UMBRELLA MODEL OF INQUIRY AND THE DYNAMICS OF SCIENTIFIC PRACTICES

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Scientific research can be conceptualized in various ways. One challenging way is offered by Sintonen in his umbrella model of inquiry. In this paper, I will describe his model, and discuss its possible implications to the dynamics of scientific practices, paying a special attention to the nature of dialogue.

The umbrella model of inquiry (UMI) gives an account to analyze research work, its organization, and the emergence of research problems within both basic and applied fields. The UMI offers a tool to question the traditional classification of research work within the domain of science policy. Namely, the dichotomy between basic and applied research is problematic in the light of the core idea of the umbrella model: inquiry is search for answers to various types of questions. The UMI is rather flexible model and it can be understood differently depending on the types of answers (admitted as answers in the questioning process) and on the dialogue partner (whether it is the Nature, fellow scientists, one's tacit knowledge or a database etc.). This flexibility plays a central role when discussing how the UMI is integrated in scientific practices.

There are two possible interpretations of the UMI. First, it can be seen as a "game against Nature", in which the inquirer tries to discover a suitable theory by subjecting nature to an array of questions and deriving theory from nature's answers to these questions. Second possibility is to consider the process from the other way around: The inquirer assumes, if only tentatively, a theory T, and explores its explanatory power by attempting to derive answers to some pertinent questions. In this case, the inquirer keeps several theories in mind and assesses the question–answer-power of rival theories (Sintonen*: 473-4). These cases are reconstructed in Sintonen (1990) where he discusses the classification of basic and applied research in the light of the UMI.

In the case of basic research, the umbrella consists of autonomous theories, which structure their problem areas: in the case of applied research, the umbrella consists of questions raised by non-cognitive criteria. In both cases, the questions guide the formation of knowledge. As Sintonen defines: "Research, both basic and applied, is systematic, goal directed activity which can be represented as questioning-answering process" (p. 28). Questioning-answering

process is by nature fairly dynamic; the theoretical umbrellas gather applied questions underneath them, and the other way round: purely applied questions transform into smaller and detailed subquestions that are theoretical by nature, as depicted in Figure 1.

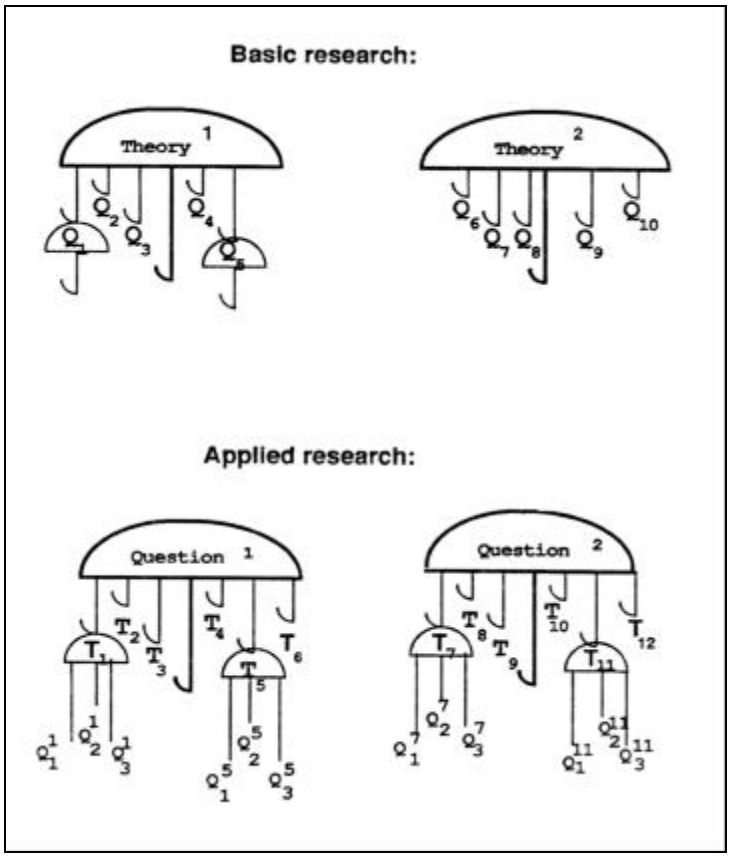

Figure 1: The Umbrella Model of Types of Inquiry (Sintonen, 1990).

The UMI focuses on the level of generality of research questions: basic innovations have starting point in descriptive and explanatory *how*- or *why*-questions. Sintonen considers ecology as an example. The question “How can one prevent algal blooms?” is practical, applied question, which is transformed into smaller and theoretical questions during the research process. Thus, it can be stated that theoretical model or set of theoretical questions has the potential to be developed into practical application. Analogously, an inquirer in an applied project can phrase research questions that are theoretical by nature.

The UMI offers a possibility to either explore the logic of interrogative model or to take a perspective on scientific practices composed elementarily of questioning-answering process, as suggested by Jardine.

Jardine (1991) has developed the idea of inquiry as a process of proposing “questions to the nature” as an attempt to overcome the contradictory attitudes, such as internal and external, intellectualist and praxis-oriented, individualist and collectivist, to the sciences. He suggests that there need to be new focus on questions rather than answers. According to Jardine, “a shift from doctrines as questions as primary focus of concern can, I suggest, yield a historiography capable of integrating the study of social and institutional practices of the sciences with the description and explication of their contents” (p. 77). This integration takes place in the dialogical process of questioning. To understand this in a wider framework, we can discuss three meanings of dialogue proposed by Miettinen and Hasu (1999). First, dialogue can be analyzed as an epistemological and methodological principle in order to overcome the problem of objective knowledge. Second, research process itself can be seen as a dialogue when focusing on the communication between researcher and scientists, engineers and possible practitioners. Third, dialogue can be regarded as an approach to study language use and talk in social practices. The dialogicity, understood in the second sense, supports the idea of proposing questions to fellow researchers as scientific method (Sintonen, 2001). He states that dialogue can be understood as a two-dimensional method: it can aim at proposing questions to the nature and to the fellow inquirer. This two-dimensionality is a possibility to overcome relativism related to constructivist approaches to science, namely to the claims that nature is constructed by scientists in the laboratories (Sintonen, 1996:133).

Dialogue has metaphorical sense, as Sintonen (2001) formulates questions to the nature and questions to fellow inquirers are as well research methods as metaphors of dialogicity. However, dialogue is a problematic metaphor in the context of the UMI, for power-relations (like inquirers power to pose questions to the nature), and subjection of the nature are present in the Baconian concept of scientific method (e.g. Lacey 1999:68). Furthermore, dialogue requires intentional agents as partners of discourse; thus the nature cannot be considered such agent. I argue that inquiry, as a process of putting questions to the nature does not fulfill the characteristics of a dialogue. In the contrary, dialogue in the Bakhtinian sense can be described by the following elements: there is the third present in the dialogue; dialogue is activity itself; and it is not a means to understand the human nature, but it is a way to form the human nature both to itself and to others. (Bakhtin 1991: 358). Moreover, Bakhtinian dialogue implies the mediatedness of action that is well presented by the cultural-historical theory of activity. Dialogicity is present in scientific practices, which are formed and sustained in the

process of inquiry and consist of historical and normative elements. These characteristics provide the dynamical nature of practices.

Mediatedness is defined by the cultural-historical theory of activity. Vygotsky has argued that human consciousness and action are always mediated by cultural means, signs and tools, which constitute sets of local instrumentalities. In addition, artifacts are inseparable and integral components of human functioning. Activity is also socially mediated: it takes place in communities and is also mediated by division of labor and rules. (Engeström 1999, Lektorsky, 1984:7; Leont'ev 1978, Miettinen, 1999:173, Saari and Miettinen 2001:303-4). Furthermore, Rouse underlines the normativeness of scientific practices, which means that actors share a practice, if their actions are appropriately regarded as answerable to the norms of correct or incorrect practice (2001:190). If research is understood by the framework of scientific practices characterized by normativeness, historicity and mediatedness, we can evaluate how values are embedded in the scene of inquiry.

Sintonen proposes two groups of values that are present in the scene of inquiry. He explicates this, quoting Bromberger (1984), that there are two types of values, which might accrue from answers to basic questions, *gosh value* and *cash value*. "Gosh value is a measure of the intellectual pleasure we derive from coming to know the answer, whereas cash value is a measure of the material benefits an answer puts at our disposal." Sintonen suggests that the flourishing of basic research is partly a result of "a happy coincidence in which individual inquirers' maximization of gosh value and institutional maximization of cash value produce outputs that benefit both" (p. 26). However – mediated, historical, and dialogical nature of scientific practices embeds variety of values intervening in the process of inquiry. If the sociological aspect of 'questions to the fellow inquirers' is present, we cannot avoid the presence of background assumptions of the members of scientific community in the research process. As Longino (1990) states, these elements are present and influential in the research practices. Supposing only two groups of values (gosh and cash value) is too narrow description of the set of values affecting science. The social and normative elements are present in the dialogue between fellow inquirers: to discuss possible applications of theoretical discoveries form a pattern with both value-laden and epistemic elements. The UMI, however, regards "questions to the nature" (if understood in the biological sense), as a domain of entirely non-normative questions.

Value-ladenness is present also in Jardine's account of inquiry, which can be read as a formulation of a possible vision on scientific practices: "The time has come for scientists to break with science. What started life as a creative program, liberating inquirers from limited scenes of inquiry, has become itself a limitation on scenes of inquiry. Freed of the mythology of science, scientists might become more perceptive of their varied practices and of the workings of their own social and political institutions. They might recover their lost literary and aesthetic consciousness. They might re-engage in historical reflection. Then we should surely see a wonderful proliferation and enrichment of the sciences and of the lived experience of all who partake in them (p. 238)." Jardine invites inquirers to consider all aspects of life possibly as present in the research process. This implies the presence of value-laden elements, both in the process of pose questions to the nature and to fellow researchers.

As a conclusion, I argue that the UMI offers one way to understand the dynamics of scientific practices; it considers research as a process of putting questions to the nature (which can be understood differently). However, scientific practices occupy a wider niche in the domain of research than the one offered by the questioning-answering process. They can be considered historically variable, dynamic, mediated, and normative, which is characterized by the dialogicity. This conception of scientific practices is only partly supported by the UMI. Although the UMI promotes the centrality of questions in science, it ignores the restricting categories of basic and applied research, and describes the active nature of inquiry – hence it constructs a useful model for further analysis of scientific practices.

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