Identity and Rationality: Towards Normative Cultural Studies of Science

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Abstract: *In traditional epistemology of science, scientific knowledge has been depicted as the result of research process independent of local historical and cultural context. In naturalised philosophy of science, the 'context of discovery' has been taken into account, and even more so in the science and technology studies (STS). The latter provide descriptions of various epistemic cultures without critical analysis, and thus without a perspective for improvement of the scientific practices. In social epistemology, naturalised epistemology is combined with normative critical approach. Helen E. Longino, Joseph Rouse, Kristina Rolin, and others have developed a critical approach which, on the one hand, provides a theoretical account of scientific knowledge, and on the other hand, relates the account with cultural and historical environment of research practice. In my paper I discuss some empirical findings of the project UPGEM (Understanding Puzzles on Gendered European Map: Brain Drain in Physics through the Cultural Looking Glass) with respect to their relevance for normative naturalised philosophy of science. Cultural variation of the physical sciences in national cultures has been studied before from an anthropological point of view by Sharon Traweek. The main goal of the aforementioned empirical research project was to identify the reasons for abandoning a career in science. In the qualitative study, issues like changes in science policy, organisation of work, workplace culture and identity were addressed. It appeared that the scientists' images tend to be largely stereotypical; in Estonia, three stereotypes for physicists prevailed: physicist as a priest of truth, physicist as a blacksmith, and physicist as a playful boy. Those not able to identify themselves with the stereotypes have experienced*

difficulties with fitting in to a particular research culture. The Estonian physics culture has suffered from the poor communication between age groups due to the missing generation. In my current follow-up analysis, I reconsider these empirical results and point out ways how those findings are relevant for normative approach.

Keywords: *epistemology and cultural studies of science, science as a workplace, scientists' identities, stereotypes, transformative criticism*

How is culture relevant for the analysis of scientific rationality?

My point of departure in this paper is in naturalised social epistemology which sees scientific rationality as part of scientific practice. Contrary to the idealised view of science which sees scientist as having a priori rational principles for justifying his/her intuitions for scientific judgements as it was developed in traditional epistemology of science, naturalised epistemology focuses on the real scientific practice. Scientific rationality in this approach is a natural human rationality or hypothetical rationality as Ronald Giere (1988, p. 7) has used the term which simply means effective use of available means for achieving desired goals. Science is a type of activities directed on creating new knowledge about the world. In history of philosophy, scientific knowledge has been conceived either as a result of logical manipulations with passively received evidence, or as response to the scientists' queries to nature/research object. In the naturalised practice-based account of science, scientific knowledge should be seen as a result of the scientists' collective research activities which consist of constructing and manipulating – both theoretically and experimentally – the research objects with research instruments in material reality. Thus, the rationality of these activities could be estimated via the measure of achieved goals. Naturalised epistemology of science aims to understand and explain the choices of actual scientists in their actual practical, social and cultural circumstances instead of trying to formulate general principles of rationality for an ideal scientist as traditional epistemology has been doing. Assuming that such a naturalised epistemology makes philosophy of science closer to the sciences than philosophy in the traditional sense, one might want to call it science of science or theory of science. However, as long as philosophical issues of knowledge-making are addressed, this meta-analysis of science should be regarded as a philosophical activity.

In one respect the difference between traditional and naturalised epistemologies is especially salient – if the traditional epistemology sees the scientists' task to be

providing correct representations of the world in the form of theories and models, naturalised epistemology takes it to be finding the best strategy among multiple alternatives for achieving one's cognitive aim. Only the naturalised approach displays the variety of different solutions to a problem – it is a pluralistic view. Every choice among the alternatives is viewed as rational to certain degree, and each of those is considered worth meta-analysis. In traditional epistemology, the only alternatives would be justified, that is, rational choice *vs.* unjustified irrational, since the traditional view is essentialist, seeking rationality as the essence of science while the naturalised approach does not assume science (or knowledge) or rationality to be a natural kind category with a kind-specific essence.

Naturalised epistemology can be developed in various ways: some philosophers have focussed on the psychology of cognitive processes, others have discussed knowledge production in the evolutionary context of human beings – what is common to all these kinds of naturalised epistemology is that philosophy is regarded as a discipline closely related to empirical sciences, the difference between philosophy and the sciences is not one of kind but rather one of degree. My approach belongs to the practice-centred study of science in which research is viewed as an activity, as work in a scientific community which in its turn is related to some wider social environment. Practice-centred account of science is not just providing descriptions of the scientists' goals and goal achieving activities, it includes a normative aspect as well, analysing the possibilities for improvement. Authors like Ronald Giere (1988) and Philip Kitcher (1993) conceive the success and growth of science as an evolutionary process with necessary self-correction mechanisms. Also, Helen Longino has developed an account of science with self-correction mechanisms. Those mechanisms are described in her formulation of the epistemic conditions for assessment of the substantive, methodological and regulative assumptions which rely behind particular scientific judgements. As she assures:

> *The epistemological problem is not determining which of a set of alternatives is always the superior one, but rather specifying the conditions under which it is appropriate to rely on a given set of assumptions. The approach utilizes the social character of inquiry to address this problem. Those assumptions are epistemically acceptable which have survived critical scrutiny in a discursive context characterised by at least four conditions. These conditions are (1) the availability of venues for and (2) responsiveness to criticism, (3) public standards (themselves subject to critical interrogation), and (4) tempered equality of intellectual authority.* (Longino, 2002, p. 206)

In an earlier work, Longino (1990) has characterised these conditions as necessary criteria for transformative criticism. The possibility of transformative criticism, in its turn, is a warranty of objectivity of scientific knowledge. At the same time, it is namely the assumed possibility of transformative criticism via fulfilment of the above conditions which enables one to relate epistemology with the cultural contexts of scientific practice and thus establish the link between the contexts of justification and discovery. It is so because the conditions are, on the one hand, normative prescription for achieving rational and objective knowledge, and on the other hand, they are realised in particular cultural contexts.

The requirement for transformative criticism is a normative epistemological principle. How it is realised in practice in particular cases, is a matter of analysis for cultural studies of science. For example, the existence and functioning of the recognised venues for criticism like public forums qua journals, research conferences and seminars, public degree defences, etc. becomes relevant for epistemological explanation of a scientific judgment. And therefore philosophy of science should be interested in contributing to the sciences and help to find the best ways to organise an inclusive and critical dialogue within a scientific community.

The second of Longino's four requirements for transformative criticism, that of responsiveness to criticism, assumes not only the correction of obvious mistakes but also a response of the wider community to the sciences in the form of public recognition like awards for outstanding work and sanctions in case of fraud.

By the condition of public standards, Longino means the influence of both epistemic and social/cultural values on research activities. The way the scientists' cognitive goals are interpreted and the strategies designed for achieving the goals depends on wider contextual or cultural values and ideologies. The wider contextual values may include, for example, understanding of the task of science in the society, the approved mechanisms of quality assessment (agreement on the merits which count for assessment such as the number of publications in certain period of time, citations, innovations, etc.), interpretation of gender ideologies with respect to the particular science, attitudes towards those, researchers' identity and self-reflection – what one can do and how.

The requirement of tempered equality of intellectual authority relates epistemology to the cultural aspect of science concerning the possibilities of different perspectives or voices to be noticed or heard. Failure to recognise cognitive authority might make one to ignore important scientific findings. Therefore, scientific communication is both culturally and epistemologically

relevant, and as Kristina Rolin (2004) especially insists, the social dynamics of scientific communication should be thoroughly discussed in epistemology.

The sociality and cultural aspects of science are epistemologically relevant in a number of different ways. As scientists work in groups, cognitive division of labour necessarily occurs both within groups and between multiple groups. So the division of effort is an important issue to analyse for its epistemic and cultural impact, since different groups focus on finding different solution paths to the problems, their mutual creative criticism and competition enables them to improve the overall quality of science. (See Kitcher, 1993; Solomon, 2001 and Rolin, 2004 about the division of effort.)

Social dynamics of scientific communication and the division of cognitive effort are both related to general styles of work. As empirical studies show, styles of research work vary between scientific disciplines and even in smaller sub-disciplinary groups (see Fuchs, 1992). Rolin (2008) has pointed out that critical reflection on the work styles is a necessary part of research organisation in order to avoid domination of particular styles that prevent dialogue and division of labour. If a group favours a competitive style, important resources contradicting this style might be overlooked; on the other hand, a group with strong group identity and protective style might miss important criticism. Thus work styles and reflection on those play a significant cultural role in knowledge gaining processes.

The collective nature of science displays itself also via the assumed mutual trust in the scientific community. As objective trustworthiness and social credibility of an individual researcher do not necessarily coincide – sometimes critical dialogue in the group might be disturbed by prejudices – further empirical investigation into the credibility creating processes is needed. Scientific community plays a significant role here not only for elimination of contingent mistakes but also for facilitating dialogue in order to be able to discuss and balance various aspects of the styles of work such as competiveness, a chilly climate, aggressive style, exclusive gender stereotypes which tend to limit the communication between individual scientists. (See Rolin, 1999; 2002.)

The social and cultural aspects of scientific practice served as a basis for the explanation of scientific knowledge in the sociology of scientific knowledge and social constructivist science and technology studies. However their approach has been rather different – empirical STS aim at explaining particular scientific views via the social and cultural conditions of adopting the views. Some of the STS research has also touched upon the material and experimental aspect of scientific research but only qua an environment in knowledge production. The

social constructivist science studies seem to interpret scientific communities qua consensus communities. Research groups are taken to be socially homogenous, their scientific views and activities are seen to be shaped by the same external social interests or other shared cultural factors. In practice, it really is not the practices of the research groups investigated in the social constructivist STS, but only the belief formation of group leaders as individuals in comparison with other groups (leaders) who hold some radically different belief. In the analysis, the solution of such a controversy between the two opposite views is regarded to be due to the strength of respective social network. Such an analysis is unavoidably one-sided, and this is not the only shortcoming of the empirical STS approach. Even more important is its failure to provide normative evaluation (apart from pointing to the strength of the social network) to the activities of a research group. However, this is not to say that empirical cultural studies of science are not valuable at all, but for the sake of improvement and critical transformation, a subtler cultural analysis is needed. For the relevance in social epistemology, Joseph Rouse (1996) has indicated another perspective of the cultural and gender studies which regard the research communities as consisting of many culturally fragmented identity groups: "heterogeneous alignments or solidarities that do not reduce to either shared beliefs and values or tolerance for individual difference" (Rouse, 1996, p. 111). Only the latter approach in the analysis of scientific practice makes it possible to reveal the real diversity of identities, at the same time promoting normative criticism.

In the rest of the paper, I shall give some examples of an empirical cultural study of science in order to show some types of cultural conditions which may appear highly relevant for philosophy of science if studied further in greater detail. I wish to emphasise that for proper epistemic evaluation of the findings, further empirical research is necessary, nevertheless, the indication of the kinds of conditions and directions which need to be studied into, might have its own value.

In the following section I shall introduce the concept of workplace culture and the methodological framework for the empirical study of physics culture which was applied in the international cooperation project UPGEM, carried out in 2005–2008.

The method of culture contrast in the study of science as workplace

Workplace cultures have been studied first of all in such a discipline as organisational studies as something the organisations involve or have, as given cultures, or as sets of values, symbols and rituals for some organisation defined by their managers (Schein, 2004). In the EC 6th Framework Programme project UPGEM ('Understanding Puzzles in the Gendered European Map: Brain Drain in Physics through the Cultural Looking Glass') the approach was different. Culture was seen as a category which itself needs analysis. At the same time, culture serves as an analytic tool which enables us to analyse and understand "what makes people think-feel-talk-mean-act in ways that everyone in their group takes to be normal" as historian and anthropologist of science Sharon Traweek (1992, p. 440) has defined the concept. Cathrine Hasse and Stine Trentemøller (2011) describe the UPGEM perspective as follows:

Our approach thus diverges from the general field of organisational culture by focusing on what informants tell us about what they do and how these doings can be related to what we analytically find informants perceive, but not necessarily accept, as the cultural values, norms and traditions of the everyday life at the workplace (Hasse & Trentemøller, 2011, p. 11).

During the project, 239 qualitative interviews in five European countries (Denmark, Estonia, Finland, Italy and Poland) were conducted (*Draw the Line! Universities for male and female researchers in Europe*; Velbaum *et al*., 2008, p. 14). For the analysis, transcriptions of all interviews were uploaded in the analysis programme Atlas.ti. As the project was aiming at identifying the cultural reasons for leaving the academic career, approximately half of the informants were selected from among former physicists who by the time of the interview had left their research career. The method of analysis suggested by Hasse is called the method of culture contrast, and it consists in the cultural analysis via both locally and cross-culturally identified contrasts. In a cross-cultural perspective, three main contrast axes were defined: (1) the 'stayers' and 'leavers'; (2) men and women, who were also equally represented among the interviewees; and (3) a major contrast between physics as research culture with its general disciplinary characteristics, and physics in national cultures, that is, in particular countries. (Hasse & Trentemøller, 2009, pp. 47–49)

For the analysis with the programme Atlas.ti, statements from the interviews were selected as quotations and labelled with the relevant thematic code(s), as for instance 'competition', 'mentor', 'mobility', etc., altogether thirty-four

codes. Thus a database of over sixteen thousand coded quotations was formed. The analysis was first carried out at the national level, in each project country, resulting in five national reports, and after that mainly by the coordinating team in Denmark at meta-level resulting in the cross-cultural conclusions and recommendations (Hasse & Trentemøller, 2008; Hasse *et al.*, 2008).

My current analysis of the UPGEM project material with respect to its relevance for naturalised philosophy of science makes up a part of an independent follow-up study. In the following section, I am going to present some empirical findings about the physics culture in Estonia and show their relevance for normative account of science. However, the relevance is not unilateral: in order to make changes in the research practice, the local cultural circumstances need first to be discussed from the normative perspective, thus the philosophical analysis is relevant for scientific practice as well.

Lack of communication in Estonian physics culture

Many interviewed former physicists as well as those active in physics today recognised the lack of communication possibilities at their workplace as a serious issue. On the one hand, many researchers appreciate the independence and free choice of working hours as it allows one to deal with complicated research topics individually, for long hours undisturbed, either at home or in the laboratory, just as one prefers. On the other hand, many informants complained about the lack of inspiring intellectual atmosphere. Motivation for more group work was strongly expressed, and the need for better coordination and division of labour at their workplace was often mentioned. For example, a female 'leaver'[1] said in the interview:

> *I liked working in physics, it's a purely mental job. And very interesting. And I liked to work in a team, team work. Like that. And that was, of course a problem, as when I came to Paramount*[2]*, there was no team here. Very few physicists. Just me – my supervisor was xxx. And there was a moment when I asked him, "Who could I discuss this with? Who could I communicate with?" And he said, "Just me." That, of course, was a problem.* [Laughing] *Because when you have a team and everyone moves on together and there's, like, cooperation. I'd*

[1] In the quotations the following abbreviations are used: FL – female leaver, FS – female stayer, ML – male leaver, MS – male stayer.

[2] Research institution.

> *like that. When it appeared I was alone and there was no demand for that, it's not clear whether anyone needs that and whenever you have to go somewhere, problems arise immediately.* (P322/FL) (Velbaum et al., 2008, pp. 187–188)

Some physicists described the regular social gatherings at foreign universities as very important venues for information exchange and informal communication with both colleagues and students. Differently from other UPGEM project countries, the younger generation Estonian physicists especially seem to suffer from the missing generation, caused by institutional reforms in the 1990s:

> […] *Another problem has emerged, that just that, as one generation is missing among physicists in science, the generation that left Estonia in the beginning of the 90s, then in some sense* – […] *That generation is about now, I'm of course generalizing because the number of these people is not so big, it is this kind of a personal view of mine but it, it's this kind of a 40-year-old physicist who somewhere at the end of the 80s was about 25 to 30.* […] (P312/MS) (Velbaum et al., 2008, p. 162).

Young physicists highly respect the older generation but communication between the old and young researchers is restricted very narrowly to professional matters:

> *There are many people alone. Actually, they're all such individualistic people. Maybe something like, we do not feel we have anything to talk about. They're all old people, 50 or 60. I have no idea what to talk about with them, just work.* (P300/FS) (Velbaum et al., 2008, p. 162)

From the interview material, it appears that more women than men are distressed by lacking feedback on their work. How important it can be is evidenced by the following quotation:

> Interviewer: *What about now that you went to xxx, did you have a supervisor there? Or how did the studying process work out there or did you have to do everything on your own?*
>
> *Mostly on my own and there were people, well, my supervisor said that this needed to be done and that was it, he left. He's a xxx and he had all those meetings all the time. So I went and found someone, they'll help, lots of guys work there* [laugh]. (P300/FS) (Velbaum et al., 2008, p. 191)

And especially women appreciate their mentors' support very highly:

> […] *In the sense that she's an older woman and she has actually been to me, as she has no children of her own, she's been to me–. We established a very good emotional contact and I was really like a daughter to her. She helped me in a real way and, let's say, during the essential work, but she's given me a lot of good advice on how to get along well in this man's world* [laughing]*, because this discipline really is relatively, well, it's mostly men here engaged in this discipline and.* (P308/FS) (Velbaum et al., 2008, p. 190)

Missing a mentor might easily lead a young researcher to leaving academic career, as it happened to an interviewee whose supervisor had died in the early 1990s (Velbaum *et al.*, 2008, p. 192).

At some workplaces the communication is restricted because of a chilly work climate which might lead to social and intellectual isolation as it happened to a female leaver:

> Interviewer: *And who, were there other people in the room?*
>
> *Yes.*
>
> Interviewer: *Did you interact with these people?*
>
> *Yes. But there were still few people, we didn't interact much. Well, with other, other people whom I didn't have much to do with, well, I didn't, like, interact with them.* (P324/FL) (Velbaum et al., 2008, p. 188)

The problems related to restricted communication in science as workplace, where either some relevant parties, or individuals, either ideas, or practices, are not included, or have not been given the necessary authority for participating in the dialogue, are highly relevant for the aforementioned conditions of transformative criticism. The missing generation, for instance, might cause inequality of authority in the research community in the sense that the generations mutually do not consider each other as possible sources of expertise. On the other hand, in the circumstances of inequality, the representatives of the old generation might be trusted on the basis of their authority as being old without necessary professional criticism. In the analysis of particular scientific judgements these issues may turn highly relevant both epistemologically and culturally. In this paper, I can only hypothetically assume how these particular workplace features may shape certain problem-solving research situations – I do not have sufficiently specific data about the research problems the interviewees were solving, but the interview material still reveals the general types of communication problems which would deserve further research.

Identities and stereotypes in Estonian physics culture

As analysed in a number of earlier papers (see, e.g., Velbaum *et al*., 2008; Lõhkivi & Velbaum, 2008), the images of physicists in Estonia bear a masculine undertone. In the analysis of the interview material, three basic types of images emerged: physicist as a priest of truth, physicist as a playful boy, and physicist as a blacksmith. The first two categories have been identified also in other studies (Wertheim, 1995 and Hasse, 2002, respectively), although the nature of the image of the priest varies from one context to another, having connotations with the ultimate authority of church whose real domain truth is in some cultures, and referring to humble serving and pursuing for the truth in others. The image of physicist as a blacksmith was suggested by an Estonian interviewee; however, during the last couple of years, authors such as Pettersson (2011) have also identified similar images. Pettersson sees the strongly masculine image being a result of consistent gender ideology of particular sub-disciplines of experimental physics, for example, that of plasma physics.

Both the Estonian image of physicist as a blacksmith and that of plasma physicists in the U.S. laboratory involve cultural stereotypes of hands-on hard work of constructing and maintaining, "manually thinking", and mastering the dangerous complicated experimental systems, plus carrying heavy vessels, cleaning up mess in the laboratory:

> *Well, let's say this that this man exactly matched those ideas of a physicist I have used when alluring the young this way. This means that, yes, I – if I have had to explain why it's good to be a physicist then I have used the expression of one of my colleagues, who introduced himself like this that do you know, I'm a blacksmith for the fourth generation, a physicist is also a blacksmith.* [Laughs] *Something like that. Well, well, actually the idea is that as in a village community, rural community, blacksmith was the one, who was able to do all the jobs, found the solution to every problem. Let's say to all the problems related to iron and smelting it, related to metal and smelting it, all that in general surpassed the skills of the average person. And in this way a physicist should also be a person, who finds solutions to problems that appear in inanimate nature and that surpass the skills of the average person. Well, you see, it should be like that in principal. So, yes, in my opinion this person matched exactly with this kind of an idea and also was able to present his subject very well and make it interesting and well, of course the ability to present*

> *oneself is important for a person. Well, for a teacher first of all and well, let's put it shortly that he made the boy want to be like him.* [Laughs] (P329/MS) (Velbaum et al., 2008, p. 179)

The image of physicist as a playful boy involves taking risks, solving problems easily, as in a game, having fun and enjoying solving complicated research problems at work. With these two stereotypes, a playful boy and a smith, female interviewees found it difficult to identify themselves with. The physicists' career survey shows that women tend to avoid the technical side of physics, and it was also expressed in the interviews in a similar way, as demonstrated in the following quotation:

> *Well, I still think it isn't, but it's actually the same at the university, I mean, physics is a really wide subject. And at the university they teach you, they try to teach everything to everyone and that might not be right for everyone and as for me personally, electronics was really not for me during the university studies, it was so–. And let's say, the part of physics that is concerned with very technical issues, that was not for me, I don't like that part, but the part that is connected to nature, I like that. Now, as to the master's studies, I also went back to environmental physics, as this is more connected to the real living environment.* (P308/FS) (Velbaum et al., 2008, p. 182)

For women, it was somewhat easier to relate oneself with the image of priest; nevertheless, as the priesthood originally still refers to men rather than women, this stereotype is perhaps the most complicated one. It is neutrally alluding to the pursuit of truth, but at the same time, as characterised by Traweek (1992), hiding the conservative view of the 'culture of no-culture'.

For the argument of this paper, however, it is not even necessary to analyse the complicated nature of the metaphors, images and their possible consequences in depth. In order to prove the relevance of cultural studies into the identities, images, stereotypes and gender ideologies of the scientific practice, for philosophy of science, only discovering that stereotypes, gender ideologies, etc. exist in scientific practice, and moreover, showing how they possibly may constrain transformative criticism, should suffice. Transformative criticism might be restricted due to the particular mechanisms of inclusion and exclusion which leave some relevant voices unheard on the ideological or cultural grounds. Therefore, diagnosing these mechanisms via the local cultural and epistemic analysis might serve as a useful tool for the improvement of the quality of scientific research.

Conclusions

In this paper, I argued from the perspective of practice-centred naturalised epistemology that empirical cultural studies of science are relevant for philosophy of science and vice versa: without the normative approach one cannot improve scientific research, therefore one needs to study both the identity of the scientists and their local goal achieving rationality at the same time in order to understand and evaluate particular scientific judgments and suggest future developments. Based on the theoretical views of Longino (1990; 2002), Rouse (1996) and Rolin (1999; 2002; 2004; 2008) in social epistemology, I presented some examples of the empirical study of the workplace culture of physics in Estonia, indicating how the lack of communication in scientific community might restrict the prospects for transformative criticism which is a necessary precondition for achieving as objective knowledge as possible. Another kind of examples – the stereotypical images of physicists in the Estonian physics culture – was selected with the intention of shedding some light on the cultural mechanisms of inclusion and exclusion of people, ideas and practices in the sciences. Also these mechanisms when left without sufficient analytic attention, limit the transformative criticism and hinder improvement of scientific research, and are thus not only culturally interesting but also epistemologically significant.

Acknowledgements

The work on this article was supported by the Estonian Science Foundation grant no. 7946. I also wish to thank Professor Rein Vihalemm, Professor Daniel Cohnitz, the two anonymous reviewers of the *Baltic Journal of European Studies* and Peeter Müürsepp, one of the editors-in-chief of the journal, for their encouragement and comments on the previous version of the paper.

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