



# On the Identity of Problem Domain

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## Abstract

By analyzing some thoughts and viewpoints of scientific philosophers such as Popper, Lakatos, Kuhn, and Laudan, this paper thinks that abstract theory and concrete theory constitute the problem domain. Abstract theory evaluates the legitimacy of the problem, and concrete theory evaluates the difficulty degree of the problem. The comparison of the legal degree of the problem and the difficulty of the problem is only possible in the same problem domain. Popper believes that the problem domain is the same in practice. Lakatos, Kuhn, and Laudan do not fully agree with Popper's views and give their solutions. Laudan's scheme is relatively reasonable.

**Keywords:** Scientific problem; Problem domain; Identity

## Introduction

The problem domain generally refers to the field where the problem is located, such as the problem in the field of physics, the problems in the field of chemistry, etc. From the perspective of problem generation, the problem is generated under a certain field and thus it exists in this field, that is, the knowledge in this field is the background knowledge of the problem generation. The background knowledge is mainly composed of abstract theory and concrete theory [1]. Therefore, in this sense, abstract theory and concrete theory and their composition scope constitute the problem domain.

### Background knowledge of problem generation

In the history of philosophy of science, Lakatos believes that science is a rational activity of empirical prediction based on a certain scientific research program. Scientists carry out research work under a certain scientific research program at a certain time. Otherwise, scientists will not be able to carry out scientific research, raise scientific questions and answer scientific questions. In short,

a research program consists of hardcore and protective belts [2]. The role of hardcore and protective belt is different. Hardcore is the essential feature of the research program, which mainly constitutes the basic principle or core hypothesis of the research program, and it is generally not questioned. The protective belt is mainly a series of auxiliary assumptions, including some theories assumed in the observation and experimental results or the basic assumptions as the initial conditions, which can be raised at any time and can be overturned at any time. In my opinion, the "hardcore" of the scientific research program is the abstract theory, and the "protection belt" is the concrete theory in the theoretical series. They are collectively called background knowledge and constitute the context in which problems are generated.

In the history of philosophy of science, according to Kuhn's view, the paradigm consists of two parts: one, as the conceptual framework of abstract theory, it presents as a collection of beliefs that the research members of a specific community share values, beliefs, technology, etc.; second, as the concrete theory, it refers

to the specific puzzles answers (examples), that is, the solution to the model problem [3]. That is, in this sense, the paradigm is the common background knowledge when the scientific community conducts scientific research, and such background knowledge is the background of the problem generation.

For Kuhn, the conventional problem lies in the paradigm, the presentation and selection of conventional questions depend on the paradigm. Abnormal problem may be temporarily unanswered in the scope of the existing paradigm. Unconventional problems are scientific crises caused by the accumulation of abnormal problems, which the paradigm must face but cannot solve. New conventional questions are questions that can be answered in the new paradigm. The unconventional problem and its solutions lead to the scientific revolution. In this sense, the process of scientific development is from conventional problems to unconventional problems, and then to new conventional problems. After the scientific revolution, the scientific community will engage in new activities under the guidance of a new paradigm, until a new crisis appears and the new scientific revolution occurs again.

In the history of philosophy of science, according to Laudan's view, the research tradition mainly consists of two parts: one, an abstract theory which is mainly represented by the assumptions of metaphysics and methodology; second, a concrete theory that constitutes the research tradition [4]. These are collectively referred to as background knowledge which is the background of problem generation. Laudan believes that the research tradition is a set of assumptions, including the assumptions of which basic entities exist in the world, the assumptions of how these entities interact, and the assumptions of the appropriate methods used to form or test the theory of these entities.

To sum up, the abstract theory and the concrete theory and their composition scope constitute the problem domain which is the background knowledge of the problem generation. Since the background knowledge of the problem generation is the problem domain that consists of abstract theory and concrete theory, in the cause of seeking scientific knowledge or acquiring scientific knowledge, how can the identity of the problem domain be obtained in natural science?

### **Background knowledge is "Falsifiable"**

In the history of philosophy of science, Popper believes that the background of problem generation is objective knowledge or "world 3". Such background knowledge has the widest consistency and identity, which provides objective reasons for the generation of problems. At the same time, he believes that such background knowledge has two features, that is, the essential fallible and the practical uncritical. The brief reasons are given as follows:

World 3, as a problem domain, provides objective reasons for problem generation. Popper believes that the background knowledge of problem generation is objective knowledge or world 3. We always choose our problems in the context of the third world; this context includes at least one language, which always incorporates many theories in the structure of its usage, ... this context includes the assumptions of many other theories, at least

temporarily uncontroversial; problems arise only in this context [5]. In this context, the problem usually arises from a conflict between two aspects, on the one hand the inherent expectations in our background knowledge, on the other hand certain new findings, such as our observations, or some assumptions suggested by the observations [5]. Although the facts themselves do not raise their own questions, however, it is easy to misunderstand that we ask questions to nature, which means that the questions raised have no objective basis [6]. In this way, because the background knowledge of inherent expectations can be objectively, exists in the world 3, new findings that new observation or observation suggests some assumptions can be objectively, exists in the world 3 or world 3 new "component", thus the conflict between the two is objective, is the conflict between the components, and the problem and its generation is objective, namely the world 3 is the background of problem generation, provide objective reasons for the problem generation.

Is this background knowledge certain? Because even if this background knowledge is objective, it is not necessarily correct, unsuspected or uncritical. Popper stated: While discussing a problem we always accept (if only temporarily) all kinds of things as unproblematic: they constitute for the time being, and for the discussion of this particular problem, what I call our background knowledge. Few parts of this background knowledge will appear to us in all contexts as absolutely unproblematic, and any particular part of it may be challenged and any time, especially if we suspect that its uncritical acceptance may be responsible for some of our difficulties. But almost all of the vast amount of background knowledge which we constantly use in any informal discussion will, for practical reasons, necessarily remain unquestioned; and the misguided attempt to question it all--that is to say, to start from scratch--can easily lead to the breakdown of a critical debate [7].

It can be seen that Popper believes that the background knowledge of problem generation has two alities, that is, essentially wrongability and practical uncritical. It is essentially wrongability because any part of the background knowledge from which the problem generates can be challenged at any time, and thus there is the possibility of adjusting or correcting any part of the background knowledge; it is practically uncritical, because if the background knowledge should not be treated as certain, unsuspected, and uncritical, then scientific research will not be sustainable, so that Popper believes that the background knowledge of the problem should be certain. That is to say, the generation of problems is under certain background knowledge. Although such background knowledge is staggered and adjustable, almost all of them must remain undisputed due to practical reasons.

In this way, Popper answered the question of how the objectivity or "intersubjectivity" of the problem and the identity of the problem domain are obtained in scientific research. It is guaranteed by "World 3" as the background knowledge generated by the problem, and it is asked under the common "World 3". Popper's "World 3" theory provides a perspective for evaluating the objectivity of the problem or problem generation in the process of scientific research, that is, using the background knowledge of problem generation

such as objective knowledge and scientific theory to evaluate the objectivity of problems. But is the background knowledge uncritical in practice?

### Is the background knowledge uncritical in practice?

Popper believed that the background knowledge, i.e., World 3 is only objective, extensive and essentially errable, but not historical. In Lakatos's view, at the key point, Popper attributes the auxiliary hypothesis to unproblematic background knowledge. Popper believes that the background knowledge is practically uncritical, except when we suspect that some of our difficulties are caused by uncritical acceptance of them. However, this "practical" reason is not sufficient, because such background knowledge may also be uncriticized in one time for "practical" reasons but may be criticized in another time.

In short, Popper, on the one hand, believes that from practical consideration, the objectivity and legitimacy of the problem are guaranteed; on the other hand, the background knowledge generated by such problems can be wrong at any time. If the background knowledge can be wrong at any time, then the problems generated by such background knowledge can be wrong at any time. This is obviously inconsistent with the history of science and the actual scientific knowledge activities.

So Lakatos believes that Popper's view should be limited. We cannot link and include all background knowledge in our critical deduction model; this process must be gradual. At any given time, there must be an agreed boundary [8]. The following is a specific analysis of how Lakatos, Kuhn and Laudan restricted this approach, that is, the condition of the same problem domain.

### Conditions of the Same Problem Domain

First, Lakatos's scheme. Different from Popper's view that any part of the background knowledge of problem generation may be challenged at any time, according to Lakatos's view, the background knowledge of problem generation should be limited as follows:

- I. In the scientific research program, the background knowledge are abstract theory and a series of concrete theories;
- II. The hardcore of the theory will not be questioned and criticized when the program is in progress;
- III. Specific theories can be questioned or criticized, if and only if, they are replaced by means of Delicate Falsification. In this way, although the background knowledge generated by the problem is errorable in essence, this restriction can ensure the normal progress of scientific research without being in the tension of Popper's "falsification" at any time.

However, how does a scientist or the scientific community acquire such background knowledge? Popper and Lakatos did not analyze this in depth, but Kuhn argued. If Lakatos first proposed that scientists conducted scientific research under a scientific research program, it can be said that Kuhn first proposed that the scientific community conducted scientific research under a paradigm. Kuhn opened up a new direction in the study of scientific problems, because he noticed the relationship between the problem and the subject of scientific activities, and the discussion of the

subject of scientific activities developed from the individual level to the collective level of the scientific community. By introducing the research results of the history of science and the sociological research methods into the philosophy of science, he pointed out that science is a rational research process of the interaction between a scientific community (or paradigm) and a specific objective object. According to Kuhn's view, the scientific community study of nature or a certain field of nature is guided by a certain paradigm, under the guidance of the paradigm. The abnormal only appears in the context of the paradigm [3].

Second, Kuhn's scheme. Kuhn believes that scientific development is the unity of continuity and discontinuity, and the science in continuity stage is conventional science, which is dominated by the paradigm. Science in periods of discontinuity is the period of scientific revolution, which is the formation of a new paradigms and the change of the old and new paradigms. In this way, Kuhn answered the reason that the background knowledge generated as the question is effective in scientific research, although it is wrong in nature. Because the scientific community uses the paradigm as the common background knowledge, until such background knowledge fails, new background knowledge or new paradigms arise. Popper's World 3, as the background knowledge of problem generation, is only objective and extensive, not historic. Different from this view of Popper, Kuhn defines the background knowledge as the generation of the problem. It is a paradigm with continuity, discontinuity and historicity, in order to be more consistent with the history of science. It is also different from Lakatos because the scientific research program does not specifically discuss the situation of problems and the scientific community [9].

According to Kuhn's view, the background knowledge of the problem generation should be limited:

- I. The scientific community conducts scientific research under the guidance of the paradigm as the problem domain;
- II. As the paradigm of the problem domain, abstract theory is embodied in the whole of beliefs, values, technologies, etc. shared by members of a specific community; concrete theory refers to the empirical theory used in specific puzzle solving (examples).
- III. Obtaining the paradigm through professional education.
- IV. Changing the old paradigm as the new paradigm through "Scientific Revolution". But Laudan is negative about the view that Kuhn's paradigm and the hardcore of Lakatos's research platform are not allowed to fundamentally change.

Third, Laudan's scheme. According to Lakatos, although the background knowledge of problem generation is misplaced in nature, it is not misplaced at all times. When a scientific research program exists, such background knowledge cannot be mistaken, unless the scientific research program is replaced. When the replacement of the scientific research program I to the scientific research program II occurs, the scientific research program I can be wrong, and the process of specific theoretical transformation is achieved through "Delicate Falsification", ensuring that the scientific

research program II is essentially wrong, but it will not be suspected in this period. According to Kuhn, such background knowledge is achieved through “example” learning. When Scientists enter the scientific community and participate in scientific research, they are under the guidance of “paradigm”. Under the paradigm I’, the scientific community does not doubt that the paradigm I’, namely, the background knowledge of the problem generation. It is constant during this period. In the process of paradigm I’ transformation to paradigm II’, it is achieved through the scientific revolution, and the scientific community working in the context of the paradigm II’ will not question the paradigm II’.

Laudan criticized the paradigm and research program, especially towards the view that “paradigm” and “hardcore” are solidified. He made a meticulous and flexible treatment and emphasized the role of reason and evidence. For the identity of the problem domain, according to Laudan, the following restrictions should be made:

- I. Scientists conduct scientific research under the research tradition regarded as the problem domain;
- II. The research tradition consists of abstract theory and concrete theory. Abstract theory is the metaphysics and the hypothesis of methodology;
- III. Research elements in the tradition can change at any time because of sufficient evidence;
- IV. Combining two or more study traditions into the new research traditions, if and only if, some core elements of each merged research tradition need to be discard (the conditions of study research change).

## Conclusion

In the history of the development of philosophy of science, Popper has answered the question of how to obtain the identity of questions in scientific research. It is guaranteed by the background

knowledge of the World 3 as the question generation, and is asked under the common World 3. Popper believes that the background knowledge of problem generation has two features, that is, essentially fallible and practical uncritical. Lakatos, Kuhn, and Laudan did not fully agree with Popper’s view and gave their own solutions. Laudan’s scheme is relatively reasonable and can be used as a reference condition in the same problem domain.

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## Conflict of Interest

No conflict of interest.

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