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František Gahér and Vladimír Marko: *Method, Problem, and Task* [*Metóda, problém a úloha*] Vydavateľstvo UK, Bratislava, 2017, 192 pp.[1]

Method, Problem, and Task is a recent book on method authored by František Gahér and Vladimír Marko. The book is relatively slim, and this can be surprising in view of the fact that its topic remains rather underdeveloped in the current philosophy of science. Nevertheless, the authors succeeded in presenting an interesting conception of method which is accessible to wide variety of readers from different fields of interests, not necessarily scientific ones. Yet, the book has its drawbacks as well.

The first two chapters (*Introduction* and *The Question of Method*) state the central motives and aims of the book, and describe the plan of the subsequent inquiry. According to Gahér and Marko, the definitions of method that are available in the philosophy of science literature are generally rather unsatisfactory. They often take the form of an ostensive definition, or just describe the ethymology of the term in question (p. 13). Moreover, and this is a crucial point, these definitions suffer from being inapplicable outside the disciplines in which they were developed (p. 10). Since important methodological concepts such as *method*, *problem*, *task* and the related concepts, as explicated in the philosophy of science, were unsatisfactory for the purposes of other scientific disciplines, the latter were forced to come up with their own fundamental methodological concepts in order to be able to keep operating in their competitive environment (p. 11). Due to the growing and deepening interdisciplinarity, there is natural tendency to find a common ground for these particular results; it seems, however, that the philosophy of science is largely excluded from undertaking this project.

The aim of the authors is to provide a definition of method that would both comply with the aims and results reached in scientific disciplines such as AI, program languages, cognitive sciences and contribute to the philosophy of science.

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In chapter *The Question of Method*, the authors map changing attitudes towards the importance of the concept of *context of discovery* in the philosophy of science, which was clearly underrated by leading persons like Reichenbach and Popper. The authors illustrate this claim by a quotation in which Popper maintains that this concept (i.e. the concept of the context of discovery) belongs to the scope of empirical psychology and cannot be an object of logical analysis, in contrast to the closely related concept of context of justification (p. 15). Scales were slightly tilted in favor of the context of discovery in second half of the 20th century, when prominent authors (Gahér and Marko mention Kuhn, Laudan, Hintikka, Nickles) studied scientific progress and mechanisms of scientific discovery, which began to be understood as a special case of the mechanism involved in problem solving.

Probably the most emphasized claim in the book says that a problem is always a problem of a subject who aims at achieving a certain goal. An immediate consequence of this presupposition is that there are no problems without someone who acts with the aim to achieve, reach, change, create, or destroy something. Differences in goals, purposes, knowledge, interests of subjects aimed at obtaining a certain goal lead to another important consequence: the conditions that constitute a problem for one subject do not necessarily constitute a problem for another subject. The key variable on which the main stress of the book is placed is knowledge. Gahér and Marko claim that in order to solve a problem one must alter her own *knowledge*.

How problems arise according to the authors? Simply speaking, there must be (i) a goal-oriented subject. (Let's denote the "subject" Mary). (ii) Mary tries to do something (e.g., she tries to replace a bulb), but (iii) she does *not know* how to do so. Mary is thus unable, at least temporarily, to fulfill her goal – she is facing a problem. When Mary finally acquires all information necessary for replacing the bulb (she *knows* what to do) she faces *a task*. In other words, what Mary actually did, according to the authors, was what all subjects who strive for obtaining a certain goal attempt to do when facing a problem, namely transforming a problem into a task (p. 170). The differences between a problem and a task are stressed repeatedly and in different ways throughout the whole book, but the demarcating line is drawn as early as in the chapters *Problematic and Unproblematic Situation* and *Problem and Task.*

The most extensive chapter entitled *Problem* introduces a number of key notions like *problem space* or *problem representation*, *knowledge space, relevant knowledge, problem solution space*. The *process* of transforming a problem into a task is articulated in this chapter in the following way. We never find ourselves in a problematic situation without having *any* knowledge. Knowledge space consists

of all knowledge that is at our disposal at the moment of problem arising. Only part of it (namely relevant knowledge) is used in order to shape the problem space or the problem representation. The problem space is a way of how we understand or represent a problem at a given time. It consists of these types of element: a) the set of *states* (an initial state, transitional states and a target state), b) the set of *operators* (legitimate and effective procedures of transforming one state into another), c) the set of *local information* (information about the current state and preceding states), and d) the *set of constraints* and *requirements* (simply speaking, the set of constraints and requirements excludes some possible ways that lead us from an initial state through some transitional states to a target state).

Moreover, Gahér and Marko introduce a distinction between *abstraction* space and *execution* space (p. 39). The need for this distinction becomes clear once we realize that we often deal not only with simple problems or tasks, but also with *complex* or *hard* problems and tasks (pp. 32-33). These kinds of problem often involve several problematic segments including a multitude of stages opened to different types of operators or are such that their execution is in some sense very difficult, time-demanding etc. *Planning* at the level of *abstract* space often includes *simplification* in the sense of eliminating marginal, or minor, tasks or subproblems and focusing on the main ones. If the abstraction level is not divided into several stages of abstraction (it depends on the strategy accepted by a solver and the nature of a problem), then the solution of the problem proceeds at two different levels. The problem is initially solved at the abstraction level and this solution is subsequently tested at the execution level.

The second half of the book is focused on the notions of task and method. The reader can now see the demarcation line between task and problem more clearly. According to Gahér and Marko, tasks and problems are structurally similar – both can be presented as consisting of the sets of stages, operators, local information, constraints and requirements. Both can be simple or complex and both can be initially planned at the abstraction level, then projected onto a lower level and finally executed. The key difference concerns the subject whose knowledge space, in the case of task, includes information about how to transform an initial state into a target state.

It is natural to expect that methods can be applied repeatedly at different times and places and that they produce the same type of result in the same type of situations. Therefore, procedures, as realized in particular circumstances, which happens especially in the case of complex tasks, are not good candidates for being methods. This is because procedures occur in rather unique conditions that are very unlikely to repeat. In relation to these considerations, I find very interesting the

part of the book in which the two related concepts of *generic task* and *generalized task* are introduced (p. 109f). Generic task is an *elementary abstract scheme* and represents a *pattern* of how to achieve goals of a specific type (e.g., classification, comparison, evaluation of objects). Generalized task is an abstract scheme that consists of several generic tasks (e.g., classification *and* evaluation). If someone tries to fulfill a complex task, she should a) decompose it in order to b) get subtasks and then c) identify relevant generic tasks. The subtasks are then d) organized in order to accomplish the complex task in accordance with certain constraints and requirements.

The need to accomplish specific types of generic tasks is related to certain conditions that are specified by *production rules* which are conditional in their form: IF (some conditions obtain), THEN (accomplish this procedure). The "IF" is followed by a sufficient condition, or a set of conditions that together constitute a sufficient condition for applying a particular procedure specified after "THEN".

Now it should be clear that the authors refuse an understanding of method as a way of solving problems or a *manual* (the readers may find a refined view of method as a way of solving problems in Zouhar, Bielik & Kosterec 2017). Using a method is always related to a solver who has certain motivations, preferences etc., and to a particular situation. These two elements are often so unique that the view according to which method is simply some kind of manual applicable in specific circumstances would lead to a *proliferation* of methods, and consequently to diminishing their value. Moreover, the authors deny the widespread opinion that we produce and learn methods in order to solve problems. According to them, problems occur if and only if there is a goal-oriented subject, and a proper method that could be used to achieve the goal is absent (p. 123). The existing methods, generic tasks, or abstract patterns are results of transforming problematic situations into unproblematic situations.

The above considerations lead the authors to the conclusion that scientific work is – at least at the stage of developing "normal science" – largely a routine enterprise. Scientists use well-tested methods in order to achieve desired goals. Regarding the criteria of *being scientific* that are applicable to methods, the authors believe that they are historically dependent and therefore not absolute. Nonetheless, they add that method must meet some minimal requirements in order to be truly scientific: every transition from one stage to another stage, when moving in a problem or task space, should be governed by warranted rules that represent a causal or some other kind of universal relation. In comparison to a simple manual in which many connections between states of executing a task are left unpronounced for practical reasons, a scientific method should be open and transparent and based on

explicit and accessible reasons. This last feature is related to the *predictive* and *explanatory* power of scientific method – each state of a task (except for the first state and the last state) should be identifiable as a consequent *and* an antecedent of another state of task (pp. 140f).

The last chapter of the book deals with method from more formal point of view, but formalism is reduced to a necessary minimum. The conceptual apparatus of the book is enriched here with new notions, mostly those originated by Tichý, and we can even see traces of his influence at the level of literary style. The authors describe sentence meanings as procedures. Procedures have results. One can understand a sentence (i.e., know which procedure it expresses) without knowing the result of the procedure. If one wants to know what the result of a procedure is, she can express her *cognitive attitude* toward the result by a question. And, finally, orders are impulses to achieve, realize or find results of procedures. In other words, orders are impulses to perform methods in order to obtain results. In contrast to other abstract entities (e.g., sets, numbers etc.), method is a kind of procedure that can be an object of *conative* attitudes of subject. In other words, their execution leads to results that can be not just abstract entities but also space-time objects (statues, buildings, etc.) Orders can be more or less specified. If orders are spelled out in great detail, an agent cannot but execute *the* procedure expressed by the order without taking the liberty of carrying out some free steps of her own. In the case of less specific or more general orders, an agent must choose from a class of *functionally equivalent* procedures that are similar in leading to the same result.

The book is written in a readable style. Gahér and Marko succeeded in developing an original conception of method that integrated the results obtained in many different scientific disciplines. Apart from introducing their own notions, the authors use terms that already are in circulation in other fields of inquiry. The reader can find in the book a lot of illuminating illustrations and examples. That is why the book is accessible to wider audience.

There are some drawbacks in the book as well. Apart from the syntactical and grammatical ones, the list of contents (p. 3) does not capture the actual structure of the book. The names of each chapter and subchapter are provided but their order is sometimes switched. Furthermore, on pp. 40-43, the authors present a distinction between *objective* and *subjective* problem space, and remind the reader that the expression "objective" characterizes a *type* of problem space (i.e., a type of *representation* or *model* of problem) and is not used to suggest that problems exist *independently of subjects* (p. 41). But few pages below (p. 46), the objective problem space is described (in contrast to the subjective problem space) as a *real* one. This

comparison does not seem to be correct because both the objective and the subjective problem space are representations and as such they do not differ ontologically, but rather epistemologically. While the objective space always involves solution and all possible trajectories from initial state to the target state, the subjective space does not.

The above errors are minor. They can cause a little confusion but careful readers can cope with them easily. The book offers a lot of insightful considerations, and that is why it can be recommended to every reader who is interested in the methodology of sciences.

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References

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