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A Microparadigm and a Scientific Microcommunity – Kuhn Revisited

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Abstract

Nearly half a century ago Thomas Kuhn's 'The Structure of Scientific Revolutions' has marked a major turn in understanding the nature, organization and progress of science. Ever since, the concept of scientific community has been undergoing some profound changes. As of today, it has become extremely diluted, both in terms of boundaries and ways of operating.

In this paper I put forward a concept of a scientific microcommunity, accompanied and concurrently created by an adequate microparadigm. This approach derives from the very roots of the whole revolution – Kuhn's theory of paradigm, yet aims to resolve some of the accusations made towards it as well as addresses a number of problems stemming from more contemporary conceptions of science (represented here by the situated cognition approach and anthropology of science).

The 'micro' prefix does not reflect only upon a size or level of analysis. It also allows to account for all the regular scientific activities and modifications that occur regularly within a few paradigms, but do not lead to a total revolution. In consequence, it enables to conceive of a fairly balanced, both theory and problem driven scientific processes, in which communities are established as closely bound to micro-models of the world, but at the same time remain flexible and open.

Keywords:

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Thomas Kuhn's 'The Structure of Scientific Revolutions' and the collective turn in the science studies

Although it may now seem that scientific practice has always been regarded a collective activity, it was Thomas S. Kuhn and his *The Structure of Scientific Revolutions* that fully acknowledged of that fact. Up to that point scientific development was widely considered in terms of a strife for the objective truth and reality; a process in which every discovery is based on the previous ones. Consequently, science appeared as the most successful and rational of all cognitive processes, while scientists as enlightened individuals making use of their special cognitive skills and a set of precise, effective methods.

Kuhn objected to such a 'development-by-accumulation' stance and introduced a vision of irregular, total shifts which every time led to incommensurable ways of seeing world and practicing science in it. Yet, what is most important, he introduced the notion of paradigm and took notice of a collective nature of scientific practice. For Kuhn's scientific community cannot operate without a paradigm, while a scientist out of any community (and without a paradigm) ceases to be one. Thanks to a paradigm, community members can choose these problems which are researchable and do not need to deal with the whole universe. At the same time, they refute these issues which do not come along the paradigm. Moreover, community members accept both verbally explicit rules and the tacit knowledge[1] within a paradigm. Studying a paradigm consists of solving numerous tasks and exemplars which allow to get acquainted with the non-verbal component and join the community, which used to learn their trade by the same means.

Hence, at first glance, Kuhnian paradigm and community appear to be inseparable: 'A paradigm is what the members of a scientific community share, *and*, conversely, a scientific community consists of men who share a paradigm. (…) Scientific communities can and should be isolated without prior recourse to paradigms; the latter can then be discovered by scrutinizing the behavior of a given community's members.' (Kuhn 1970: 176).

However, a vicious circle in explaining these two concepts can be avoided if a paradigm is understood in a narrow sense, that is as a certain tradition which, on the one hand, provides scientists with a set of rules on how to choose and analyze objects of research, and, on the other hand, imparts adequate methods and criteria of effectiveness[2]. This way, paradigm remains ontologically previous to a community (these are the scientists that group around a certain paradigm), but, in epistemological terms, the community is

[1]Tacit knowledge is understood here as a range of unwritten and unspoken conceptual and sensory information and images, based on various emotions, experiences, intuition, observations, etc. (Polanyi 2005).

[2]In a wide sense, a paradigm is understood as a disciplinary matrix comprising of symbolical generalizations, metaphysical presumptions, values and exemplars.
In this paper, I will refer to paradigm strictly in a narrow sense, as explained in the main body of the text.

precedent to a paradigm (a paradigm can be delineated once the group is established; Jodkowski 1990).

Criticism and Kuhn's response

Kuhn's ideas immediately received some strong criticism from a range of intellectuals (see: Fuller 2000; Hoyningen-Huene 1993; Lakatos, Musgrave 1970; Toulmin 1970). Some of the most severe accusations pertained to the problem of paradigms incommensurability, assumed irrationalism and relativism. Yet, from the point of view of the approach presented in this paper, the most serious drawback to Kuhn's conception is its strong conservativeness.

The course of science as puzzle-solving, with scientists reluctant to delve into any extra-ordinary problems that could threaten group consensus, appear extremely hindering and non-creative. By the same token, the distinction between pre and post-paradigm periods seems way much too schematic and forces to assess social sciences as immature and underdeveloped.

In the second edition of his book, Kuhn does admit that each of the competing schools from the 'early' period shares something alike to a paradigm and, what is more important, that there may occur circumstances under which two paradigms can coexist peacefully in the period of normal science. Furthermore, he states that although in normal science the community is the judge of the solutions elaborated by its members, its unanimity or size should not be overestimated. Communities split into a number of subgroups, each sharing a somewhat peculiar but valid version of a paradigm. Finally, Kuhn accepts the fact that communities may well range from global ones to small entities of around 20 to 30 people.

Thus, the acceptance of a paradigm is no more dogmatic, while the normal science is witness to several, rival schools and minor shifts, not even close to revolutions. Kuhn somewhat acknowledged of that fact: '[I]t need not be a large change, nor need it seem revolutionary to those outside a single community, consisting perhaps of fewer than twenty-five people. It is just because this type of change, little recognized or discussed in the literature of the philosophy of science, occurs so regularly on this smaller scale that revolutionary, as against cumulative, change so badly needs to be understood.' (Kuhn, 197: 180-181).

However, regardless of all the transformations to the original conception, Kuhn never actually made a shift towards collective approach to cognition. His communities consisted of a number of individual researchers, but failed to constitute an emergent, collective entity. He put much emphasis on how groups exerted influence on a researcher, yet neglected their own specific knowledge production processes (see also: Afeltowicz 2012).

A microparadigm and a scientific microcommunity approach

The concept of a microparadigm and a microcommunity is a result of several theoretical transformations to Kuhn's initial conceptions and some empirical research, conducted within a diploma thesis in y. 2011-2012 under a working title of 'A Reception of the Grounded Theory in Poland'.[1] Such approach intents to overcome one of the most serious drawbacks to Kuhn's original findings, that is, firstly, regard social sciences as multi-paradigm disciplines with many and sometimes opposing communities, and, secondly, consider scientific practices as genuinely innovative and problem-driven. Moreover, it enables to sketch a structure of paradigms, which ranges from the ones on the highest level of generality, enormous size and large margin of flexibility, to those of high precision, limited scope and fairly fixed rules.

Hence, there are global paradigms which operate above the discipline boundaries. Subsequently, there are so called base-paradigms which stem from the global ones and are restricted to several disciplines. And finally, there are microparadigms which operate in the area of different problems undertaken within disciplines. The global, base- and micro-paradigms exert different types of influence on the scientific practice and the communities that accompany each of them. Obviously, it is no sooner than a global paradigm gains recognition that base- or micro-paradigms takes ground in science as a whole.

Global paradigms are considered as broad and well-established traditions that influence many scientific disciplines at a time. They provide criteria to make distinction between science and non-science as well as delineate the most basic assumptions of ontological, epistemological and methodological kind. A community around a global paradigm is immensely large. Its members do not know each other in person, have no common specific means of communication. Usually they deem members of another global paradigm community as non-scientists. It seems that in social sciences there are two global paradigms, both of very long traditions and detailed elaboration, that stir much controversy. These are normative and interpretive paradigm.

Base-paradigms serve as elaborations of a global paradigm within a discipline. They give more straightforward rules according to the selection of problems of research and ensure methods and preferred ways of theorizing. The members of a community that share a base-paradigm are mostly aware of this fact and its consequences, such as the need to reach unanimity. Moreover, a base-paradigm research is undertaken in several distinguishable academic centres which at the same time train students to become community members. The base-paradigm community members may be at odds with the members of other base-paradigm communities, yet, as long as they identify them within the same global paradigm, they recognize them as scientists.

[1]The investigation was undertaken in order to check and elaborate several assumptions inspired primarily by Kuhn's work. It was carried out among Polish researchers who used grounded theory methodology in their work. I conducted 12 in-depth interviews and analyzed several written sources (e.g. newsletters, websites content, syllabuses) until elaborating a fairly coherent and credible theoretical frame.

To give a few examples, symbolic interactionism may be seen as a base-paradigm stemming from the global interpretive paradigm, while post-positivism, structuralism and functionalism can be considered secondary to a normative paradigm.

Finally, at the intersection of a number of base-paradigms there are several microparadigms with specific microcommunities. A microparadigm emerges as a detailed elaboration of both selected research methods and adequate assumptions that are granted within a base-paradigm. Consequently, a microcommunity then an entity of a limited size and defined margin of flexibility when it comes to a paradigm application. It operates with its own means of communication, rules of conduct and internal order. Its members share a common conceptual map (stemming from the base-paradigm core and tacit component), education, language, experience, and culture.

A global paradigm can influence a microparadigm twofold. If a global paradigm is deemed non-scientific (and a crisis emerges), it seems impossible to act as a scientist within this paradigm – simply because of an adequate community lacking. Nevertheless, rarely is a global paradigm universally rejected. it may well be already institutionalized in another geographical area. If so, a scientist can simply choose to leave their previous community for a new one. And, once a global paradigm is fully recognized, it almost loses any significant influence on a day-to-day scientific work. Most often it is referred to as evidence of the correctness of a dubious microparadigm.

The same refers to base-paradigms – when considered non-scientific they may eliminate related microparadigms from science at all. But once put on the normal science map, they exert much more influence on the microparadigms than the global paradigms. In this case, a base-paradigm serves for a microparadigm as a kind of Kuhnian's disciplinary matrix, providing a general set of statements, values and methods of research. This extensive basis stands for a core of each related microparadigm – requires further refinement, but under no circumstances should be transformed. Moreover, a base-paradigm serves as a meta-perspective for the members of many related microcommunities. It allows to run large-scale projects which apply many methodologies and procedures. The members of all microcommunities related to a base-paradigm should be able to identify themselves within this tradition.

How is then a microcommunity is related to a certain microparadigm?

First of all, a microparadigm determines main fields of interest for the scientists that belongs to a microcommunity and recognizes some of their elements as worth attention, and others as insignificant. It does not need to settle the very definite areas, yet it does determine a certain way of seeing the reality. Any problem object is good for a paradigm, but only if adequately perceived, 'carved out' of reality.

Second of all, a microparadigm scrutinizes the methods and techniques of research leaving a margin for preferences and aspirations of the researcher. There is always a set of specific procedures that constitute the core of a microparadigm's methodology and, in consequence, allow to judge the adequacy and correctness of a its application. They are perceived as

fundamental and indispensable and usually stem directly from the base-paradigm. However, there are also some procedures secondary to the core – those which are desirable, but not cardinal. Their application depends on whether a scientist takes the methodology as a research programme or a tool box. The former requires a complete, systematic and versatile application of all the procedures, while the latter admits a more instrumental and partial approach (e.g. using selected procedures together with another methodology, on the condition that they solve the researched problem). The choice is conditioned by individual preferences as well as institutional and tacit exigencies of an academic centre. For example, mixing selected procedures from two methodologies allows to comply with some more general standards applying to the size of the sample or amount of data analyzed. These may not be explicitly formulated, but become apparent in doctoral thesis and 'internal', unofficial peer reviewing.

Then, a microcommunity is usually composed of at least a couple of academic centres which are characterized by a relative acceptance of the fixed components of the microparadigm. Not all of them need to treat the microparadigm in terms of a research programme – provided that they agree on the core procedures, the rest relies upon a specific situation of the centre. Furthermore, some major issues discussed on the level of base or global paradigms may gain ground in a microcommunities daily practice, depending on its size, circumstances in which it operates and its planned cohesion and progress.

Usually a network comprising one chief and several dispersed centres emerges. The chief centre gains the status of a leader thanks to its theoretical comprehension and innovative applications of the microparadigm as well as managing the area of communication inside and outside the network. It becomes an expert for the professionals, a destination for the potential followers and the spokesman for institutions.

Each centre usually has their own, local 'guide', who plays crucial role in introducing new adepts and teaching them 'into' the tacit knowledge as well as grounding the local group of microcommunity members within an institutional structure of the centre.

All academic centres that form a microcommunity need to have an institutionally grounded career path within a microparadigm. A complete career path may well emerge solely in the chief centre, while the dispersed centres only need to ensure their potential members with a PhD within a microparadigm. Then, further career steps can be closer to a base or global paradigm instead of a rather precise, limited microparadigm. It means that a scientist can continue to be a member of a microcommunity, but needs to situate their work within a larger tradition.

Generally, the size of a microcommunity should allow to discriminate it from a wider context and other micro- and base-paradigms and allow it to maintain necessary group cohesion and conceptual homogeneity. However, its borders are never fixed, while membership remains open – it is rather based on shared practices and interests than values or norms. The ultimate principle to

establish a membership is an act of a self-identification by a scientist, and the fact of being recognized as a community member by others.[1] It is feasible as microcommunity members usually maintain direct interpersonal contacts between (at least) some scientists and their centres as a whole, of both formal and informal kind.

Moreover, a microcommunity is capable of performing a fairly concise strategy of communication. Again, it is usually conceived and implemented by the chief centre, with the dispersed centres playing a secondary yet effective role. When directed inward the network, the communication strategy aims to settle some shared criteria of judging the adequacy and correctness of a paradigm's application. It is also set to foster integration, mainly by holding regular workshops and conferences. When directed outside the network, the communication strategy aims to somehow 'tame' and acquaint the members of other communities with the core of the paradigm and at the same time try to attract the not-yet-fully-fledged scientists so that they can easily become new followers. In other words, the external communication aims to disseminate basic knowledge of the paradigm (so that weak examples of its application are pinned down to a researcher, not the paradigm itself) and solicit new members.

A change of a microparadigm is a microrevolution which makes a bearing on solely a part of scientists belonging to a larger community. The microrevolutions often result from subtle yet influential transformations to the tacit knowledge. They need not lead to a major revolution in the normal science.

To conclude, a microparadigm – as every kind of paradigm - consists of a set of fixed components of ontological, epistemological and methodological nature. The 'micro' prefix only indicates the fact that microparadigms and microcommunities tend to be fairly precise and rigid (both in terms of group behavior and the acceptance for theoretical discrepancies). They stem from the very practice of collective knowledge production and tend to refine the more general rules and procedures from the base-paradigm exactly to that use – everyday scientific work. At the same time, they operate within larger communities sharing some base-paradigms and being surrounded by several different microcommunities and microparadigms. For this reason, every microcommunity has to be analyzed in a way that encompasses two standpoints – of individuals with their own rules of conduct and interests, and of a collective which exerts control and establishes its conceptual and operational borders.

[1]In this matter, a microcommunity resembles to some extent 'an actor constellation' of Jurgen Glaser (Glaser, 2001). Both notions put much emphasis on the fact that they are delineated from their surroundings thanks to their members overlapping interests and action potentials. However, the microcommunity approach puts more emphasis on the role of tacit knowledge and shared beliefs that solely practice.

New approaches – 'scientific communities' in situated cognition and anthropology of science

Last but not least, I will briefly present two of more contemporary conceptions of how science works – situated knowledge approach and anthropology of science (mainly Actor-Network Theory and Knorr Cetina's works). They were selected as one of the most influential ones in contemporary philosophy of science and, at the same time, most challenging to the idea here presented – a microparadigm and a microcommunity approach.

The first broad and versatile tradition in contemporary philosophy of science that requires consideration in this article is a so-called situated cognition. Following the stance taken in Cambridge Handbook of Situated Cognition (Robbins, Aydede – eds. 2009), cognition should be considered it terms of an embodied, embedded and extended activity. It is stated that every cognitive process is situated within a specific context of certain circumstances, problems and tasks to perform. A community ceases to operate as a cognitively homogenous subject; instead it is replaced by specific cognitive systems. In these systems human beings are disposed of their autonomous, central place. The system as a whole is established specifically to solve a certain problem and consists of entities with their own, unique cognitive perspectives and knowledge resources which are far more extensive than what one has in their head. Each cognitive action requires application of all the resources available, including other people with their knowledge and experiences as well as technological appliances and different material and symbolical objects, artifacts.[1]

A somewhat different stance is taken in the conceptions known under the name of anthropology of science[2]. They are characterized by a focus on laboratory practices and technologically-oriented activities instead of the analysis of theories or methodologies. Science is considered here both as a product (a specific, yet not privileged, kind of knowledge) and action (a distinct conduct and research practices). Consequently, the scientists do not need to prove genius to be successful; all they are after is a laboratory which enables to reduce the complexity of the world by 'carving' an object out of the reality. Similarly to the situated cognition approach, according to anthropology of science a cognitive collective consists of individuals as well as cultural, technological and material elements and the interactions between them all.

[1]As Heyligen, Heath and Van Overwalle state: 'Distributed cognition (…) framework is based on five fundamental assumptions: 1) groups of agents self-organize to form a differentiated, coordinated system, adapted to its environment, 2) the system co-opts external media for internal propagation of information, 3) the resulting distributed cognitive system can be modelled as a learning, connectionist network, 4) information in the network is transmitted selectively, 5) novel knowledge emerges through non-linear, recurrent interactions.' (Heyligen, Heath, Van Overwalle 2004: 1).

[2]In this paper anthropology of science is represented by, firstly, Actor-Network Theory (elaborated by Latour, Callon and Low, but many times particularly identified with Latour only; see: Callon 2005; Doing 2005; Latour 1987, 1993; Latour, Woolgar 2005; Sismondo 2008) and, secondly, works of Karin Knorr-Cetina (1981,1999).

What Latour particularly emphasizes is that facts and artifacts are not only socially constructed – the process of construction involves the use of certain devices while all traces of production are made almost impossible to detect. For him, there is no such thing as a cognitive agent at all. There are only 'actants' which include both humans and non-humans. Actor-Network Theory envisages science as a strife for stable, grounded and fairly large networks of actants tied together by means of consecutive translations. The role that a scientist or a researcher (usually) plays is a spokesperson, who cannot be taken for granted but must speak for other mute actants so that the collective involves both humans and non-humans.

According to Knorr Cetina scientific facts are fabricated in the sense that they are derived from decisions that can be unveiled by finding their alternatives. Previous selections constitute a resource which enables the scientific inquiry to proceed. At the same time, several decisions are made in relation to the expected response of specific members of a community (so-called validators). One of the most controversial ideas of hers is 'the erasure of the individual as an epistemic subject' in high-energy physics (Knorr Cetina 1999: 166–171). The only available epistemic agent is the extended experiment in which an individual is eliminated by means of various collective practices. The general aim is to turn most of the energy for the benefit of the research, not the researches themselves. In the same book, Knorr Cetina states that experiments in molecular biology usually involve a single investigator working with a number of instruments. Accordingly, she does admit that even a single person with an instrument constitutes a distributed cognitive system.

The approaches mentioned above have received a great deal of criticism (see for example: Bourdieu 2001; Fuller 2005; Hess 2011; Giere 2002; Goldman 1999) and, in consequence, have been undergoing many transformations ever since (e.g. Latour 2011). What is most important is the fact that the notion of a scientific community has become so loose and remote that it has almost disappeared. In situated cognition and anthropology of science the scientists themselves no longer possess privileged access to world, while laymen and various material objects with certain desired 'skills' begin to play an important role inasmuch as they all solve a problem, which is at the same time the very incentive for their cognitive activity. Moreover, the concepts presented above tend to focus on the practice of 'hard' science while neglecting the social sciences. It appears that these are technological artifacts and instruments that constitute a core of scientific research, while any scientific collective is of size of a laboratory. Furthermore, it seems that in social sciences all the seemingly abandoned dichotomies (e.g. social vs. natural, human vs. non-human, objective vs. subjective, micro vs. macro) still stir many heated debates and are a base of group differentiation. Finally, being reduced to inscriptions and texts, 'science is then just a discourse or a fiction among others, but one capable of exerting a 'truth effect' produced' (Bourdieu 2001: 28).

The microparadigm and scientific microcommunity approach avoids many of these problems, while others are addressed within it. It enables to take

account of both individuals with their subjective tacit knowledge and material artifacts, all situated within a diverse institutional and technical context. However, the agency and the exact moment of knowledge production must be limited here to human beings and their interactions (with other humans and non-humans). Such a stance still allows to examine science in terms of social practices (or ANT's demand to 'follow the actors'), but resolves the problem of intentionality and sets reasonable limits to what we consider a scientific community and scientific practice. Consequently, the microparadigm and microcommunity approach puts more emphasis on the processes of negotiating the interests, practices and the identities of a scientific community members, especially if we take into consideration the fact that microcommunities are always seen as operating in a wider context composing of several base- and micro- paradigms and their adequate communities. Finally, this large, yet detailed landscape reflects various ideas that still drive conflicts in different disciplines.

Conclusions

The microparadigm and scientific microcommunity approach may serve as a fruitful and effective frame to investigate the while scientific enterprise – its practices, people and results, both in social and natural sciences. It takes notice of the fact that the quest for truth (no matter how successful it is) does impinge upon the organization of science and collective practices. As a result of acknowledging both epistemological and social incentives that lay behind the scientific activity, this approach avoids narrowing the science to political play or technological effectiveness. At the same time, it does not yield the outdated vision of science as a socially autonomous, stable institution with delineated disciplinary structures, but captures it as a flexible, problem-driven, collective activity with elaborated methods of knowledge production and quality control. Finally, this approach takes notice of the institutional frames on par with the material and social context.

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