Вестник Томского государственного университета. Философия. Социология. Политология. 2025. № 85. С. 46–63.
Tomsk State University Journal of Philosophy, Sociology and Political Science. 2025. 85. pp. 46–63.

Original article
УДК 001.11; 165.1; 167.7
doi: 10.17223/1998863X/85/4

TOWARD A SYSTEMIC-COMMUNICATIVE PHILOSOPHY OF SCIENCE: FROM MAX WEBER TO NIKLAS LUHMANN

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Abstract. The article conceptualizes the concepts of truth and knowledge in social epistemology and systemic-communicative theory. The possibilities of the philosophical understanding of scientific cognition are considered in comparison with research perspectives of science studies, sociology and psychology. It is substantiated that it is the philosophical conceptualization of science that permits interpreting science as a complex phenomenon requiring the resources of a higher socio-philosophical theory. The connection and difference between scientific cognition and descriptions and observations carried out in other social systems – politics, religion, art, mass media – are considered. The solution of the problem of demarcation of science and value judgments in Max Weber's understanding sociology is presented, as well as the concretization and formalization of Weber's principle of freedom from value judgments in Robert K. Merton's ethics of science. Further, a critique of Merton's ethics of science is reconstructed in the Strong Programme of David Bloor, who engages causal social-epistemological analysis of not only false but also true beliefs and judgments. Finally, a reconstruction of Niklas Luhmann's systemic-communicative philosophy of science is presented. Scientific truth is understood in this theoretical context as a symbolic generalized means of scientific communication that provides in itself an incredible consensus in scientific work.
Keywords: science, truth, knowledge, system theory, communication

Acknowledgments: The study by was conducted under the state assignment to Lomonosov Moscow State University.

For citation: Antonovsky, A.Yu. & Pogozhina, N.N. (2025) Toward a systemic-communicative philosophy of science: from Max Weber to Niklas Luhmann. *Vestnik Tomskogo gosudarstvennogo universiteta. Filosofiya. Sotsiologiya. Politologiya – Tomsk State University Journal of Philosophy, Sociology and Political Science.* 85. pp. 46–63. (In Russian). doi: 10.17223/1998863X/85/4

Научная статья

НА ПУТИ К СИСТЕМНО-КОММУНИКАТИВНОЙ ФИЛОСОФИИ НАУКИ: ОТ МАКСА ВЕБЕРА К НИКЛАСУ ЛУМАНУ

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Аннотация. В статье концептуализируются понятия истины и знания в социальной эпистемологии и системно-коммуникативной теории. Рассматриваются возможности

философского понимания научного познания в сравнении с исследовательскими перспективами науковедения, социологии и психологии. Научное познание анализируется как комплексный феномен, требующий привлечения ресурсов более высокой социально-философской теории. Для этого последовательно реконструируются идеи Макса Вебера, Роберта Мертона, Дэвида Блура и Никласа Лумана.
Ключевые слова: наука, истина, знание, системная теория, коммуникация

Благодарность: исследование выполнено в рамках государственного задания МГУ имени М.В. Ломоносова.

Для цитирования: Antonovsky A.Yu., Pogozhina N.N. Toward a systemic-communicative philosophy of science: from Max Weber to Niklas Luhmann // Вестник Томского государственного университета. Философия. Социология. Политология. 2025. № 85. С. 46–63. doi: 10.17223/1998863X/85/4

Introduction: How Does Philosophy Understand Science?

In this chapter, we consider scientific cognition from a socio-philosophical perspective. Science is studied by many disciplines – science studies, sociology, psychology, history, each in its own special aspect. The sociology of science reveals the social functions of science, the impact of science on society and the reverse impact of society on science. Science is understood as a specific social institution or social system. The psychology of science, in turn, records how the characteristics of individuals, personality traits affect the effectiveness and nature of scientific activity. Finally, science studies using interdisciplinary approaches generalizes these studies, considers science in its structure and dynamics, looks for ways of scientific measurement of scientific results, which are now called scientometrics. What is left to the philosophy of science? Have the disciplines dismantled the domain of science, leaving nothing for philosophy?

It should be recognized that philosophy also offers its own perspective, fixing in the phenomenon of scientific cognition its specific and at the same time the most general aspect. The philosophy of science reserves for science a special function, namely, the task of conducting objective scientific research, and includes this function in a broad social context. Science is a specific view of the world, which is different from other ways of understanding and cognizing it. However, the world is mastered and tried to understand in its own way by different social systems – religion, art, social movements, literature, mass media. Philosophy recognizes these forms of observing the world and understands science as one of the possible ways of describing it. But with all the specificity of scientific worldview, no one but science is capable of realizing an *objective, truthful, methodologically-verified, verifiable, reflexive, and rational* cognition of the world.

In this sense, the field of questions of philosophy of science is quite broad and includes the question of the essence of scientific knowledge and cognition. But this issue cannot be solved if we do not raise the question of scientific truth and the conditions for its achievement. The list of these conditions is quite extensive. We have to define with the concepts of verification or verification of the obtained knowledge, its reliability and justification procedure. The conditions for obtaining scientific truth are characterized by a generalizing term – the concept of rational cognition.

At the same time, the philosophy of science is not satisfied with the internal definition of science, scientific knowledge and scientific truth, but asks about its external – social – function. This formulation of the problem requires an answer to the question: how does science differ from other ways of observing the world, from other forms of activity and communication? How does rational scientific cognition differ from non-scientific types of mastering and describing the world and society? Philosophers of science pose this question as a problem of demarcation (differentiation) of scientific and non-scientific cognition of the world.

All these questions can be summarized and reduced to one: how can we have a complete and internally consistent concept of science, which would bring together all other perspectives and aspects of understanding science – sociological, psychological, historical, scientific? Hence, the fundamental task of the philosophy of science is to propose a generalizing and synthetic concept of science.

The Concept of Science: A Quick Glance

A cursory glance at science is enough to understand the super-complexity of this phenomenon. Science includes the most diverse forms of activity and communication: scientific thinking, theoretical research, experimental and laboratory activities, writing of scientific texts and scientific projects, the work of scientific organizations and interaction within scientific teams, expert evaluation of scientific projects and reviewing of manuscripts, etc.

The multilayered nature of scientific practices is compounded by the complexity of the research field that requires differentiation and hierarchization of specific disciplines. Disciplines differ radically in their maturity, the rigor of the concepts used, the formalization of language, the clarity of wording, and the type of fixed scientific laws, which makes it very difficult to find a *generalizable and synthetic* definition of science.

Strangely enough, almost no one doubts that science is a single, dynamically evolving phenomenon and it requires a relevant comprehensive definition.

What Is a Philosophical Concept of Science For?

However, is it necessary to formulate a generalized definition of science at all, since science successfully copes with its social function without it? Practicing scientists, sociologists and historians of science obviously get by without a definition of the concept of science procedurally and “routinely” resolving the above-mentioned problem of demarcating science from what does not correspond to the principles of scientific cognition.

Today this demarcation is realized, on the one hand, through a formalized mechanism of rejection of manuscripts of scientific articles by editorial boards and experts of scientific journals. On the other hand, the actual demarcation is carried out by expert teams (the Higher Attestation Commission, the Russian Academy of Sciences) controlling scientific qualifying papers. Moreover, in neither case are the experts guided by the explicitly formulated concept of scientificity, but rather by intra-disciplinary criteria of relevance, novelty, adjacency of specific scientific publications and research topics.

Nevertheless, the search for a synthetic definition of science is a matter of self-reflection and self-identification of the scientific community. There have been many attempts to find such a reflexive self-definition of science. Thus, one of the solutions to the problem of scientific knowledge demarcation has been proposed in the logical positivism of the Vienna Circle. As a criterion of scientific knowledge, the meaningfulness of the propositions of the language of science is recognized as opposed to other – religious, metaphysical – expressions that do not allow carrying out their empirical testing or verification. Karl Popper's critical realism sees such a criterion of scientificity in the ability of science to falsify its own statements because only refutation, not confirmation, is a logically flawless way of obtaining scientific truth.

However, even today, the question of science's meaningful self-determination has not lost its relevance because it meets the central challenge of modernity. In a democratic society that implies freedom of expression and thus equality of all discourses and claims to the corresponding social significance, how can we prove the universality and superiority of scientific observation in competition with religion, ideology, journalism, and even what is commonly called the common sense viewpoint?

The Concept of Science in the Domestic Philosophy of Science

In Russian philosophy, its own definition of science has been proposed by its leading representative Vyacheslav Semenovich Stepin:

> Science is a special type of cognitive activity aimed at developing objective, systematically organized and substantiated knowledge about the world. It is a social institution that ensures the functioning of scientific cognitive activity. As a type of cognition, science interacts with other types of cognition: common knowledge, art, religion, mythological, philosophical knowledge. Arising from the needs of practice and regulating it in a special way, science aims to identify the essential links (laws) in accordance with which objects can be transformed in human activity. Since any objects, such as fragments of nature, social subsystems and society as a whole, states of human consciousness, etc., can be transformed during activity, all of them can become subjects of scientific research [1. P. 560–561].

According to this approach, science is defined both as a type of cognitive activity aimed at obtaining objective knowledge (specific concept) and as a social institution (generic term).

Like any definition, it raises questions of completeness and internal contradiction. Is it science when we exchange acquired knowledge at a conference or read a scientific article written by scientists or experts of a journal, a competition committee, a scientific foundation, etc.? After all, knowledge production is distinct from its reception or sharing. This definition also does not specify where the production of knowledge takes place – in the scientist's head, in the laboratory, in scientific debate or in the course of writing an article. Does it constitute science when the outside public and laymen receive finalized scientific knowledge, and when this knowledge is proliferated in popularized form outside the discipline and the scientific community? What is scientific criticism? After all, it does not produce, but rejects and sifts out the false and unscientific! Does false knowledge, which is obviously produced, inter alia, by the most scientific "social institutions", belong to science? Can the selection of already *produced* knowledge in journals, the work of scientific councils and the whole scientific-organizational activity be considered science? Is the application of previously produced knowledge to engineering, such as calculating the trajectory of a satellite, science? There is also a general question: how can we separate science and its causally significant (organizational, existential, communicative) conditions? If they are outside science, do we not deprive science of its systemic self-sufficiency?

If science is considered as an activity, a social institution, or a social system, then it would be logical to turn to the theoretical resources of a more fundamental theory (general theory of activity, general theory of communication, theory of society, theory of social systems, etc.).

Such attempts to provide a functional description of science as a social institution, and to clarify a unique social task within the framework of fundamental social theory have been made repeatedly.

These attempts include Max Weber’s interpretation of science within the framework of understanding sociology; Robert K. Merton’s functionalist understanding of science; interpretation and critique of science in the Critical Theory of the Frankfurt School[1]; the approach of social epistemology or the Strong Programme in the sociology of science; Niklas Luhmann's systemic-communicative theory of science.

Max Weber: External and Internal Conditions of Scientific Cognition

Max Weber was one of the first to raise the question of scientific knowledge as a specifically rational view of the world, different from other types of observation – artistic, religious, political-ideological. The concentrated form of this problem was reflected in his article “Science as a Vocation”.

The first part of the article, which has not been translated into Russian, conceptualazes the “external-social” conditions of science as a social institution and as a profession. Capturing the trend of professionalization of science, Weber connects it with the gradual establishment of the North American standard of organizing science as a large “state capitalist enterprise”. In this sense, the “profession” of the scientist is indistinguishable from the social status and position of the employee in a modern capitalist enterprise, and the employee being primarily aimed at success as the main value of bourgeois society. “Here we encounter,” writes Weber, “the same condition that is found wherever capitalist enterprise comes into operation: the separation of the worker from his means of production” [2. P. 131] (such as the library, instruments of scientific observation, laboratories, classrooms, departments, etc.). “The worker, that is, the assistant,” he continues, “is dependent upon the implements that the state puts at his disposal; hence he is just as dependent upon the head of the institute as is the employee in a factory upon the management. For, subjectively and in good faith, the director believes that this institute is 'his,' and he manages its affairs” [2. P. 131].

[1] Thus, Jürgen Habermas, following Theodor W. Adorno and Max Horkheimer, asserted the socio-functional principle of disciplinary differentiation of knowledge, which corresponds to three basic functions. These are the functions of social control and adaptation to the external environment (natural-scientific knowledge), description of communicative processes (interpretive-hermeneutic knowledge) and emancipation (Critical Theory itself).

What is most important in this diagnosis of science is that the *external* motivation of a scientist is not so much the search for true knowledge, but, above all, promotion, career and material rewards, professional success[1].

Today, the traditional "true meanings" and motivations of scientific work, unrelated to reward and career, are fading into the background. In the science of the modern era, the pursuit of truth was inextricably linked to other forms of mastering the world. It implied that its ultimate goal was the cognition of the beautiful, the divine, and the virtuous, which defined the scientist's self-understanding, vocation, or mission. However, today, according to Weber, the pursuit of truth has lost its motivational power. The scientific passion and all-consuming interest now turns to particular fields and problems. "Only by strict specialization," writes Weber, "can the scientific worker become fully conscious, for once and perhaps never again in his lifetime, that he has achieved something that will endure" [2. P. 135]. The scientist is no longer a sage who can give advice in any sphere of social life.

However, in today's society of division of labor and focus on success this passion and enthusiasm for the subject of research is not something special and unique to the scientist. Passion for science and passion for entrepreneurship are common expressions of the Protestant work ethic.

"A merchant or a big industrialist without 'business imagination', that is, without ideas or ideal intuitions, will for all his life remain a man who would better have remained a clerk or a technical official. He will never be truly creative in organization. Inspiration in the field of science by no means plays any greater role, as academic conceit fancies, than it does in the field of mastering problems of practical life by a modern entrepreneur," writes Max Weber [2. P. 136].

However, if the social dimension of scientific motivation reveals similarities between science and economics, essential differences are found in the field of distinguishing between scientific and value judgments. Modern science is no longer able to claim to establish eternally significant truths. The eternally significant is asserted in art, whose masterpieces do not "become obsolete" but retain their aesthetic significance in all changes of styles and in the emergence of new forms. On the contrary, "In science, each of us knows that what he has accomplished will be antiquated in ten, twenty, fifty years. That is the fate to which science is subjected; it is the very meaning of scientific work, to which it is devoted in a quite specific sense, as compared with other spheres of culture for which in general the same holds. Every scientific 'fulfilment' raises new 'questions'; it asks to be 'surpassed' and outdated. Whoever wishes to serve science has to resign himself to this fact," writes Weber [2. P. 138].

The dynamics of modern scientific cognition does not allow stopping the assertion of eternal truth and final meaning definitions because any scientific cognition is significant only at the moment and immediately raises new questions. The general meaning of the world remains inaccessible and could be grasped by other ways of mastering the world. Weber states,

[1] However, it should be taken into account that in German usage, profession and vocation are lexically indistinguishable. In this Protestant-colored sense of the German word "Berufung", any personal, professional, career, etc. success is a consequence of the worker's God-given vocation.

> And today? Who – aside from certain big children who are indeed found in the natural sciences – still believes that the findings of astronomy, biology, physics, or chemistry could teach us anything about the meaning of the world? If there is any such "meaning," along what road could one come upon its tracks? If these natural sciences lead to anything in this way, they are apt to make the belief that there is such a thing as the "meaning" of the universe die out at its very roots. And finally, science as a way "to God"? Science, this specifically irreligious power? That science today is irreligious no one will doubt in his innermost being, even if he will not admit it to himself [2. P. 142].

As a result, Weber (partly explicitly, partly implicitly) formulated the basic problem of the meaning of modern science: what motivates scientists to continue doing science if a complete and final understanding of natural objects is impossible? Can science as an occupation and field of activity offer some other – its own – achievements to replace the "lost illusions" about the possibilities of knowing nature as a whole, the Divine Design and the meaning of human life? "What is the meaning of science as a vocation, now after all these former illusions, the 'way to true being', the 'way to true art', the 'way to true nature', the 'way to true God', the 'way to true happiness', have been dispelled?" writes Weber [2. P. 143].

"Consider the historical and cultural sciences. They teach us how to understand and interpret political, artistic, literary, and social phenomena in terms of their origins. But they give us no answer to the question of whether the existence of these cultural phenomena have been and are worthwhile," he continues [2. P. 145].

The judgments of science do not answer questions about religious, artistic, ethical or political values, about things that should be believed, about what is beautiful, virtuous or just. At the same time, politics, religion, and ethics in turn should not interfere with questions about the truth of scientific judgments. Science in the society of isolated social systems, having separated from religion, art and politics, focuses on its own function – to conduct scientific research, defined by the binary code of all knowledge, recognize judgments claiming to be true, and reject all other value judgment, first of all, artistic, religious and political-ideological ones.

Robert K. Merton's Ethos of Science (The Weak Programme in the Sociology of Knowledge)

Thus, the question of truth (objectivity, evidence and validity) of scientific statements becomes a generalizing feature and demarcation criterion of science. However, in order for science as a special community to be able to focus on this task, it was necessary to disassociate itself from "external values" that could intrude and manipulatively distort the objective nature of scientific judgments.

In this regard, science was required to formulate more clearly its own attitudes and values that would demarcate real and "fake" science. These normative attitudes were codified by Robert K. Merton and were called "scientific ethos". "The ethos of science" concretized and clarified the Weberian methodological principle of "value-freedom" (the ability of the researcher to keep their own values (ideological, political, artistic, religious) from interfering with the research process). This issue became particularly relevant in the 1930s and 1940s in Germany, where German scientists and philosophers willingly served the Nazi regime while Jewish scientists, on the contrary, were expelled from science and philosophy.

In the lecture "Science and the Social Order" and the work "A Note on Science and Democracy" Merton formulated the above-mentioned value principles of science which were designed to protect science from external expansion by other social systems and communities [3]. However, the demarcation of truly scientific activity is now broader and more radical. "Pure science" has to dissociate itself not only from the values, motives, attitudes, and standards of neighboring value systems (art, religion) and political ideologies but also from the damaging effects of individual predilections, the influence of economic (monetary) motivations, and even from the influence of internal hierarchies (scientific statuses, positions, and authorities). These values were reflected in the concepts of *communism, universalism, disinterestedness and organised scepticism* (the acronym CUDOS).

Thus, the value of *universalism* required that scientists, when making and evaluating scientific judgments, should not take into account the personal and social qualities of scientists: ethnicity, nationality, religion, social status, and individual character traits. None of the above should influence criticism, evaluation of the truth and reliability of research.

The value of *communism* reflected the fact that scientific knowledge is produced collectively and therefore should be relevant and accessible to all researchers without exception.

Selflessness (disinterestedness) indicated that a scientist should not be motivated by economic interest. In this regard it is important to recall that Max Weber identified the tendency of scientific work to become a kind of labor in capitalist production. In contrast, Merton considers passion for the subject, altruism, and curiosity to be the true motivations for scientific work.

Organized skepticism, in turn, emphasized the role of the critical attitude that requires to take into account the whole variety of facts that could be analyzed alone to provide the final judgment on the truth of scientific judgment. Both in the methods and the institutional defense of research, it was required to ensure that a final judgment would be made only when all the necessary facts were available.

David Bloor's Social Epistemology (The Strong Programme in the Sociology of Knowledge)

Mertonian norms of scientific ethos were based on the general idea of demarcation, the distinction between intra-scientific factors that determine the nature of research and the autonomous logic of the development of scientific knowledge and external – or extra-scientific – factors that undoubtedly determine science but are not "rational" from the point of view of scientists themselves.

External (first of all, economic and political) factors demanded the scientific development of certain socially significant scientific topics in which adjacent social systems – politics and economy – were interested. Scientists were required to discover and produce new types of energy, new medicines, materials with specified properties, new foodstuffs, and last but not least new weapons. However, addressing these research tasks does not follow directly from the autonomous logic of scientific development. Hence, there is a distinction between the "internal history of science" and its "external history", which becomes widespread mainly in the postwar philosophy of science (Imre Lakatos, Larry Laudan, etc.). Consequently, the criteria of scientific rationality (observability, verifiability, validity, experimental nature of science, use of proven methods, universal reproducibility of results, provability, cost-effectivness) are applied to the case of the internal history of science, while the external history of science should be explained by sociologists of science.

In fact, the internal history of science can be understood and "rationally reconstructed" on the basis of the above criteria, since they are the basis (causal explanations) for the selection of the best possible scientific theories by scientists, and the reasons why they are sure that their scientific judgments are truth.

On the contrary, errors, delusions, and, in general, the false nature of scientific statements received a separate, extra-scientific causal explanation. Their causes were seen in external political or economic influences on science. The phenomenon of "Lysenkoism" provides a typical example of such external social, political-ideological pressure on science, which led to the approval of anti-Darwinist approaches in Soviet biology, with the notion of properties of living organisms acquired during life being inherited by next generation. On the contrary, the above-mentioned internal scientific standards of rationality obviously could not explain this event in the domestic history of science. Why did not the Mertonian norms of scientific ethos (the Weak Programme) work and protect science from external expansion by adjacent social systems?

A common place in the philosophy of science was the idea that science follows "the internal logic of its development", which does not require causal analysis of scientists' beliefs and judgments. After all, their beliefs are determined by the very subject of research, the structure of which forces the scientist to speak about the subject in this way (in a true way) and not otherwise. In this sense, the truth of scientists' judgments and corresponding beliefs have no *external*, social causes. Science (as a set of true judgments) is what it is, regardless of social influences. This consideration united philosophers of science who used the *externalism/internalism* distinction as an asymmetrical one, where only false judgments received a causal, external, socially determined explanation and true statements received the status of self-explanatory.

This asymmetry in the externalism/internalism distinction has come under fire from a number of scholars at the University of Edinburgh. David Bloor, Steven Shapin, and Barry Barnes formulated the so-called "Strong Programme" of explaining the history of science contrasting it with the the Weak Programme, which refers primarily to Robert Merton's conception.

The Strong Programme is based on the directive principle: the interpreter of science tries to uncover the reasons for scientists' beliefs using the same types of reasons to explain both rational (true, successful) beliefs and irrational (false, unsuccessful) ones [4].

For example, the theory of thermodynamics was believed to be causally related to "influence of the practical development of technologies for the use of water flows." However, less complicated and more trivial examples can be also given. Thus, the actual results of mathematical operations, for example, division, are reflections of the distribution of produced social products; the results of subtraction are the consequence of their consumption, and the results of addition are the consequence of their accumulation and storage; the result of multiplication, in its turn, stems from the procedure of growing crops as multiplication of planted seeds. In general, the ability of scientists to classify natural objects and give generic and species definitions was believed to be a consequence of social classifications of people and communities (Emile Durkheim).

As if in opposition to the four principles of the Weak Programme, David Bloor formulates four principles of the Strong Programme: causality, impartiality, symmetry, and reflexivity:

1. The sociology of knowledge should be *causal*, i.e., it should identify the causes of certain states of mind of scientists, their scientific ideas and beliefs. At the same time, it should distinguish social types of causes from non-social ones, which in turn "causalize" scientists' beliefs.

2. The sociology of knowledge is *impartial* in addressing the issue of *truth/falsity*, *rational/irrational,* scientific achievements and fiascos. Each side of these distinctions is explained causally by identifying the relevant causes.

3. The form of explanation must be *symmetrical*. The types of causes that explain the formation of both true and false beliefs of scientists must be identical.

4. The sociology of knowledge has a *reflexive* nature. This means that causal types of explanation of their falsity or truth should be applied to the beliefs of sociologists of science as well.

The goal of the Strong Programme is a causal analysis that explains the development of both "the internal" and "the external" history of science. Proponents of the Strong Programme believe that the causes of all beliefs and related statements should be sought in influences from one or another of the social structures.

Opponents of the Strong Programme, however, pointed out that among the reasons involved in the formation of scientists' beliefs, the main place belongs not to social pressure, but to the very structure of the cognizable object. The scientific reconstruction of the structure of natural objects (living organisms, DNA, chemical substances, atoms and elementary particles) as they exist outweighs the social pressure on the scientist in most cases, even if it takes place. For example, Ernest Rutherford's belief that atoms have dense central nuclei was a causal consequence of the results of alpha-particle scattering experiments. Most of them, passing through the gold foil, were not deflected, but in a small number of cases the angle of deflection was ninety degrees or more. This physical but not socially determined circumstance was the reason for Rutherford's belief in the existence of the atomic nucleus because it explained the mechanism of alpha-particle scattering.

The pressure of social institutions, of course, manifested itself in attracting funding and state support for this research topic, but still the main causal factor of Rutherford's beliefs and statements were the results of this experiment.

Certainly, sociologists can also offer their own explanation of this event because they are the ones who record the social factors that increase the probability of the alpha-particle scattering experiment. The social division of labor, the financing of fundamental science and the formation of the experimental base of scientific research appear to be some "additional" reasons that co-participate in the formation of Rutherford's beliefs. Such "additional" reasons include the existence of a special type of scientific communication, primarily in the format of scientific publications (scientific journals as a special type of social institutions), which Rutherford read and which co-formed his beliefs. These socially significant factors can also include (partly) bureaucratically imposed agonality in science, requirements for originality, which "push" scientists and require them to promptly formulate non-trivial statements, such as the statement about the existence of the atomic nucleus.

The reference to social pressure explains to some extent the choice in favor of a particular theory within competing paradigms in specific circumstances, for example, the choice in favor of the theory of inheritance of acquired traits and the rejection of the theory of genetic transmission of hereditary factors during the Lysenkoist period, and the choice of field theory over contact mechanics. However, the fact that the theory itself was created is better explained by reference to the structure of an object of nature (atom, gene, chemical substance, etc.) than by external scientific social pressure.

Niklas Luhmann's Systemic-Communicative Sociology of Science

Social epistemology (in the format of both the Weak and Strong Programmes) pointed out a number of omissions of classical epistemology. Both of these epistemic approaches raise the question of the origin and preconditions for the crystallization of scientific knowledge. However, if classical epistemology understood knowledge in a narrow sense, gave its standard definition as a *true and justified belief,* and saw the source of knowledge in the properties of the cognizer, namely, in their sensual abilities, ability to remember, accumulate and process information, to draw rational logical conclusions from it, then social epistemology in both of its variants understood the sources of knowledge more broadly, investigated the transfer and diffusion of knowledge in society, reconstructed the social conditions of acceptance and further proliferation of scientific messages inside and outside science, and analyzed the links between knowledge and collective action based on it.

The newest stage in the development of social epistemology is represented by the systemic-communicative philosophy of science, whose leading representative was the German sociologist Niklas Luhmann.

This approach eliminates the incompleteness of the philosophy of science and the theory of knowledge in general because, unlike other approaches, it analyzes science and science communication based on a more general social theory. The systemic-communicative theory is based on the possibilities of a comparative analysis of science with other social subsystems, such as economy, art, religion, politics, and it does not do it exclusively negatively in the style of Weber or Merton, but reveals a number of cross-cutting communicative properties of science, not only specifying scientific cognition but also uniting it with other types of communication.

From the point of view of the systemic-communicative theory, any communication system consists of system-specific elementary operations. Thus, politics consists of collectively binding decisions, and economics consists of payments and purchases. At the same time, each operation represents a communicative request for contact, which can be accepted or rejected. The probability of rejection of such requests requires compensating mechanisms or binary codes, guided by which participants of communication do accept the requests, despite the *improbability* of such claims. (No one wants to share property in economics, obey other people's decisions in politics, or accept the validity of someone else's claim in science.)

Thus, the integration of system operations within a single system, their non-random connection to each other, is ensured by the presence of connecting "selection mechanisms". For example, power as a binary code of the political system selects decisions that are important to the state, which becomes the subject of political decisions. All decisions are made taking into account the binary distinction of power/non-power: first of all, decisions that retain and maximize power are selected, and those that lead to its loss are rejected.

Payments in the economy are in turn regulated by the binary code of money. Transactions are realized through the monetary distinction of solvency/insolvency. An economic transaction is aimed at maximizing profit, just as a political decision is aimed at maximizing power. All possible communications that lead to the opposite outcome are rejected.

In this comparative context, the system of scientific communications can be considered as one oriented towards its own binary code – scientific truth. This code provides integration of scientific judgments within the scientific system, just as money provides sequences of transactions.

Scientific Knowledge as Communicative Inquiry

Thus, knowledge itself arises in the process of discussion and in the form of discussion, i.e., in its material form (sounds, ink) it is not at all similar to *the external (= discussed*) world that is only "reflected" to any extent in the form of consciousness perception. It is thus only a question of the fact that the event of *knowledge* is simultaneously observed (and by this observation only *produced*) from two systematic observational perspectives: from the point of view of communicative discussion and from the point of view of its perception by consciousness. Therefore, it acquires a certain identity ("objectivity") *of its own,* as if going beyond the limits of both systems - the system of psyche (the sequence of mental acts) and the system of communication (the sequence of messages).

However, as it has been said above, scientific communication is not only structurally connected with mental systems (consciousnesses) experiencing the *external world* but also shows structural analogies with other communicative systems that have differentiated parallel to science in the course of social evolution[1].

The relationship between science and politics is a particularly interesting case, as these systems turn out to be in a kind of a mirror relationship. Meanings of political events are determined by coupling of *actions with actions.* And, indeed, how else is it possible to establish non-random and, most importantly, rather long-term sequences of events around significant collective-binding (but in most cases extremly challenging, such as the construction of pyramids) goals, if not with the help of a special symbolic instrument – *power* that tightly binds the actions of

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[1] Specifically on the process of social differentiation: Luhmann, N. (2013) *Theory of Society.* Volume 2. Stanford: Stanford University Press.

actors to each other? Meanings of cognitive (scientific) achievements consist in coupling of *experiences with experiences, perceptions with perceptions.* And how else can we verify the mutual provability of scientific statements except by means of mutual authentication of perceptions (first of all, in the reproduction of experiences and experiments) with the help of science's own mediation instrument – the symbolic means of communication: *truth*?

Truth, then, is an instrument of binary *coding of improbable* propositions. Improbable due to their complexity or strikingness, such as Copernicus' heliocentric thesis. Coding is understood here as the process of categorizing sentences according to their meanings or values – truth and falsity. At the same time, any communication, not necessarily thematizing *scientific* knowledge, can be encoded. And the simplest statement "it is raining" can be true and false. But truth as a sustainably reproducible code, and thus, also as a systemic-communicative one, emerges only with the isolation of the corresponding communication system – the system of scientific communications.

Truth in this proper sense emerges only due to special – in some sense even improbable – requirements for scientific knowledge and the communication of this knowledge.

After all, there should have been an *incredible* motivation to read hundreds of not very clear texts and conduct thousands of experiments, most often with negative results. Truth as a communicative code, as an index of scientific knowledge, thus solves the problem of legitimizing and ensuring the acceptance of requests for contact, the content of which is the research conducted.

Such legitimizing purpose of truth was connected with its special function: responsibility for social *positive* (!) evaluation of *new* knowledge and, as a consequence, for its demarcation from other types of knowledge! Other possible types of knowledge (traditional, already known, unscientific, intuitive, religious, male, secret, etc.) are not specifically evaluated and are not categorized into positive or negative values by means of special programs for their legitimization (see below).

Actually, this distinction goes back to the most ancient *asymmetry* – between the requirement to keep from forgetting the knowledge of the subject in some unconcealed state (truth as *aletheia*) and the clearly social imperative "do not lie" (lie as *pseudos)*. David Bloor and Barry Barnes return symmetry to the two divided sides showing that truthfulness is as constructive as falsehood and cannot designate knowledge defined solely by its subject.

Nevertheless, this asymmetry of truth and falsity has realistic grounds. It does point to a fundamental *difference* that makes truth and falsity unequal parties. It is the difference between *actions (messages)* and *experiences (perceptions, imaginations, desires, beliefs).* It is to the former that the corresponding normative requirements are imposed: "one must not lie"; whereas to the latter there are cognitive requirements, the prohibition of forgetting.

Falsehood then turns out to be *socially conditioned* in some deeper sense than it was assumed to be conditioned by interest, language, prejudice, etc. For it is *commensurate with the action (= message).* On the contrary, truth, although represented in the message, is perceived exclusively by consciousness. The perceptual data are then presented in the communicative message but only in an extremely truncated form. That is why truth is not determined by the properties of messages, i.e., by actions, and, as a resut, by various kinds of manipulations and fabrications.

Truth in the Sym-bol/Dia-bol Function

Truth functions as a binary *code* of the operations of science and as a *program for the distribution of coded values.* To clarify these abstract terms, Luhmann introduces this concept by comparing it to the more fundamental media of perception (air and light) and to the specific media of communication of other communicative systems (money and power).

Designated media are in a sense analogous to truth in their instrumental or medial function (mediator function). Truth in this sense is like air, an invisible instrument (the medium of sound waves) through which we hear noises (the accessible *forms* of an inaccessible medium). But still, air can also be heard if it "superimposes a form" on itself (e.g., in the form of wind). In the same way, light (electromagnetic waves) as an unperceivable medium of perception makes it possible to see, but only in the form of certain observed colors (specific forms of light).

In this most abstract sense, truth, as an invisible medium, instrument or symbolic mediator of communication, makes it possible to fix this or that knowledge, but it itself eludes the direct observer of knowledge. At the least, the practicing scientist rarely asks about the concept of truth and what it is. And even more so, its communicative functions and prerequisites are not clear or interesting to them.

These prerequisites consist in the special *symbolism* and *generalizing* character of truth which, like any symbol, ensures the connection of elements of the system and, as a principle of generalization, the inclusion of the elements claiming to be truth in a scientific community or organization. The integration of scientific teams is ensured through such truth symbolization of knowledge certified in its generalizability. Symbolization and generalization are standard social functions of all communicative systems, and science as a system does not cease to be a communication, the same one as communication in all other communicative subsystems of society.

However, in addition to such a function of "communalisation" and a factor of social order, any medium must also solve the problem of differentiation or *isolation* of its own system (the system that this medium regulates). In the former case, truth as a *sym-bol* of reliable knowledge ensures the communicative unity of the scientific system and, as a consequence, contributes to the integration of the whole society by supplying it with scientific knowledge; in the latter case, it acts in a kind of a *dia-bol* function of isolation and separation.

Here again, there is a paradoxical metaphor of observing the unity of the world. If we try to conceive of some "supreme unity" (unity of society, unity of the world, etc.) as a unity of different things, then, starting with Anselm of Canterbury, we are bound to encounter a paradox. The figure of God traditionally serves as a *symbol* of some kind of the biggest, best, all-encompassing. However, how can this unity be observed? After all, while observing, we have to somehow *designate* this observed thing, distinguishing it from everything else that is not so great. And, if this unity is really so broad that it does not allow for an external reality in relation to it, there is still the observer himself. Hence, the observer's conclusion that their themselves are something lesser, worse, limited from the observed perfection seems inevitable. The observer definitively falls away from the "supreme unity" he observes, just as the "fallen angel" falls away from God. So, truth, as a generalized symbol, unites scientists, ensures the connection of true messages and the formation of a unified system. However, as a result of this special type of observation and concentration of truth statements, dia-bol consequences arise, namely *more and more false judgments* and an *increase in the volume of the unknown.* Of course, this happens as a consequence of the observer's limitation and insufficiency in comparison with the highly complex observed unity.

What is truth from a more concrete meaningful and conceptual point of view? Luhmann rejects the widespread conception of truth as the *adequacy* of a judgment in relation to the external world (the correspondence theory of truth), where the external world would appear as a guarantor of the correctness of statements about it [5]. And, this is evidenced in mathematics because the correspondence theory requires one to look for objects of mathematics somewhere outside the discipline.

There is also a question: what to do with the huge number of false judgments, obviously indicating the inexplicable "malignancy" of the objects of these judgments, which for some reason do not show themselves immediately and unconditionally to the observer? However, Luhmann also reserves many *positive* functions for false judgments (see below), but it is especially interesting to consider them from a comparative system perspective.

Falsity in scientific judgments is in some sense functionally analogous to the representations of the opposition in the political system, the medium of the power code. Thus, opposition judgments, from the point of view of the parliamentary majority, are recognized as erroneous but, nevertheless, are not considered "criminal" despite the fact that their ultimate goal is to change social structures, reform and, finally, to oust the ruling party. Such judgments should provoke the rulling party to instantly neutralize them, but nevertheless they are freely articulated, considered and even sometimes accepted.

Their improbable probability and the improbable probability of erroneous judgments in science should be explained. Why is someone who is wrong being tolerated rather than called a liar, or at least excluded from the scientific community as an unsuccessful participant?

Truth from a Comparative Communicative Perspective

Truth, in terms of its medial, i.e., mediation function, retains some properties common to other communicative media of communication (power, money, love, faith, law, etc.).

The genesis of truth is as *improbable* as the one of these media. Indeed, how improbable is this colossal effort of spending one's own time reading and creating highly specialized texts!

Truth is capable of *inflation and deflation*, i.e., it is capable of gaining or losing its significance from the point of view of observers of truths from other systems.

It is as abstract as other media, and therefore has to rely on bodily-and-material mechanisms to prove its significance, i.e., it is able to form some kind of *symbiotic* mechanisms, to use the bodily properties of the organism (primarily its perceptual abilities) to control the process of truth–value distribution in case of doubts about the truth: just as the medium of *power* is able to rely on the mechanisms of its certification and control through *physical* violence, and the medium of *love* uses the symbiotic mechanism of the body and sexuality to prove the abstract and therefore unreliable symbolic meaning of this medium.

The improbability of the genesis of the medium of truth is first of all expressed in the fact that the one who offers new truths is not seen as a liar or falsifier! After all, it undermines past, and thus reliable and authenticated, knowledge, and doubts the fundamental foundations of scientific consensus. In the system of legal communications, this is equivalent to the situation when a reformer who proposes changes in legislation and thereby undermines the "foundations" of an actually functioning state is not, after all, perceived as a criminal (and if he or she is interpreted as such, it means that the communicative system of law has simply not reached maturity) [6].

All communicative systems face this mismatch between the *function of selecting* the best of the possible offers of meaning (i.e., integrating this system and rejecting everything that does not belong to the system (economic, political, religious requests for contact) and the function of social media in establishing social consensus).

Thus, the dilemma of *consensus-conflict* in science is decoupled from the dilemma of *truth and falsehood*, which forces the rejection of an *activity-based* understanding of truth. The rejection of a false proposition is no longer to be seen as an "arbitrary and purposeful" act, as a free action; such an assertion of truth and rejection of a former false position is now stylized as a "forced" decision based on the objectivity and intersubjectivity of perception, with which opponents are forced to agree. As a result, these decouplings of the two dilemmas *(true/false and consensus/conflict)* multiply variations: conflict (or polemics) can be organized around both falsehood and truth, and neither guarantees agreement.

Science and Second-Order Observation

Thus, the generic concept of science reduces truth to a communicative system, i.e., an internally *closed* sequence of messages (= actions), categorized by their meaning or significance into true or false, which guarantees that the system is isolated. And although it consists of messages (actions), their meaning is determined intersubjectively – by certifiable *experiences* (perceptions) of external reality. That is why science simultaneously demonstrates the properties of an *open* system because, unlike other systems, it is also able to capture external reality using its perceptual abilities. It sees what is closed to other observers, even if this primary observer is the practicing scientist himself.

In the first-order observation, the observer (the practicing scientist) does not distinguish between his knowledge of facts and the world, between facts as events of the external world and facts as scientific fixations of these events. Everything that the scientist *knows* coincides with the boundaries of the cognizable *world*, and knowledge turns out to be true, i.e., correlative to the world – knowledge.

It is only in the second-order observation that one suddenly discovers that not everything in knowledge corresponds to the world (e.g., some theoretical variables do not find correlates in the world), that not all knowledge is *true,* and thus knowledge of how things really are is different from this "really".

Hence, there are (at least) three modi operandi of possible observational statements: "A is"; "I know that A is"; "I know that it is true that A is". In each subsequent statement, some additional observational perspective is added.

At the same time, the second-order observation is realized in science at least twice. In the first case, it takes place in determining the actual value of a scientific result, when some researchers observe how something "the same" is observed by others (in the repetition of experiments in other laboratories, in the expert evaluation of scientific publications, at thesis committees, at scientific conferences, etc.). In the second case, the second-order observation is built on top of the first two observations: when a special subsystem of the scientific system with the function of reflexion (epistemology, theory of knowledge, philosophy, sociology, or history of science) capable of generating criteria for evaluating the "best theories" is isolated.

Of course, science is always evaluated also from the point of view of its *external* observation: politics, church, economy, mass media, etc., but all of them do not have competences comparable to scientific observation. If science cannot be observed by a sufficiently competent observer capable of adequately capturing the complexity and functions of science, one has to take into account the possibilities of internal observation, look for internal competent authorities capable of evaluating scientific theory from their own disciplinary perspectives.

Conclusion: Publications and Disciplines

And yet, the number of potential connections (that promises that some scientific topics will be successful) remains too large to be finally categorized by means of a binary code of truth/falsehood through methodological-theoretical verification.

The last prerequisite for "inclusion" in the world of scientific communication is publication. Publication is, above all, the presentation of knowledge, not its production. Here the communicative conditions of science are particularly evident. In fact, it is only at this stage that communicative messages claiming to be truth and new ones become knowledge! In order to turn into knowledge, some initially extremely complex messages obtained as a result of knowledge production must be reduced (shortened, simplified, presented in a highly selective manner) to such an extent that they can fit into the framework of a scientific article. Only in this way can they be adequately understood and accepted. Otherwise, they will never become knowledge.

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Авторы заявляют об отсутствии конфликта интересов.

The article was submitted 19.04.2025;
approved after reviewing 21.05.2025; accepted for publication 30.06.2025
Статья поступила в редакцию 19.04.2025;
одобрена после рецензирования 21.05.2025; принята к публикации 30.06.2025