

# What is Science?

Volker von Prittwitz

What does the term *science* mean? Particularly: What requirements are to be met in scientific projects? Substantial answers to these questions can be learned from the science philosopher Karl Popper. According to his *Critical Rationalism*, science is characterized by two interdependent criterions:

- 1) Any scientific statement has to be formulated in a way that - in principle - makes it possible to falsify the statement. Hence only **checkable statements** that can have scientific character - a basic methodological criterion.<sup>1</sup>
- 2) Science strives for reaching statements with empirical substance as big as possible. At it, the degree of empirical substance is defined through a) the **universality** of a statement: the more universal a statement, the bigger is its scientific substance; b) **precision**: the more precisely a statement is formulated, the bigger its scientific substance.<sup>2</sup>

Hence science is not only determined by its methodical requirements (checkable = falsifiable statements), but also and above all by its striving for universal and precise knowledge (theory-building). While checkable statements are also required in other sectors of society such as professional journalism, science stands out due to its specific striving for theory-building.

Theory-building, in turn, implies maximal testability because both universality and precision maximize the chances to falsify a statement. Hence there is an intense interrelationship between striving for theory-building and scientific methodology. That interrelationship can only be kept vital in a sustainable process of **communication** between all involved scientists; hence communication is a further basic demand of science. In order to meet that demand, the involved scientists have at least to write down and to publicize their scientific products as well as to read products of the other scientists. The usage of supplementing channels such as written or personal discussions fosters the vitality of a science furtherly. This applies in a universal manner -

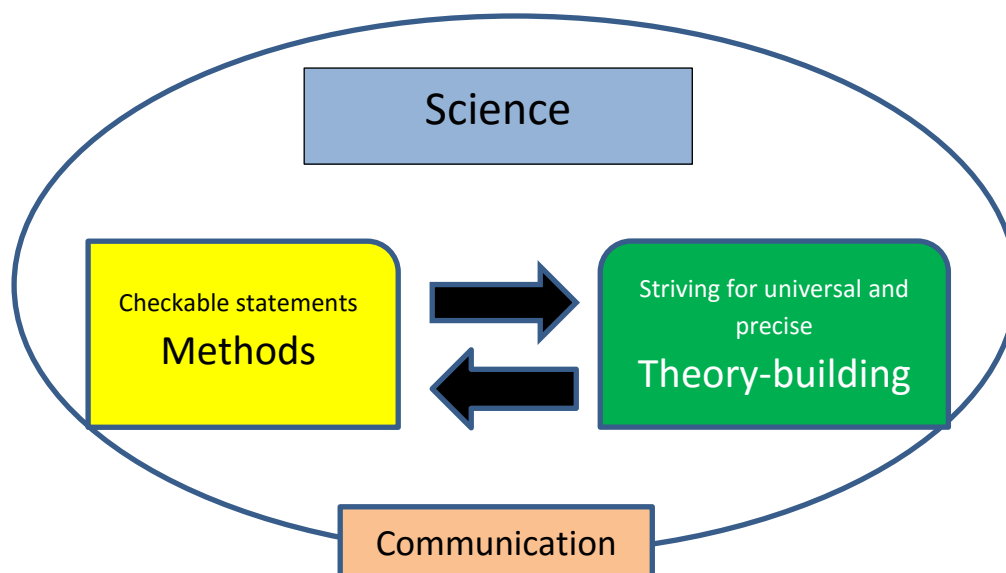
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<sup>1</sup> Popper, Karl R. 1934/Third edition 1969: *Logik der Forschung*, Tübingen (Mohr); Popper, Karl 1934: Popper, Karl 1934: *Die wissenschaftliche Methode*, in: Karl Popper *Lesebuch*, Tübingen (Mohr)/UTB 2000, S. 118-126;

<sup>2</sup> Popper, Karl 1934/Third edition 1969: *Logik der Forschung*, Tübingen (Mohr), ps. 77-96, in particular 83- 85.

implying the demand of **worldwide accessible and free theories (concepts, models), data, and discussions** - a technical-organizational requirement that can be met by the internet without any restriction.

Figure 1: *Basic requirements of science*



Aside of methodical and organizational prerequisites such as the freedoms of publicizing, reading, and discussing, there are also certain substantial needs of communication: Since scientists are only able and willing to communicate with each other if they can refer to certain agreed methods, concepts, and assumptions - a basic requirement of arguing - , they **need to have some theoretical basics in common.**<sup>3</sup>

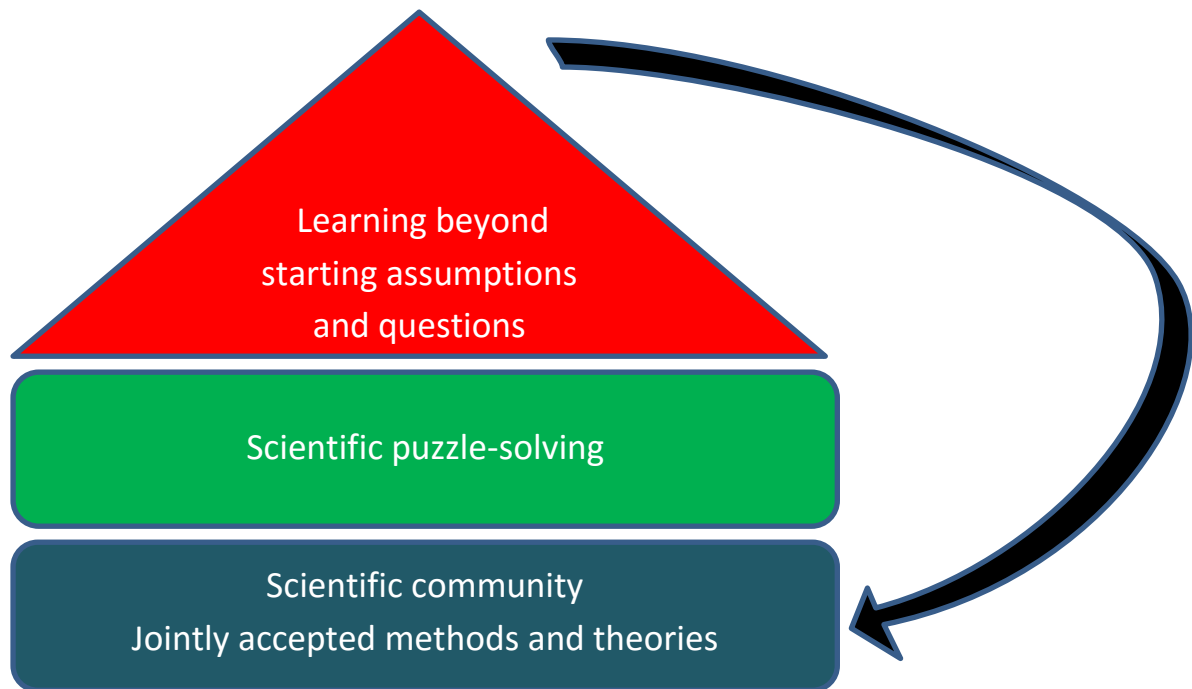
That overlap does not prevent controversial discussions; in the contrary, as Thomas Samuel Kuhn has showed in his book *The Structure of Scientific Revolutions*, scientific theorizing, observing, and experimenting goes on best within a settled paradigm or explanatory framework, so-called **normal science.**<sup>4</sup> At it, Kuhn considers only scientific *puzzle-solving* given in normal science, that is, the solving of a given set of questions and challenges based on agreed theories and methods. Starting from jointly accepted methods and theories of

<sup>3</sup> Prittwitz, Volker von 1996 (Ed.): *Verhandeln und Argumentieren. Dialog, Interessen und Macht in der Umweltpolitik*, Opladen (Leske+Budrich), taken over by Springer-Verlag: <http://www.springer.com/de/book/9783810014702> , particularly Saretzki, Thomas: *Wie unterscheiden sich Argumentieren und Verhandeln?* ps 19-39.

<sup>4</sup> Thomas S. Kuhn: *The Structure of Scientific Revolutions*, University of Chicago Press, deutsch: Thomas S. Kuhn (Author), Kurt Simon (Translator), Hermann Vetter (Translator): *Die Struktur wissenschaftlicher Revolutionen* Erstausgabe: Suhrkamp (Theorie, Gruppe 2), Frankfurt am Main 1967

a scientific community, indeed, also new orientating questions and challenges of a science can be developed - a process that may reach until scientific paradigm changes, that is, until deep learning beyond the hitherto accepted assumptions. That's why science is not only capable of meeting tasks and challenges that correspond with its agreed methods and theories; it rather can be capable of learning beyond its starting assumptions and questions.

Figure 2: *Science capable of learning*



That concept of a science capable of normal and deep learning corresponds with Socrates' , *I know that I don't know anything*; but above all it corresponds with the complex concept of learning - differentiating instrumental learning, goal-related learning and learning of learning (*deutero learning*) - traceable to Gregory Bateson and Argyris/Schön.<sup>5</sup>

At it, the basic idea of a scientific community capable of learning corresponds with the general pattern of **Bound Governance**. Accordingly principally equal and free actors interact based on jointly accepted rules that can be further developed by the community - a structure of coordination that fosters peace, individual performance, and general welfare.<sup>6</sup>

<sup>5</sup> Bateson, Gregory: *Ökologie des Geistes*. Anthropologische, psychologische, biologische und epistemologische Perspektiven. Frankfurt a. M.: Suhrkamp 1981, ISBN 3-518-57628-3; [https://de.wikipedia.org/wiki/Gregory\\_Bateson](https://de.wikipedia.org/wiki/Gregory_Bateson); Chris Argyris, Donald A. Schön: *Organizational Learning II*, Addison-Wesley, 1996, ISBN 0-201-62983-6; Chris Argyris: *Knowledge for Action. A Guide to Overcoming Barriers to Organizational Change*, Jossey-Bass Wiley, 1993, ISBN 1-55542-519-4;

<sup>6</sup> Prittwitz, Volker von 2016: <http://diberlin.info/governance%20plus.htm>;