirable. However, during the 1940s and 1950s, Hayek gradually shifted from a strict methodological dualism in his writings regarding natural and social sciences — exemplified in his articles on “Scientism and the Study of Society” ([1942-4] 1952) — towards a more nuanced view that acknowledges a *continuum* of complexity between sciences dealing with relatively simple phenomena and those addressing inherently complex phenomena. Shortly after the publication of *The Road to Serfdom* (1944) in March 1944, Hayek began working on *The Sensory Order* (1952), which was based on a manuscript he had drafted while studying law at the University of Vienna in 1920. In the late 1940s and early 1950s, Hayek progressively adopted the advancements from early complexity theorists, notably Karl Ludwig von Bertalanffy (1950a, 1950b, 1968), the Austrian biologist and founder of general systems theory (GST).

As Paul A. Lewis (2016a, 2016b) documented, Bertalanffy's work was very influential in Hayek's development during this period, offering a set of concepts that articulated the resolution of what in philosophy is known as the mind-body problem. Thus, concepts from complexity theory structured Hayek's interpretation of the relationship between mental and physical events—i.e., between mind (the sensory order) and body (the physical order). As Hayek (1952, p. 80) writes, “[a]n adequate account of the highly purposive character of the action of the central nervous system would require as its foundation a more generally accepted biological theory of the nature of adaptive and purposive processes than is yet available.” In this context, Roger Koppl (2005, p. 289) argues that “[c]omplexity was not Hayek's escape from

hermeneutics into science; complexity allowed Hayek to reconcile hermeneutics and natural science.” Therefore, Hayek’s *The Sensory Order* (1952) can be seen as a “scientific defense of methodological dualism.” On the other hand, in his 2004 intellectual biography, Caldwell (2004, p. 362) contended that this period represented a shift in emphasis from methodological dualism to complexity theory. In the 1950s, Caldwell (2004, p. 362) writes that Hayek linked the notion of a spontaneous order with the idea of complex systems, allowing him “to drop the old natural science–social science dichotomy [...] that could have led to a hermeneutical or interpretive turn, and place economics squarely among those sciences that studied complex adaptive orders.” Indeed, Caldwell himself writes about “Hayek’s Scientific Subjectivism” (1994b). As Hayek (1979, p. 199) pointed out,

My colleagues in the social sciences find my study on *The Sensory Order* [1952] uninteresting or indigestible. [...] But the work on it helped me greatly to clear my mind on much that is very relevant to social theory. My conception of evolution, of a spontaneous order and of the methods and limits of our endeavours to explain complex phenomena have been formed largely in the course of work on that book. As I was using the work I had done in my student days on theoretical psychology in forming my views on the methodology of the social science[s], so the working out of my earlier ideas on psychology with the help of what I had learnt in the social science helped me greatly in all my later scientific developments.

Furthermore, the influence of general complex systems theory gradually shaped Hayek’s emerging views on social and economic forces as a particular case of a complex general adaptive system. This complex general adaptive system consists of varying levels of self-organization and exhibits both structural and emergent properties. For example, the concept of negative feedback, borrowed from early cybernetics, was central to Hayek’s explanation of how human purposive behavior emerges and how social, political, and economic orders spontaneously form (see Oliva, 2016). As Hayek writes in volume 2 of his trilogy *Law, Legislation and Liberty* (1976, p. 124-5),

The correspondence of expectations that makes it possible for all parties to achieve what they are striving for is, in fact, brought about by a process of learning by trial and error, which must involve a constant disappointment of some expectations. The process of

adaptation operates, as do the adjustments of any self-organizing system, by what cybernetics has taught us to call negative feedback: responses to the differences between the expected and the actual results of actions so that these differences will be reduced. This will produce an increased correspondence of expectations of the different persons so long as current prices provide some indications of what future prices will be, that is, so long as, in a fairly constant framework of known facts, always only a few of them change; and so long as the price mechanism operates as a medium of communicating knowledge which brings it about that the facts which become known to some, through the effects of their actions on prices, are made to influence the decision of others.

Consequently, in the early 1950s, Hayek's emphasis on methodological dualism between the natural and social sciences led to the incorporation of complexity theory. These influences were particularly significant in characterizing the degree of complexity of different patterns recognized by the mind as the sensory order, defined as the minimum number of components necessary for their qualitative reproduction. As discussed earlier, variations in the complexity of phenomena can alter the scientific dynamics of explanation, prediction, and control. Thus, one could argue that while Hayek appears to adopt Popperian falsificationism in principle, he does not fully embrace it in practice. The main lesson of explanations based on principles and pattern predictions in complex sciences — initially reflected in "Scientism and the Study of Society" ([1942-4] 1952) — remains relevant. The core of Hayek's methodological contributions since the 1940s is preserved, though it is framed within the structure of modern complexity theory.

According to Hutchison (1981, p. 212-240), there are two distinct methodological stances in Hayek's intellectual evolution as a social scientist. Hutchison differentiates between "Hayek I," who adheres to a supposedly Misesian-Wieserian dogmatic methodological approach based on apodictic apriorism — i.e., centered on the Aristotelian self-evidently true propositions discovered by the exercise of reason — and "Hayek II," who aligns more closely with Popperian philosophy. The latter is primarily concerned with the fallibility of scientific knowledge and the pursuit of falsifying empirical elements in conjectures and refutations. Hutchison asserts that this methodological transformation is marked in Hayek's famous November 1936 presidential address to the London Economic

Club, titled “Economics and Knowledge” ([1937] 1948). In the 1937 essay, Hutchison argues that the Hayek departed from the a priori methodological stance inherited from his mentors, Friedrich von Wieser and Ludwig E. von Mises, in favor of a position more compatible with Popper, who had published his book *Logik der Forschung* (1935) shortly before. It is important to note that Popper published his book in Vienna in the autumn of 1934, with the imprint “1935” (see the preface of the first edition in Popper, [1935] 1959). Hutchison draws attention to Hayek’s ([1937] 1948, p. 33, f.n. 1) reference to Popper’s *Logik der Forschung* (1935) and his critique of the sterility of the standard tautological neoclassical equilibrium theory in making causal empirical propositions about the real world.

Caldwell (1988, 1992a, 1992b) addresses the controversy with Hutchison by agreeing, at least in part, that Hayek’s influential 1937 essay represents a shift away from Misesian principles and neoclassical equilibrium theory. In his classic article on “Hayek’s Transformation” (1988), Caldwell emphasizes this point. However, he argues that Hayek’s divergence from standard neoclassical theory is fundamentally rooted in the differing interpretations of equilibrium analysis when transitioning from individual to social equilibrium. The pure logic of choice, grounded in a priori subjective knowledge within the individual sphere, is not adequate to explain the social coordination of varied subjective expectations and individual plans that typify social equilibrium. Caldwell asserts that Hayek never accepted Mises’ concept of apriorism, and that the philosophical implications of the term “a priori” differ significantly between Hayek and Mises.

This distinction is further explored by Scott Scheall (2015), who argues that Hutchison’s “Hayek I” thesis is untenable since Hayek and Mises hold fundamentally opposing views on a priori knowledge. While Hayek regards introspective sensory knowledge as fallible and relativistic, Mises views a priori knowledge as absolute and infallible. Thus, even if one were to accept Hutchison’s unsubstantiated claim that “Hayek I” was an apriorist, it would contradict Mises’ position, as Hayek’s understanding of a priori knowledge is fundamentally opposed to that of Mises. Scheall (2015a, p. 89–96) draws upon Hayek’s work in theoretical and philosophical psychology, which was first articulated in his incomplete 1920 student paper in Vienna and later fully developed in *The Sensory Order* (1952). In this psychological theory, Hayek posits that a priori sensory knowledge is shaped by external experiences, making it fallible and subject to revision in light of encounters

with external and physical reality. The mind, along with its networks of neuronal connections, is formed and refined through cultural learning and individual experiences.

Additionally, Caldwell argues that there is no evidence of Popper's influence on Hayek before and after 1937, at least until the 1950s, particularly regarding the methodology of social sciences. On the contrary, significant conflicts and incompatibilities exist between Hayek's view points and those of Popper, especially in the works that constitute the Abuse of Reason Project. Nevertheless, Caldwell agrees that Popper influenced Hayek's later writings on methodology, though he disputes the extent of this influence. This also applies to the acceptance of the hypothetico-deductive method and the criterion of falsifiability as a means of scientific demarcation. Given the intricate nature of social phenomena, which limits its predictive and testing capabilities, Caldwell (1992b, p. 40-41) initially categorized Hayek as a "minimalist falsificationist."

In the 2000s, prompted by new archival evidence, Caldwell revised his historiographical interpretations concerning the relationship between Hayek and Popper. Although Caldwell's original thesis regarding Hayek's 1937 essay was modified in some respects, his initial 1988 position largely remains intact (e.g., see Caldwell, 2004a, p. 209-214). A key change in Caldwell's updated historiographical interpretation is a reevaluation of Popper's influence on Hayek. Caldwell (2006, p. 113) contends that new archival evidence indicates that neither thinker had much influence on the other in terms of their ideas about conducting social science. Instead, their major influence on one another lay more in the rhetorical presentation of their respective arguments. To support this revised interpretation, Caldwell reviews four instances: (i) the first meeting between the two men and Hayek's first mention of Popper in 1937; (ii) the extent of Hayek's influence on the third and fourth parts of *The Poverty of Historicism* (1957); (iii) the influence of Popper on Hayek's later methodological writings in the 1950s and 1960s; and finally, (iv) the inclusion of certain Popperian themes in Hayek's last book, *The Fatal Conceit: The Errors of Socialism* (1988). Caldwell's evaluation is focused on their influence on the methodology of social sciences, specifically the theory of complex phenomena.

Let's analyze each of the four episodes that Caldwell examines in detail. First, we will consider Hayek's initial mention of Popper. Their first meeting took place in 1936 when Popper was invited to present a paper at the legendary seminar

organized by Hayek and his close friend, the English political economist Lionel Robbins, at the London School of Economics and Political Science (LSE). Hayek subsequently wrote his groundbreaking article “Economics and Knowledge” (1937) shortly after this meeting. The straightforward chronicle of these events, along with Hayek’s claim that he readily accepted the general philosophy of Popper’s 1935 book, provides a clear understanding of the *rationale* of Hutchison’s thesis. Nevertheless, Caldwell (2006, p. 114-5) argues that Hayek was never an apriorist, particularly not in the Misesian sense. Mises’ apriorism focuses on the fundamental axioms of human action, while Hayek’s central emphasis as a technical economist was on monetary theory and the business cycle. Furthermore, as Scheall (2015) points out, Hayek and Mises assign different meanings to the term “a priori.” Additionally, in a letter to Caldwell (reprinted in Caldwell, 2009, p. 223-4), Hayek states that he was never an apriorist (in the Misesian sense or any other) and that the inclusion of the term “falsification” in his 1937 article was an editorial suggestion made during the final proofs. Caldwell also argues that in Hayek’s writings post-1937, particularly those related to the Abuse of Reason Project and *The Sensory Order* (1952), there is little evidence of Popper’s methodological influence.

In the second case, regarding Hayek’s impact on *The Poverty of Historicism* (1957), Caldwell (2006, p. 116-7) concludes that the division between the first two parts and the last two arises from Popper’s effort to address some of Hayek’s objections, particularly concerning scientism and the engineer mentality. However, this effort is more about the presentation and rhetorical framing of Popper’s original ideas than the actual incorporation of Hayek’s influence. In the various references Popper makes to Hayek, Caldwell identifies only two as substantial. The first involves Popper encouraging Hayek to consider the distinction between the engineer mentality – which Hayek critiques – and piecemeal social engineering, which Popper supports. Popper differentiates between the non-dogmatic application of the scientific method through trial and error and the pure engineer mentality attempting to reshape society according to its own design (cf. Kerstenetzky, 2007). The second significant reference led to the addition of two paragraphs in Hayek’s essay “Scientism and the Study of Society” ([1942-4] 1952), in the compilation edition of Hayek ([1952] 1979). This addition addresses the discrepancy between what scientists claim they do *de jure* and what they actually do *de facto*. Popper qualifies that the “Scientism” ([1942-4] 1952) essay argument contributes to his own

notion of methodological monism and that what Hayek called scientism is not the method of the natural sciences.

The third episode highlights the influence of Popper on Hayek's mature writings on methodology, a point Caldwell (1992a, 1992b) initially acknowledged and emphasized. In his revised position, Caldwell (2006, p. 118-9) suggests that while Popper was one of many influences during Hayek's tenure at the John U. Nef Committee on Social Thought at the University of Chicago from 1950 to 1962, it was not the sole one. During this time, Hayek engaged deeply with numerous interdisciplinary scholars and fields, including cybernetics and complexity theory. These influences were integrated into Hayek's work as a *continuum* rather than a strict division between the natural and social sciences, as discussed earlier. Caldwell argues that Hayek's motivation for these incorporations stemmed from his desire to refine and advance his unique research program and methodological contributions. In Caldwell's (2006, p. 118-9) view, it was Hayek's effort to develop and enhance his *sui generis* position "that was the driving force behind any changes he underwent. The twin notions of pattern prediction and explanations of the principle were his core ideas," and they were established in the early 1940s.

Finally, the last episode pertains to the adoption of evolutionary Popperian themes in Hayek's *The Fatal Conceit* (1988). However, Caldwell correctly notes that the book suffers from problematic edits by American philosopher William W. Bartley, whose non-passive editing complicates any assessment of Popper's influence on Hayek (cf. Buchanan, 1992, p. 133). As it is well-known, Bartley was a distinguished student of Popper at the LSE, where he completed his Ph.D. in 1962. The mutual interest between Hayek and Popper likely stemmed from their complementary backgrounds and theoretical advancements, which reinforced their respective research programs, even across different professional fields (see Hayek, 1983, p. 16-20, 74, 235-7).

In his review of the controversy involving Hutchison, Caldwell (2009, p. 323-4) includes two letters from Hayek addressed to Hutchison and one to Caldwell. These letters are essential for understanding the historiographical debate and the development of Hayek's methodological views. In our view, they provide substantial support for Caldwell's thesis. Hayek is quite clear in these letters, stating that he never accepted Mises's methodological apriorism, both before and after 1936. Moreover, this admission suggests a certain compatibility that Mises might have

recognized from Hayek's own critique in 1937. In the second letter to Hutchison, Hayek reiterates several points previously discussed and offers insight into his different interpretation of a priori knowledge.

Both letters seem to support Caldwell's (2006) analysis. He defends three main components: (i) Hayek's rejection of Misesian a priori knowledge, (ii) his view that a priori knowledge is a fallible and provisional concept, and (iii) the understanding that the structure of pure logic of choice or economic calculus strictly adheres to the postulates of human action. Hayek also clarifies that the first reference to Popper in his work was added based on an editorial suggestion during the final stages of publication, indicating that his 1937 article was composed before any influence from Popper. He notes that his support for the hypothetico-deductive method was already evident in his edited book, *Collectivist Economic Planning* (1935), before any interaction with Popper. Indeed, Hayek had already outlined this idea of distinguishing the empirical element of the natural sciences from that of the social sciences in his opening essay to *Collectivist Economic Planning* ([1935] 1948, p. 126-27). As he writes,

In the social sciences [...] experiment is impossible, and we have therefore no knowledge of definite regularities in the complex phenomena in the same sense as we have in the natural sciences. But, on the other hand, the position of man, midway between natural and social phenomena - of the one of which he is an effect and of the other a cause - brings it about that the essential basic facts which we need for the explanation of social phenomena are part of common experience, part of the stuff of our thinking. In the social sciences it is the elements of the complex phenomena which are known beyond the possibility of dispute. In the natural sciences they can be at best only surmised. The existence of these elements is so much more certain than any regularities in the complex phenomena to which they give rise that it is they which constitute the truly empirical factor in the social sciences. There can be little doubt that it is this different position of the empirical element in the process of reasoning in the two groups of disciplines which is at the root of much of the confusion with regard to their logical character. The essential difference is that in the natural sciences the process of deduction has to start from some hypothesis which is the result of inductive generalizations, while in the social sciences it starts directly from known empirical elements and uses them to

find the regularities in the complex phenomena which direct observations cannot establish.

Therefore, Hayek argues that Popper's influence was confined to the philosophical basis of the hypothetico-deductive method and the discussion about the methods of the natural sciences, specifically noting "that they did not do what most of the physicists claimed they did and urged us to imitate" (Caldwell, 2009, p. 323). Below, we reproduce Hayek's letters to Hutchison and Caldwell.

Dear Hutchison,

I had for some time intended to write to tell you how much I liked and admired your *Politics and Philosophy of Economics* but too much travel and trying to finish a major book seem to prevent me from ever studying it systematically from cover to cover as I wished to do at first. So after a half an hour spent on some to me especially interesting parts I want to express at least the main point. You are of course perfectly right that my 1936 lecture on 'Economics and Knowledge' marks the beginning of my independent thinking as an economist. But its chief point I had seen a little earlier and you will find some of the basic ideas already in my essays in *Collectivist Economic Planning*. But the main intention of my lecture was to explain gently to Mises why I could not accept his a priorism. Curiously enough, Mises, who did not readily accept criticism from his juniors, accepted my argument but insisted it was not incompatible with his view which, by implication, he restricted to what I called the Logic of Choice or the Economic Calculus. I left it at that, but I did want to say that I was *never* an a priorist, though I would still insist that *part* of the essential knowledge of the economist or the social theorist generally is derived from his given familiarity with the processes of human thinking.

With best regards, sincerely, F. A. Hayek (November 26, 1981, Hayek to Hutchison, reprinted in Caldwell, 2009, p. 223-4).

Dear Hutchison,

I have recently at last been able to read at least the sections of your new book dealing with me and had intended to write. I have however stupidly lent it to a student before doing so and must now try to write before my memory fades completely, but without being able to refer to the text. There is some misunderstanding in the

emphasis on the complete break in my thinking, although I may be partly responsible for it. I had never accepted Mises' a priorism and when I speak of man's knowledge of his own thinking I mean of course only our knowledge of the general manner in which men think, not knowledge of what they know or think at a particular moment. This I still believe to be true. My 1936 essay was written and the lecture delivered before I knew anything about Popper and the reference to 'falsification' was inserted in the proofs. As it is evident from certain passages in my essays on *Collectivist Economic Planning*, I had arrived at a definite hypothetico-deductive view before I knew of Popper's existence, but of course then embraced the philosophical justification of it which I could never have provided. Popper's influence on me was great on the question of the methods of the natural sciences – that they did not do what most of the physicists claimed they did and urged us to imitate. You will probably find more evidence of my pre-Popper thinking already in my 1933 Inaugural lecture in *Economica* of which I have at the moment however not even a copy at hand – I never reprinted it, because I was aware that some parts of it were muddled. Certainly 1936 was the time when I first saw my distinctive approach in full clarity – but at the time I felt that I was merely at last able to say clearly what I had always believed – and to explain gently to Mises why I could not ACCEPT HIS A PRIORISM. Curiously enough, Mises, who was so sensitive to criticism from younger men, praised that article without seeming to be fully aware how much it conflicted with his views.

There was yet another much less important point which I wanted to take up with you, but which I do not now remember but which I may rediscover, when (if I ever!) I get the book back. Perhaps there may still occur an opportunity to discuss these questions. With best regards, sincerely yours, F. A. Hayek (May 15, 1981, Hayek to Hutchison, reprinted in Caldwell, 2009, p. 223-4).

Dear Professor Caldwell,

Although your kind letter of July 10 was promptly forwarded to me at my vacation address, the accompanying typescript had, in accordance with my instructions, awaited my return which has been unusually delayed. I have now at last been able to read your article and greatly enjoyed it and am very grateful to you for having so clearly exposed Professor Hutchison's misunderstandings. I

entirely agree with you. Though I very gratefully accepted Popper's justification of the hypothetico-deductive procedure which I have long been following but could not have adequately justified – I am not a trained philosopher – I am sure he had no influence on my method in economics – certainly not yet in 1936 when I had only recently become acquainted with his *Logik der Forschung*. Indeed I clearly remember that I only at the last moment remembered that “verification” was no longer adequate and I believe only in the proofs inserted the footnote to which I refer for the first time to Popper, whom at that time I did not know personally. I am most grateful to him for having made clear to me that the natural scientists did not really follow the inductive methods which they claimed to observe and urged us to imitate, and I have much sympathy with his recent distinction of the “three worlds,” though I cannot quite accept it. We became close friends in the few years we were together at the London School of Economics, but I would not wish to say which of the two of us had had the greater influence on the other (Not for quotation!)

I still have not read your book though I am expecting the copy which I bought last week in London.

I assume you have already noticed yourself that on the sixth page of your typescript, line three, “theoretical” ought to be “philosophical”, and that the emphasis mentioned as added in the last line is in fact missing.

With repeated thanks, very sincerely yours, F. A. Hayek
(September 29, 1981, Hayek to Caldwell, reprinted in Caldwell, 2009, p. 223-4).

In general, we concur with Caldwell regarding Popper's specific and somewhat limited influence on Hayek in developing his methodological stance on social or complex sciences. In this section, we aim to enhance Caldwell's final assessment of the relationship between Hayek and Popper. Our main argument revolves around the shared meta-theoretical perspective grounded in the fallibility of knowledge. We seek to highlight the epistemic aspects of both thinkers as a progressive and unifying element in understanding their intellectual relationship. To achieve this, we draw on Caldwell's excellent scholarly article “Clarifying Popper”

(1991), which addresses the inconsistency between Popper N and Popper S, as discussed by Hands (1985, 1992) and other scholars. We argue that the fallibilist spirit of critical rationalism can also clarify the relationship between Hayek and Popper concerning their methodological nuances.

Caldwell (1991, p. 25) posits that pursuing the philosophy of critical rationalism is crucial to resolving the dilemma of how two distinct approaches—falsificationism and situational analysis (the method Popper advocated for social sciences) — can coexist within the same philosopher. Situational analysis states that we must explain individual and social behavior according to the situational context in which the individual perceives reality and the logical or rational response that follows from adequate means and ends. Thus, an observed action is explained as an individual rational action that follows the contextual logic. The main hypothesis is the rationality principle, i.e., that people maximize their scarce means to achieve different and conflicting ends in light of their subjective contextual perceptions. Although this hypothesis is frequently challenged by empirical evidence, Popper maintains that it should not be dismissed as a valid scientific explanation in the social sciences.

Writing on social sciences in general, and economic sciences in particular, Popper rarely approaches these sciences with his falsificationist lens. As Hands (1985, p. 84) put it, “[m]ost philosophers who have addressed this issue, including Popper himself, have implied that situational analysis produces explanations which are entirely unique to social science and less than adequate when judged by strict falsificationist standards.” This is exactly the methodological point on complex phenomena — such as social and economic sciences — that was discussed in detail above in Hayek’s case. Indeed, discussing his positions on situational logic and the rationality principle, Popper (1976b, p. 117-8, original emphasis) states that “[t]he main point here was an attempt *to generalize the method of economic theory (marginal utility theory) so as to become applicable to the other theoretical social sciences.*”

As a side comment, it should be noted that the incongruence pointed out by Hands (1985, 1992) has faced criticism from Popperian scholars, such as Mark Blaug (1985). Blaug argues that the recommendation of situational analysis can be compatible with Popperian methodological monism, depending on how the latter is interpreted. Blaug (1985, p. 286–87) considers the position attributed to Popper S

to be weak: “My own resolution of the clash between Ps and Pn is to throw doubt on Popper’s views on social science. The fact is that Popper knew little about social science and even less about economics. His own statements about situational analysis are very sloppy: they seem to be a restatement in loose language of the *Verstehen* Doctrine in sociology, colored by the recognition that this was in fact the underlying principle of orthodox microeconomics. But the whole problem of the *Verstehen* Doctrine has always been the question of whether it provides a valid method of explanation in the social sciences or the only valid method of explanation, in which case, for example, Keynesian economics is an invalid social science.” Additionally, Blaug (1993, p. 58) critiques the methodological stance on pattern predictions, expressing concern that Hayek is unclear about which economic patterns or tendencies should be predicted and how those predictions should be made.

Popper’s philosophy of critical rationalism emphasizes the limitations of knowledge and its fallibility, recognizing the inherent deficiencies of any scientific method. As he stated in the 1959 preface of *The Logic of Scientific Discovery* ([1935] 1959, p. xix, emphasis in the original), “[t]he central problem of epistemology has always been and still is the problem of the growth of knowledge. *And the growth of knowledge can be studied best by studying the growth of scientific knowledge.*” Acknowledging that ignorance and error are integral to the scientific process of conjectures and refutations, it is essential to establish effective critical social and institutional mechanisms to rectify inevitable mistakes. This is best accomplished through critical questioning and appropriate criticism to eliminate erroneous theories. Since we cannot be certain of our knowledge, the optimal approach to addressing ignorance is through critical examination. Critical rationalism is a philosophical attitude that resolves the *scientific knowledge problem* through the evolutionary mechanism of theory diversification, selection by critical evaluation, and trial and error reproduction. In essence, critical rationalism can be viewed as a learning mechanism through which scientific knowledge progresses. A similar process is evident in the social and economic realms concerning social coordination, summarized in the concept of inter-individual equilibrium. As Popper ([1935] 1959, p. xix) writes,

I am quite ready to admit that there is a method which might be described as ‘the one method of philosophy’. But it is not characteristic of philosophy alone; it is, rather, the one method of

all *rational discussion*, and therefore of the natural sciences as well as of philosophy. The method I have in mind is that of stating one's problem clearly and of examining its various proposed solutions *critically*. I have italicized the words '*rational discussion*' and '*critically*' in order to stress that I equate the rational attitude and the critical attitude. The point is that, whenever we propose a solution to a problem, we ought to try as hard as we can to overthrow our solution, rather than defend it. Few of us, unfortunately, practise this precept; but other people, fortunately, will supply the criticism for us if we fail to supply it ourselves. Yet criticism will be fruitful only if we state our problem as clearly as we can and put our solution in a sufficiently definite form—a form in which it can be critically discussed.

As each type of problem has its own specificities, scientific evaluation must focus on an optimal level of criticism, taking its context into account. The level and intensity of criticism will vary depending on the qualitative nature of each problem. Thus, critical rationalism challenges the notion of strict methodological monism, which naive falsificationism implies, particularly when considering different phenomena — such as natural versus social or simple versus complex phenomena — where the critical capacity for evaluating theories differs. In certain situations, such as in the physical sciences, it is more effective to evaluate different hypotheses through empirical tests. In other contexts, applying logical situational analysis may yield better results. In contrast to the positivist aim of scientific demarcation, critical rationalism does not stress rigid specificities in the critical judgment method. Instead, it seeks to continually enhance the process of scientific learning by correcting errors. As Caldwell (1991, p. 25) argues, embracing the fallibility of knowledge, as advocated by critical rationalism, “is to keep the critical process going, an environment in which the optimal amount of criticism is able to flourish.”

In this way, Popper's philosophy of critical rationalism can reconcile seemingly opposing approaches—falsificationism and situational analysis—within a single epistemic framework centered on knowledge fallibilism. Both Popper N (falsificationism) and Popper S (situational analysis) offer distinct strategies for addressing different scientific subjects and reinforce the notion that theories are provisional, changeable, and fallible hypotheses. Critical rationalism accommodates both approaches within the same problem-solving evolutionary framework,

recognizing them as different means to tackle the growth of human knowledge. This perspective also applies to the formal and informal institutions that enable impersonal social coordination, which have contributed to the development of civilization itself — a key theme in Hayek’s social philosophy. Since “Economics and Knowledge” (1937), Hayek has also taken as the guiding principle of his research program the limitation and fallibility of knowledge. Indeed, this is the starting point of his original and independent thinking. With the notion of subjective, tacit, and dispersed knowledge, Hayek was able to reformulate the concept of neoclassical equilibrium analysis that assumed perfect and objective knowledge given to all individuals. This perspective underscores the fundamental philosophical issue faced by all social sciences: the problem of social coordination of knowledge. The neoclassical assumption of perfect knowledge overlooks the real issue: how different individuals acquire the knowledge necessary to coordinate their plans with one another and with external reality. In the early 1940s, Hayek argued that this lack of understanding is a widespread methodological failure of the economics profession—a failure influenced by Cartesian rationalism and the French Enlightenment’s disproportionate emphasis on the power of Reason. The nature of the economic problem, characterized as a growth of knowledge issue, parallels the scientific problem in its epistemological dimensions.

As discussed, the fundamental epistemic notion of fallible and limited knowledge is central to Hayek’s research project. From this understanding emerges the coordination problem, the defense of true individualism rooted in the Scottish Enlightenment, a critique of scientism in its various forms, and his mature methodology for reconciling limited — but attainable — scientific knowledge of complex phenomena. Focusing on these ontological and epistemic concepts provides a clearer understanding of the distinct research projects of Hayek and Popper and their philosophical relationship. Popper’s critical rationalism posits that the optimal approach to achieve the growth of inevitably fallible knowledge is to establish both formal and informal institutional structures for scientific practices. These structures facilitate rational criticism that identifies errors and excludes unsubstantiated hypotheses and theories. Effective criticism serves as a crucial mechanism for fostering intense error correction in the competitive market of ideas. Therefore, the best way to address inevitable errors is to promote their gradual elimination.

Popper starts with Socratic ignorance, rooted in fallibilism and intellectual humility, as a foundation for any scientific inquiry. Consequently, scientific practice encourages self-examination and collective criticism through a continuous and relentless process of conjectures and refutations. On the other hand, Hayek internalizes the idea of fallible and limited knowledge to reformulate neoclassical equilibrium analysis as a process of coordination among subjective individual expectations, which involves the continuous adaptation of different action plans. The epistemic recognition of the fallibility of knowledge is central to the problem of inter-individual plan coordination. For Hayek, this is not only the fundamental economic problem but also a key philosophical issue for all social sciences. True individualism in the tradition of the Scottish Enlightenment practitioners such as Adam Ferguson, Bernard Mandeville, David Hume, Francis Hutcheson, Adam Smith, etc, by appreciating the adequate role of reason in the unfolding of social institutions that define and create civilization, manages to develop the role of institutional analysis in the process of spontaneous interaction among individuals resulting in social coordination marked by extended cooperation in impersonal exchanges under the international division of labor and knowledge. As Hayek ([1974] 1978, p. 34) writes,

If man is not to do more harm than good in his efforts to improve the social order, he will have to learn that in this, as in all other fields where essential complexity of an organized kind prevails, he cannot acquire the full knowledge which would make mastery of the events possible. He will therefore have to use what knowledge he can achieve, not to shape the results as the craftsman shapes his handiwork, but rather to cultivate growth by providing the appropriate environment, in the manner in which the gardener does this for his plants. [...] The recognition of the insuperable limits to his knowledge ought indeed to teach the student of society a lesson of humility which should guard him against becoming an accomplice in men's fatal striving to control society - a striving which makes him not only a tyrant over his fellows, but which may well make him the destroyer of a civilization which no brain has designed but which has grown from the free efforts of millions of individuals.

The human ability to coordinate the actions of greater numbers than those found in the group of mutually familiar individuals was acquired because man developed practices that were different from the instincts that bound together the small group, and that,

therefore, restricted these instincts or were even opposed to them. This came about as occasional changes in individual behavior were selected, which made it possible to coordinate greater numbers—changes that often required the suppression of instincts that, although supportive of the collaboration within the small group, proved to be impedimental for the enlargement of the groups. Such new rules could assert themselves and become widespread, *not* because people *understood* that they were better, but only because they enabled groups that adopted them, possibly accidentally, to multiply through procreation and attraction of outsiders (Hayek, 2013, p. 240, emphasis in the original).

The coordination of different individual interests within society does not happen *a priori*, as Hutchison (1937) and many critics suggest. Diffuse interests do not harmonize *in vacuo*; instead, the emergent properties of economic coordination and social order arise through an appropriate institutional framework, similar to the pursuit of truth in scientific practice. This perspective aligns with the spirit of Hayek's later interdisciplinary research, which underscores the importance of both formal institutions and the informal, transgenerational rules and norms of conduct. These norms are often unconscious in the processes of learning and social coordination among individuals who lack complete knowledge. Therefore, the problem of knowledge is not unique to scientific practice. It is the central problem of all social sciences.

However, it is important to emphasize that the underappreciation of fallible knowledge can and does lead to bad scientific practice. With the rise of the use and abuse of Reason, the degeneration of scientific practice in certain sciences occurred *pari passu*. The incorporation of the epistemic problem of knowledge implied the limited explanatory and predictive capacity of phenomena called complexes. Human reason may not be able to explain and predict in detail many of the phenomena surrounding us. In this condition, a humble scientific position is realized and developed, accepting the intrinsic human knowledge limitation and fallibility — but not, at least, a pretense or false one. Hayek addresses the social or complex sciences, which often face societal and intellectual pressures that conflict with their ontological nature and scientific boundaries. Both Hayek and Popper share a similar epistemic view of knowledge.

However, their differing methodological approaches reflect their diverse

backgrounds in distinct fields. The epistemological concept shared by Hayek and Popper serves as a common ground that enhances our understanding of their complex intellectual relationship. Bartley (1984, p. 19) succinctly captures this shared epistemic perspective: “I learnt from Popper that we never know what we are talking about, and I learnt from Hayek that we never know what we are doing.” Interestingly, Hutchison himself had an intuitive vision of this epistemic dimension later in his book *Knowledge and Ignorance in Economics* (1977), an intermingling between Hayek and Popper in economic science (e.g., see Hutchison, 1977, p. 9, 21-3, 31, 33, 38, 41-43, 48-9, 58-9, 61). For instance, Hutchison (1977, p. 61) concludes by highlighting what can be understood as the central and fundamental axis of methodological movement, interpreted as the shared epistemic element between Hayek and Popper.

We would emphasise, in conclusion, that no one has insisted or explained more clearly than Sir Karl [Popper] that any methodological prescriptions for scientific decisions and investments must inevitably be based on certain ethical or political choices. The philosopher of science, no more than the economist, can lay down, for the kind of decision-makers or ‘investors’ with whom he is concerned, any general formula, with any significant degree of content and applicability, for absolutely and objectively ‘rational’ conduct in real-world conditions of uncertainty and ignorance. The attempt might be made to analyse the investment decisions, or the ‘portfolio’ of theories, the ‘rational’ scientist should take or hold, but no very practically informative formula would emerge. All that can be set out are ‘reasonable’ principles, or maxims, for scientific decision-making and investments, which will not yield any uniquely correct answers and will inevitably need interpretation and judgment for their practical application. The principle of falsifiability is linked with what Popper calls ‘fallibilism’ as the epistemological basis for a free, pluralist society. Watering down, disarming, or stifling this critical principle, by leaving the green light switched on permanently, signalling ‘anything goes’ for every kind of complacent, pretentious, and noxious dogmatism would constitute a grand new ‘*trahison des clercs*’.

6. Conclusion

Friedrich A. Hayek made substantial contributions to the development of both the theoretical scope and methodology of the social sciences, with a particular

emphasis on political economy and social philosophy. In the 1930s, the controversial debate on the possibility of rational economic calculation in a socialist society served as a catalyst for his independent and original thinking, reverberating into methodological inquiries. In Hayek's view, the disputing positions of this debate emerged from a broader methodological failure, which prevented neoclassical economic theorists from accurately identifying the contested assessments and, consequently, from addressing the fundamental philosophical problem of all social sciences, the problem of knowledge. The coordination of inter-individual plans constitutes a knowledge problem, which emerges and becomes significant only when framed as an epistemic issue involving subjective, dispersed, and tacit knowledge, i.e., fallible knowledge. Standard neoclassical economic theory obscures this problem by presuming perfect and objective knowledge given to all individuals within equilibrium analysis. In the 1940s, Hayek argued in the *Abuse of Reason* Project that this methodological shortcoming reflects a wider intellectual trend characterized by the ascendancy of scientism and the misuse of Reason.

Hayek's methodological concerns are fundamentally grounded in an epistemic posture of fallible knowledge. He accepts the hypothetico-deductive method and the falsifiability criterion as a means of demarcating science from non-science. However, Hayek sees that complex phenomena deny the possibility of detailed explanation and precise prediction and empirical testing, as required by standard Popperian falsificationism. He defines the complexity of phenomena as the minimum number of elements required to reproduce the phenomenon qualitatively. While the possibility of falsification remains in principle, with complex phenomena, we can only offer explanations of principle and pattern predictions. At first glance, Hayek accepts the Popperian falsificationist philosophy. However, his ideas about the limits of explanation and prediction in complex phenomena weaken his strict agreement with Popper. We argued that both Hayek and Popper share a common epistemic view of knowledge as fallible, as seen in Hayek's research program based on the coordination problem and Popper's philosophy of critical rationalism. Both thinkers addressed the problem of radical ignorance and the growth of knowledge — Hayek in the social, political, and economic institutional structure of an extended society marked by the division of labor and impersonal social cooperation, and Popper in the philosophy of science and scientific practice.

To understand their intellectual connection, we argued that we must recognize their shared meta philosophy of knowledge fallibility. In his groundbreaking article “Economics and Knowledge” (1937), Hayek placed this at the heart of his thought with his postulation of the problem of coordination of subjective, dispersed, and tacit knowledge. Popper did so in building his lifelong philosophy of critical rationalism. Each thinker used different methods to reach different audiences, but both confronted the same fundamental epistemic problem. In an interview, Hayek (1983, p. 235-7; also p. 16-20, 74) summarizes what connects them:

You see, Popper, in writing already *The Open Society [and Its Enemies]*, 1945], knew intimately my counterrevolution of science articles. It was in these that he discovered the similarity of his views with mine. I discovered it when *The Open Society* came out. Although I had been greatly impressed — perhaps I go back as far as that — by his *Logic of Scientific Discovery*, his original book, it formalized conclusions at which I had already arrived. And I arrived [there] due to exactly the same circumstances. Popper is a few years my junior; so I did not know him in Vienna. We were not in the same generation. But we were exposed to the same atmosphere, and in the discussion, then, we both encountered two main groups on the other side: Marxists and psychoanalysts. Both had the habit of insisting that their theories were in their nature irrefutable, and I was already by this driven to the conclusion that if a theory is irrefutable, it's not scientific. I'd never elaborated this; I didn't have the philosophical training to elaborate it. But Popper's book gives the justification for these arguments — that a theory which is necessarily true says nothing about the world. So when his book came out, I could at once embrace what he said as an articulation of things I had already been thinking and feeling. Ever since, I have followed his work very closely. In fact, before he went to New Zealand, I met him in London — he even spoke at my seminar—and we found a very far-reaching, basic agreement. I don't think there's anything fundamental with which I disagree, although I sometimes had, at first, hesitation. His present new interest about the three worlds I was at first very puzzled about. I believe I now understand it, and I agree. When, in that Hobhouse Lecture, I speak about culture as an external element which determines our thinking, rather than our thinking determining culture, this is, I believe, the same thing Popper means when he speaks about the three worlds. Of course, in the few years we were together at the

London School of Economics — only about from '45 to '50 — we became very close friends, and we see completely eye-to-eye on practically all issues.

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