

What can we learn from a peer review?

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Abstract

The quality assurance of research articles is based on a widespread reliance on peer review, which has gradually become black boxed, as the way to do it. By opening the black box, it turns out that this form of quality assurance varies a great deal. This article looks at the comments offered by peer reviewers and treats them as an important but overlooked element of the methodological circle and science production. Based on an auto-ethnographical study of one manuscript that undergoes peer reviewing in three different journals the article examines how the review comments affect the author and hence promote/inhibit the becoming of a research article. The article offers a transmethodological look at peer review by employing concepts from actor-network theory. This allows for a theoretical move from notions of single authorship to notions of writing as a performance of relations between heterogeneous actors. The analysis aims to identify the connections that are established between the manuscript and other actors such as scientific standards for good research, journals' aim and scope, universities' requirements for staff publication, peer reviewer's personal academic interests etc. which all become part of a peer review network. In conclusion, the article suggests acknowledging the relational and co-productive aspect of peer reviewing as an important part of quality assurance of scientific knowledge

Keywords: peer-review; science production; methodology; auto-ethnography; actor-network-theory.

Introduction

The point of departure for this article is American sociologist Robert King Merton's thesis that the allocation of science funding is a self-fulfilling prophecy (1948). He argues that a grant provider gives grant recipients such an advantage over those whose applications were rejected – in terms of peace of mind to work, prestige and opportunities to conduct research – that they end up becoming the most qualified researchers. Thus, according to Merton, grant providers do not select the most qualified researchers – they create them!

The question, then, is whether the same applies to the evaluation of manuscripts submitted for peer review in scientific journals? Is it possible that peer reviewers do not select the most qualified texts but rather create them? My hypothesis is based on the rationale that a large proportion of manuscripts are returned to their author, who is asked to make minor or major revisions before the manuscript can be accepted for publication. The quality assurance of research articles is based on a widespread reliance on blind review, which has gradually become black boxed, as the way to do it. By opening the black box, it turns out that this form of quality assurance extends from three crosses in a form to many pages of in-depth comments and suggestions for literature and specific wordings. Depending on how such comments affect the author, how they discourage or inspire the revision of the article, they might become decisive for a manuscript's fate. I would therefore argue that the review process should be seen as an essential part of the methodological circle (Haavind, 2000), as an element that not only assesses the finished dissemination product, but which in itself contributes to the creation of academic knowledge. Therefore, Merton's thesis calls for a study of peer reviewers' comments with the aim of analysing whether and how they help to develop the quality of scientific texts.

A large amount of research literature on scientific peer review already exists. One way to gain an overview of the literature is to read research reviews (e.g. Garfield 2004 & Bornmann, 2011; Weller, 2002), which show that much of the literature discusses the reliability, fairness and validity of the peer review system and its ability to select the best manuscripts. In this context, reliability is a question of whether the selection is well founded or a matter of coincidence. Fairness pertains to whether certain groups of applicants or authors are given preferential treatment based on criteria that are irrelevant to the quality of the manuscript, such as gender, age, ethnicity and class. Validity is whether the manuscripts selected later prove to be the best based on other criteria such as how many times they are cited by other articles, for example (Bornmann, 2011). Although peer review consists of two elements – an assessment of the manuscript’s suitability for publication and comments that support this assessment and advise the author how to improve the text – the existing research focuses primarily on the assessment. There are fewer studies of peer review comments (see Bornmann, Nast and Daniel, 2008 and Gosden 2003). Therefore, Bornmann (2011) has expressed the need for more studies based on an analysis of the contents of the assessments, in order to gain an insight into what causes disagreements between peer reviewers and how harshly different peer reviewers evaluate specific shortcomings in manuscripts. It is noteworthy that not much of the interest in analysing the contents of the comments stems from the desire to understand more about the comments’ formative effects on an author’s work on improving the manuscript. Thus, the learning dimension is largely absent from the literature.

Although the research literature does not pay much attention to the effects of peer reviews on authors’ subsequent revisions of their manuscript, indications that the comments are perceived to be valuable by the authors are commonly found in the acknowledgements section of their texts where they thank the people who assisted them in their work. Even Lutz

Bornmann who have written extensively about peer reviews, expresses his thanks to the three peer reviewers who commented on his major research review as follows:

“The author wishes to express his gratitude to three anonymous reviewers for their helpful comments” (Bornmann, 2001, p.232)

Clearly, it is a convention to thank anonymous reviewers investing their time and expertise to improve a manuscript, yet Bornmann most likely chose to do it because he actually felt that the peer reviewers' comments had helped him to improve the article. I am certain that other researchers recognise this situation, as they too have similar experiences of how peer reviewers have helped to improve their articles. This observation invites us to look at peer reviews in a different light and pose new research questions: What prompts an author to express gratitude? What constitutes a useful comment? Which types of criticism help to improve a manuscript?

A transmethodological look at peer review

The theoretical ambition of the article is to answer these questions by utilising concepts mainly from the French philosopher and anthropologist Bruno Latour and the Danish psychologist Estrid Sørensen. I have chosen this very approach because it has an eye for the whole academic system in which the manuscript is being created, instead of looking at the manuscript as a product of a single author. In addition, Latour and Sørensen offer concepts that are suitable for focusing on often overlooked processes and connections between different types of actors (material and human). The intention is to involve the actors who actually have an effect on the manuscript's biography and to examine how they affect the manuscript yet to become an article.

Latour's central concept 'actor-network' differs from the conventional understanding of configurations and relations between constitutive parts and wholes. The actor-network idea entails that all individual parts constituting a whole are characterised by agency and can

operate autonomously. At the same time, they can enter the whole, become parts of assembled networks or move in and out of networks (Latour, 2005). The idea is to consider the actor and the network simultaneously (hence actor-network with a hyphen). Latour insists that action is always dislocated, articulated, delegated and translated – these movements and relations constitute his primary analytical interest. It is only through interactions between the actors in a network that differences, hierarchies and unequal power relations emerge.

Drawing on this ontology, I want to suggest another way of looking at the author and the article. Rather than a subject being individually responsible for a bounded text, I would argue that an article is the result of interaction with human as well as non-human actors, without which neither research nor writing and publishing would take place.

Actor-networks do not have a lasting structural character, but presuppose a continuous interweaving of human and non-human actors in various ways. The purpose of the actor-network conceptualisation is to resist designations of the ‘essence’ of phenomena under investigation, for example of the manuscript, the author and the reviewer. Actor-network theory (ANT) distances itself from any notion of underlying, implicit, invisible forces that can explain social phenomena in their empirical reality. This does not mean that phenomena such as the manuscript, the author or the reviewer do not exist; they come into being through formation, interconnections and movements in heterogeneous actor-networks. However, ANT suggests that all the elements and forces involved in creating, enacting and performing a review exist on the same level.

ANT operates with a network in which all actors, regardless of whether they are ideas, people, discourses, technologies, objects or emotions, in principle are equally important. Since there are no external forces that control the course of events, it becomes the researcher’s most important task through empirical analyses to describe the review as it occurs. Thus, the main objective when working with ANT is to examine how actor-networks

are assembled in relation to a project, an issue or a goal, and how they are maintained and put to work with a view to achieving this specific goal. The analysis of peer reviews therefore aims to identify the connections that are established between the manuscript and other actors, such as scientific standards for good research, a journal's aim and scope, universities' requirements for staff publication, peer reviewers' personal academic interests etc., which become part of the performance of a peer review.

Sørensen proposes the term “networked imaginary” to denote the ideal of how a socio-material network works (Sørensen 2007 and 2009). In connection with peer reviews, this corresponds to our notion of how peer reviews ideally work: Peer reviewers evaluate a manuscript by measuring it against a common standard for what counts as a scientific contribution. However, Sørensen argues that this is not the only way socio-material networks work. They are not always stable. Sometimes they are fluid and require actors to make various adjustments to make the network work. To describe this, she introduces the concept of “fluid imaginary”. This concept makes it possible to focus on the corrective actions that both author and peer reviewer take to evaluate a manuscript and provide instructions on how it can be improved and considered for publication.

This approach to peer review changes the way we think about this practice. We can no longer consider it an institution with one standardised practice and a fixed role repertoire. Instead, it is regarded as an interaction between author, manuscript and peer reviewer, which constitutes a socio-material network that gives the manuscript certain opportunities to become or not become an (accepted) article. In the analysis, I therefore place emphasis on describing the fluid nature of a peer review.

The transmethodological perspective that inspires this analysis provides a different view of what a manuscript is and how it becomes an article. A manuscript is a research contribution in the making, which is dependent on several actors in the analytical field in

order to come into being. In this context, peer reviewers play a key role as the actors who create connections between an article's contents, form, academic standards and potential. Mexican-American philosopher Manuel De Landa distinguishes between major and minor science (De Landa, 2016). Major science is characterised by seeking universal truths. Minor science, on the other hand, is characterised by following the phenomena wherever they may lead the researcher. De Landa uses the courtroom as a metaphor for the way major science approaches scientific objects. They place scientific objects in the witness stand and interrogate them with questions derived from ideal phenomena, whereas minor science allows the phenomena to create problems by deviating from the ideal. If we transfer De Landa's distinction to the part of the scientific practice relating to peer review, then the peer review of a manuscript may be based on an ideal of what a scientific article should look like by looking for errors and shortcomings (major science?). Alternatively, the reviewers can promote the becoming of the manuscript and follow its lead (minor science?). The first strategy can be carried out rather mechanically by comparing a discipline's principles of good research with the submitted manuscript. The second strategy, on the other hand, requires the reviewers to engage in the manuscript becoming an article. The professional involvement of the peer reviewers can lead to the article developing in multiple directions.

By taking such a transmethodological approach I will examine

1. Patterns of relations performed around a specific manuscript submitted for review in three different journals (see method section below).
2. Performative effects of the interactions between author, peer reviewer and various other actors on the manuscript's biography.

Method

Rejection from a journal is not usually the end of the road for a manuscript. It is likely to be given a new lease of life in a different journal (Abelson 1980, Gans & Shepherd, 1994

and Bornmann & Daniels, 2008). Bornmann and Daniels' study (2008) showed, for example, that 90 % of the manuscripts that were rejected by one particular journal in the field of medicine were published by other journals later on. In this article, I present the biography of a manuscript entitled "Learning to become a science talent", which was submitted to three different journals prior to publication. It went through three peer reviews with, respectively, three, two and two peer reviewers involved in the assessment of the manuscript. Thus, there is a lot of written material, and this provides the empirical basis for this article's content analysis. The entirety of the material is displayed in the table below.

Table 1: *Journals to which the manuscript was submitted*

Journal	Social Studies of Science	MONA Matematik- og Naturfagsdidaktik (Mathematics and Science Teaching) Published in Danish to teachers and researchers	Nordic Journal of Science and Technology Studies
1st round of assessment	Three reviews and an editorial synthesis	One review and an editorial synthesis	Two reviews and an editorial synthesis
2nd round of assessment		Two reviews and an editorial synthesis as well as email correspondence between the author	

		and the editor	
Assessment	Rejection	Withdrawal of the manuscript	Acceptance

Table 1: overview of the three peer reviews and their out come

The transmethodological approach in my analysis is to retrace how the manuscript became an accepted article in a journal. The point is not to present the assessment as arbitrary, but to provide insight into which actors come into play in different performances and what performative effects this has on the author, script and peer reviewers.

Instead of looking at the peer reviewers' comments solely as justifications for their assessment, I am also interested in them as suggestions for how to further develop the manuscript. Therefore, I read the comments with a view to assessing how they affect the becoming of the manuscript. How the becoming is inspired, transformed, inhibited, blocked etc. In order to identify the kinds of relations established between the manuscript and various actors in the socio-material network, I take inspiration from Carolyn Ellis (2000). She distinguishes between three types of readings that involve her as a reviewer in different ways. The first way to read a manuscript is a test of whether it can engage her emotionally or cognitively and whether she wants to learn more about the subject matter from the author's perspective. At this stage, she lets the words and images flow through her in order to discover what the text does to her. Does it keep her attention or does her mind begin to wander? Thus, the first reading investigates the manuscript's ability to engage the reader by drawing parallels between the manuscript and the reviewer's personal and academic interest at both emotional and cognitive levels. During the second reading, Ellis asks questions about what she has learned from the manuscript: About social life, social process, the experience of others, the author's experience and her own life. She asks whether the author brings something new to the table – perhaps a new way to view or twist the familiar. She also asks

about the author's goals, claims and achievements. Did the author learn anything new about himself? About other people? About the processes and relationships described? Will the manuscript help others cope with or better understand their worlds? As part of the second reading, she also inquires about ethical considerations: Whether the author got permission to portray others and gave them a chance to contribute their perspective on the story etc. Based on this reading, Ellis considers whether she should try to convince the editor that the discipline could learn something from the author's text. In the third reading, Ellis wonders if she has been helpful to the author. It makes her go through the peer review again to rewrite it in a more encouraging tone. For example, can she express her criticism in a way that also protects the author's sense of self? Thus, it is also important to convey the positive qualities of the manuscript. It is important that the author perceives the comments as both critical and supportive.

Ellis presents the three ways to read a manuscript as phases in her overall approach to making a peer review. However, it is certainly not all peer reviewers who proceed in this way. Some choose one reading others choose more. When I find Ellis' approach inspiring, it is because it so clearly illustrates how peer reviewing can be performed in various ways. If we then read Ellis through Latour and Sørensen's conceptual apparatus, then we will be able to see how her three readings perform different patterns of relations. The first kind of reading establishes a relation between the author as storyteller, the reviewer as audience and the manuscript as literary text. The second kind of reading connects numerous actors: the manuscript, the author as researcher, the researched subjects, the research community and the ethical standards of the academic field. In this kind of reading the manuscript is produced as a bounded scientific contribution. In the third kind of reading, the reviewer establishes a relation between the author as a learning subject, the reviewer as a supervisor, and the text as a potentiality. In a transmethodological perspective these three kinds of readings should not

be taken as exhaustive. In my view transmethodology opposes the closing of categories. I therefore use them merely as entries to the analytical section of this article in order to tune in the analytical gaze on the various ways in which peer reviews can be performed as patterns of relations.

The scarcity of studies of peer reviewers' comments is undoubtedly due in part to the difficulty of accessing this type of material. I can think of three ways to gain access to peer review comments: via journal editors, reviewers or authors. The advantage of accessing them via a journal is that the editor will have an archive of numerous peer reviews to which access may be given. The disadvantage is that this would not provide access to the entire biography of a manuscript. The same goes for accessing manuscripts from reviewers. However, this is possible if we take an author's experiences of trying to get a manuscript published as our point of departure. Therefore, I have chosen to use my own experiences of publishing a manuscript as the empirical basis for this analysis. Since I was involved in the review process as the author, it makes the method autoethnographic (Ellis & Bochner, 2000). I recognise that autoethnography has been criticised for blurring the lines between fiction and reality (e.g. Atkinson, 1997). However, working within a transmethodological approach encourage the researcher to transgress such traditional lines between reality, biography and fiction in order to stay close to the performative effects of networked processes. The challenge is to convey all the effects equally well when they are experienced from a particular position within the actor-network. It turned out in the work on this article that it is easier to spot the forces that influence the reviewer than on the author. I therefore chose as an analytical strategy to refer to myself in the third person. In this way, I was able to better objectify the actor network that I, as a university-employed academic, am embedded in and highlight the forces that moved through me and made me experience and react to the reviewers' comments in given ways. Anderson (2006) argues that not all kinds of autoethnography pose the same problems. He

proposes an analytical approach to autoethnography that holds three characteristics: The researcher is a fully-fledged member of the group or context that is being studied, as I am as the author of the manuscript. The researcher is visible as a member in the published text, as I am the reading and reacting ‘I’. The researcher commits to developing theoretical understandings of broader social phenomena. The purpose of this analysis is to contribute to our shared knowledge about the dynamics within an academic institution in regard to peer review in which all researchers are regularly involved.

As described above, this article focuses on the part of the research actor-network activated in the peer review process. It potentially involves an infinite number of actors, some of whom are human, such as editors and reviewers, while others are either material or immaterial, such as academic standards and requirements imposed on researchers to publish more, the system of ranking journals, which influences rejection rates etc. I zoom in on a number of knots and connections of this actor-network by examining the relationship between a number of peer reviewers and an author. In some cases where editorial synthesis is important, I also involve the editor, but not in a way that fully reflects the central role of the editors in the assessment process as such. By doing so, I am aware that I exclude a number of actors that might influence either the assessment or the revision. Since it is too huge a task to cover all the actors within the scope of this article, I let the relevant actors be determined by what seems to have effect in those particular events of reviewing on which I zoom in.

The manuscript I submitted for reviewing in the three journals had the title “Learning to become a science talent”. It was based on a case study of how the knowing subject comes into being through participation in a talent development programme at the Mærsk McKinney Møller Science Center in Denmark. I submitted the manuscript in English to Social Studies of Science and in Danish to the Nordic Journal of Science and Technology Studies and in Danish to MONA. The article focused on the concept of talent and its enactments in a science

talent programme. It looked at how students became a particular kind of knowing subject through their participation in a science talent programme. Drawing on concepts from new materialist studies (Blok & Ellgaard Jensen, 2009; Fox & Alldred, 2017; Latour, 1993), the article explored the relationship between the possibilities for distribution that were offered to the participants, and the ways in which the participants responded by centring and decentring within the talent network (Mialet, 1999 and 2012). The purpose of the study was to contribute to our understanding of how the increased focus on talent development in many national educational systems influences basic preconceptions of what a science student is and how the knowing subject in society should treat science, by looking into the micro-politics of talent development. The study was based on small-scale ethnographic fieldwork at a science talent camp over three days.

The peer review process

The first journal I submitted the manuscript to was *Social Studies of Science*. This journal is internationally acclaimed and has been central to the academic field of Science and Technology Studies (STS) since 1970. It accepts contributions from a variety of disciplines that expand our understanding of science, technology and medicine as social and material practices. The manuscript was sent to three anonymous peer reviewers. The journal's response consisted of an email from the editor with the journal's decision to reject the manuscript based on the statements from the three peer reviewers, which were included as attachments. I refer to them here as SSS-R1, SSS-R2 and SSS-R3.

The second journal I submitted the article to was *MONA*, a national, discipline-specific journal which publishes articles related to science teaching. The journal's intended audience is teachers and researchers. I submitted a Danish-language version of the manuscript to this journal as its readership is able to read Danish. There were two rounds of assessment. The first round was based on a peer review (M-R1), which recommended that I

rework the manuscript and resubmit it. Subsequently, I received a new assessment based on two peer reviews (M-R1 and M-R2) which once again placed the manuscript in the same category as before and recommended further revisions, after which the manuscript could be submitted for a third assessment. I communicated with the editor about the process and chose to withdraw the manuscript.

The Nordic Journal of Science and Technology is an open access journal published by NTNU (Norwegian University of Science and Technology). It publishes articles in the intersection between the humanities, social sciences and the natural and technical sciences and focuses on how technological and scientific developments affect the ways in which society is organised, among other things. The journal is linked to the Nordic network for STS research. Two peer reviewers read the manuscript and they both recommended that the article be published if the author made the revisions that they advised. I refer to these peer reviews as STS-R1 and STS-R2. As I do not have access to the peer reviewers' biographical data, I refer to all the reviewers using the personal pronoun she and the author as he.

Analysis

Patterns of relations performed as disengagement

In this section, I ask which relations are established in the peer review. I begin with performances that establish relations between the reviewer, the manuscript and the author in terms of personal academic interests. I am interested in how this kind of performance facilitates the further development of the manuscript depending on how it resonates with the author's personal academic interest. This kind of performance most often occurs in combination with other performances. However, one of the peer reviewers from Social Studies of Science engaged exclusively in such a performance.

SSS-R1's most important objection to the manuscript is related to gender, a theme she thinks should have been an object of analysis. She finds that sexism is at play at the camp,

and that this is crucial to who is positioned in the centre versus the peripheries. She writes: “On page 7 the judges are quoted being deeply sexist. ‘He’ can develop ‘his’ ideas but ‘she’ couldn’t explain ‘hers’.” In this example, the reviewer brings up an academic interest in feminism that makes the judges’ assessment of the two participants’ projects appear gender biased. It is indeed possible that the judges’ assessments could have been analysed as such, since it is one of many possible biases. When the reviewer and the author base a peer review on clearly divergent research interests, a mutual commitment between them is not established. However, this does not exclude that SSS-R1’s comment in the meeting with another author with academic ambitions to investigate gender bias in scientific talent environments could have created productive connections between reviewer, manuscript and author (R-M-A). In this case, where the article has a different focus, namely the transformation of supposed science talents into entrepreneurs, the patterns of relations performed exclude the author from the network.

In another comment, SSS-R1 establishes a connection to a particular understanding of what science is, which also has an excluding effect when applied to the manuscript. In her assessment, SSS-R1 expresses the opinion that the science camp studied by the author did not have much to do with science: “they do not do any science, or meet any science role models, or learn any science - everyone they meet is a non-scientist”. SSS-R1 finds this ironic and states that the author should also have mentioned this in the analysis. It could indeed be argued that it is relevant to study the various approaches to science teaching that the students encounter in science talent programmes. It was indeed one of the purposes of the article to investigate how science and science talents are developed at the science talent camp, but based on a Latour-inspired approach, where the studied teachers and participants themselves are the ones who define what counts as science. This approach disqualifies SSS-R1 as she seems to have a particular conception of science as something performed by real scientists,

for example in laboratories through experiments. Such courses are also held at the science talent camp. However, the definition of real science excludes some of the other activities that take place and which aim to promote a commercialised version of science, which i.a. was in demand by the business community and the conservative government in office at that time. Here, traditional science is interwoven with business models, patents and dissemination strategies, etc. The patterns of relations that SSS-R1 performs in her commentary have the effect that a performance of talent development such as entrepreneurship and innovation education is excluded from the network?

SSS-R1 acknowledges that the theme of the study is interesting and that the theoretical framing of talent development as an effect of networking is relevant. Besides this, she is unwilling to contribute to the papers' future existence. In order for her to engage further in the paper, the study would have to include completely different themes (the absence of scientific content at the camp and the suspected gender bias). The author, however, has completely different research interests and perceptions of what counts as science. He therefore also finds it difficult to overcome the barrier that has been created by the peer review. He notices that SSS-R1 does not comment on the themes that he does discuss in the article. Therefore, this performance of the review does not resonate with the author's project, which creates the mutual effect of disengagement.

With regard to the article submitted to MONA, it seems like the reviewers actually found the manuscript interesting, but did not allow that to influence their assessment. How can we understand that?

“The contents of the article are both relevant and interesting and it poses many good questions about the way talent work is done in Denmark and the types of talents we want to develop. The article presents a lot of good and interesting considerations but there are several problems in relation to the fact that this is a research article.”

In this comment made by M-R1, two contradictory readings of the manuscript drawing on two different patterns of relations can be identified. One pattern connects the script with the reviewer's interest in a critical analysis of talent development. It can be described as an R-M-A pattern as in the previous examples. When she reads the manuscript within this actor-network, it appears as a relevant and interesting contribution to the debate about what kind of talent development we should promote in Denmark. The second pattern connects the manuscript with a specific standard of what should be in a research article. This adds an actor to the network, namely the standard S, which expands the network to S-R-M-A. When she reads the manuscript within that network, she is barely able to recognise the manuscript as a research article.

The same ambivalence is even more evident in M-R2's reading of the manuscript in the second round of assessments for MONA. M-R2 is even fiercer in her criticism of the article's lack of scientific merit than M-R1, but when disregarding her position as a representative of the academic field, she is also able to read the manuscript in a more positive manner:

“On the other hand, the article provides an interesting insight into what happens at the front-line of talent work in Denmark, and how such activities unfold in practice. This is highly relevant and would be a welcome contribution to the discussion about how to handle talent work in Denmark, particularly in relation to talent and innovation.”

Based on this, the peer reviewers and editor recommended that the author rewrite the article in a more narrative and polemical style, abandoning the analytical genre. In other words, the choice of genre was regarded as an obstacle for M-R2 to connect her involvement in the topics, research questions and insight into Danish talent practice with the author's desire to develop the paper into a scientific contribution. The proposal to write in another genre could solve the ambivalence produced by the reading performed by M-R1 and M-R2,

in that the article would no longer have to live up to the notions of scientificity that the peer reviewers draw on. Consequently, in order to have the manuscript published, the author would have to accept that the study does not count as science. The author, in this case, was not willing to give up the ambition to publish the manuscript as a scientific article. This was related to his position within the scientific actor network. His reading of the comments and the editor's suggestions activated a number of connections to, among other things, requirements and expectations that his own university had for scientific staff's production of scientific articles, which, in turn, is related to universities' economy based in part on earning BFI points. The proposal to publish in a non-scientific genre also collided with the efforts the author had made to conduct the study and write the article in a busy everyday life, where it is difficult to find time for research. In that context, it seemed to be too small a benefit to gain from his research efforts. Finally, the author thought that if he chose to follow the recommendation, then the study would be made public, which could stand in the way of any subsequent scientific publication of the same study. In other words, the author extends the network R-M-A with the actors' performativity and the university's economy as well as rules for publication and the possibility of merit. If we carry out the thought experiment of pulling the author out of his contemporary scientific network, going back 20 years and placing him in a network where performativity was assessed in a different way, then it may well be that the editor's proposal would have had a different effect. Then this author would probably have prioritised the opportunity to reach out to MONA's readers, who are the professionals that handle science teaching and talent development in Denmark. Therefore, it can be argued that the current production goals at the Danish universities have the unfortunate effect of making genres other than scientific articles irrelevant and the criteria for what counts as science more limited.

Patterns of relations performed as scientific standards

In accordance with the network imaginary, we expect a reviewer to perform certain actions related to judging a manuscript based on a common standard. She will evaluate whether the manuscript establishes and fills a gap in the existing knowledge, and whether the author considers the existing literature or overlooks a significant or relevant aspect of it. Furthermore, she will assess the study's methods, theories and conclusions and assess whether there is a basis for the conclusions drawn and whether the analysis is meticulous. Although the academic disciplines share a number of quality criteria, they do not have completely identical standards. It is therefore relevant to examine which standards are involved in a given peer review. The two peer reviews I analyse here seem to be based on different standards, which we can call S1 and S2. When these standards are involved, they have the effect of making an epistemological and ontological distinction between the peer reviewer and the author.

M-R1 from MONA writes that the manuscript has several epistemological shortcomings. She feels that the article lacks a clear research question and purpose, and that the camp is described in too much detail. It also lacks a method section with details about how the data were gathered and analysed. The reviewer states that “The research process is almost invisible”, and that a large proportion of the article consists of descriptions and observations. She would prefer to see a more clearly defined analysis in the article to connect the descriptions with the more general observations, which she likes. Furthermore, she makes some specific remarks on what?

It is clear that the manuscript activated epistemological differences between an interpretative and a positivistic paradigm. One of these differences is evident in M-R1's way of referring to empirical material as “data” and the production of empirical material as the “gathering of data”. Furthermore, M-R1 expects a clear distinction between observation and

analysis, whereas the boundary between “thick description” and analysis is less clear-cut in ethnography (Geertz, 1973). Although thick descriptions are detailed reproductions of events, they are always reproduced by an interpreting researcher subject. Therefore, the difference lies in the degree of analytical processing and not in any categorical difference between data and analysis. The standard applied by M-R1 is thus related to “data”, the “gathering of data” and a clear distinction between description and analysis. This pattern of relations transforms the manuscript into a poor example of ethnographic work in which the analytical process is too implicit and obscure for the reader.

After the first round of review, the author was in doubt whether M-R1 and the author could ever bridge the divide between the different epistemological assumptions that the assessment activated. He considered whether it was worth the effort to rewrite the manuscript based on the expectation that if the quality (singular) of the study were high enough, it would pass as an acceptable contribution to the science-teaching field, or whether it would be a better option to look for another journal. Eventually, he chose to make the required revisions, accepting the networked imaginary of one shared scientific standard. The author specified the criteria of the standard he tried to meet in the cover letter when he resubmitted the revised manuscript to MONA:

“Thus, the most significant alteration to the original manuscript is that the research question has been defined and clarified. I have added a separate methodological section in order to emphasise the empirical study that forms the basis of the article. In the analysis, I have separated the description from the analysis so that the empirical basis and analytical processing are more evident. The conclusion is now more closely linked to the study and the more opinion-based comments have been omitted. I hoped that with these adaptations, the article will match MONA’s academic standards and profile.”

The author tried to meet MONA's epistemological conditions by, among other things, sharply distinguishing between data and analysis, while at the same time balancing it with the epistemological premises of ethnography, which rejects that data are neutral representations of reality and that description can be kept separate from analysis.

When he received a response from MONA's editor, it became apparent that the epistemological divide had grown even wider. Another peer reviewer had been involved in the process (M-R2) and M-R1's tone was even more pointed. The compliance with the scientific standard now seemed to disqualify research based on ethnographic methods in general. M-R1 wrote, that "It is difficult to see which forms of empirical data were gathered besides "observations documented in a field diary" and a questionnaire." She called for other forms of empirical data, because field observations of practice and informal conversations were insufficient as the basis for the argument of the study. Furthermore, M-R1 concluded that, "following" some students and conducting "informal" conversations is not research."

M-R1's failure to acknowledge ethnography as expressed here had consequences for her assessment of the study's analytical section. Although the author attempted to differentiate between descriptions and concept-based analyses, M-R1 was now unable to see the basis of the analysis and how it was conducted. Furthermore, M-R1 also claimed that the link between the description of the camp's knowledge practice and the development of particular types of talent was unclear: "The connection between understanding the field's knowledge practices and the development is tenuous." Here, M-R1 opens an insurmountable gap between ethnography, which allegedly uses non-scientific methods, and a different kind of science, which MONA accepts. That this is compliant with one particular scientific standard is emphasised by the fact that five peer reviewers from the other two journals judged the manuscript based on criteria that did not exclude the epistemological basis for ethnographic research. For example, one of these reviewers, SSS-R3, underlined:

“The article’s account of how narratives become transformative, its description of the ways in which individuals become owners/authors of “their” projects, and its analysis of how notions of talent are transformed into materiality and identity.”

The second round of review with MONA proved that M-R1 and M-R2 would only ever consider the manuscript to be research if the author entirely abandoned the ethnographic way of producing knowledge.

In the next case, there was a greater overlap between the peer reviewer and the author’s epistemologies as they both work within the very broad field known as science and technology studies (STS). The author and peer reviewer, however, drew on different ontologies. The reviewer acknowledged that the study was interesting and that it was a good example of how to use STS ideas to study school students. This is “rarely done”, as she put it. However, she was rather critical of the theoretical perspective the author used in the material as she felt that it missed the mark in relation to the empirical material.

“It seems that the real topic of this paper is the innovation camp’s attempt to teach entrepreneurship to these students, in effect trying to craft entrepreneurship onto the presumed talents that these students already have. While that might be seen as part of a study of talent, the author does not make a convincing case here, and as a result it seems that the good introduction is irrelevant to the fascinating material that follows.”

SSS-R2 reads into the empirical material a depiction of how the talent programme attempts to force entrepreneurship upon the presumed scientific talents. She thus introduces a categorical distinction between scientific talent and entrepreneurship. To SSS-R2, being an entrepreneur does apparently not count as a way of having science talent. Instead, SSS-R2 reads it as though the talents were transformed into something that they were not.

This disagreement is about the approach to the study of talents: whether one should define what a science talent is in advance (non-entrepreneur) or whether one should let the

participants in the field themselves define it through their practice. The author followed Latour on this point and wanted to make as few a priori assumptions about the phenomenon as possible. From this perspective, one cannot know what science talent is prior to the participants' encounter with the talent programme. The ambition of following Latour was to become better able to observe how connections are established between science and innovation. This analytical strategy would make it possible to see that those who turned out to be talents were the ones who could translate their ideas into a commercial product. According to the author's reading of Latour, this would not be possible by following SSS-R2's instructions to separate the phenomena of science talent and entrepreneurship, because it is precisely in the entanglement that the talent is created. Based on a realist ontology, SSS-R2 instead wanted the author to comment on the fact that the science talent camp links science talent development with innovation instead of teaching students proper science. The peer reviewer's ontological assumptions that science talents are certain kinds of people make her disqualify the author's research interest: "that the author is fascinated by the network analysis of genius, and is forcing that fascination onto an empirical subject matter that should be interesting for very different reasons."

The assessment does make the author reflect critically on the risk of overwhelming the empirical material with theoretical concepts and thereby losing the necessary sensitivity to what is important to the participants in the field. However, as the criticism is also based on ontological assumptions, the author finds that the manuscript will have to be radically rewritten in order to have a future within the actor network that SSS-R2 proposes.

The two examples show that the network imaginary that a peer review takes place within a stable network of R-M-A with reference to a common standard S is not always the version that is performed. Peer reviews draw on different standards, which can have different effects depending on the manuscripts to which they are applied. They can both connect and

separate R and A across epistemological and ontological boundaries. The first example, which spanned two review rounds with the journal MONA, also showed that a given dividing line must be understood as fluid. In the first round, the review was performed in a way that invited the author to meet the reviewer by complying with the standard that was put forward by the reviewer. In the second round, the standard was sharpened to such an extent that the author had to renounce the ethnographic epistemology in order for the manuscript to be recognised as a potential scientific contribution in this journal.

So far, I have examined the performance of a scientific review that looks at the manuscript as a whole, where peer reviewers point out a number of different shortcomings that disqualify the manuscript as a scientific contribution. Some of the reviewers suggest more or less drastic revisions of the manuscript to make it fit their academic interests and live up to the scientific standard utilised by the journal. However, these are suggestions that do not resonate with the author's research interest, epistemological approach based on ethnographic methods or ontological assumptions of what talent is. In other words, the reviewer and the author together with scientific standards, aim and scope of the journal and current performativity demands on university staff members do not succeed in establishing an actor-network in which the manuscript can develop and eventually become a scientific contribution.

Patterns of relations performed as the potential of a manuscript

This section provides examples of reviews that go beyond the existing script by focusing on its potential. The review can do this by extending the manuscript with various heterogeneous actors that can give the author ideas and visions in relation to how the text can be developed.

Two peer reviewers, SSS-R3 from Social Studies of Science and STS-R2 from the Nordic Journal of Science and Technology Studies, supplement the two performances

described above with a performance that provides the author with guidance on how to develop the project.

SSS-R3 begins with a very precise résumé of the article's aims and analytical approach. SSS-R3 also finds the article interesting and feels that it addresses a knowledge gap, "as it sheds light on the world of education and pedagogy that is so central to knowledge production, but is still relatively unexplored by STS scholars." She mentions one article that would be relevant for the author to consult. SSS-R3 shows that she allowed herself to be influenced by the article as she read it, because it made her think about other contexts where talent becomes visible and is formed, such as in the television show "American Idol". She may be going off on a tangent, but in mentioning the associations that arose while she was reading the article, she demonstrates that she has accepted the author's invitation to enter into a dialogue about how to improve the manuscript. SSS-R3 describes in more detail what she finds interesting about the paper. She finds that Mialet's concepts centring and decentring within a network work well in this context (in contrast to STS-R2) because they show that talent is not the product of an individual's brain, an organisation or a network, but rather a phenomenon that emerges from the shifts between distribution and centring.

Her reading draws several elements together. She recognises the article's premises, i.e. the application of Mialet's concepts and analytical approach in relation to science talent development. She finds that this approach helps us understand how certain articulated understandings of talent transform into materiality and identity for the participants. However, she would like to see a more precise use of concepts and a greater awareness of the broader discussion to which the study contributes. However, in contrast to STS-R1 and STS-R2 from the same journal, she does not read the manuscript in order to find its shortcomings and measure it against an ideal standard. Rather she looks for what the manuscript is about to become. By making an effort to understand the author's project, she is able to suggest

improvements to the manuscript on the project's own terms. In schematic terms, the reviewer extends the pattern of relations with a not yet realised manuscript (a potential M): R-M-A---Mp.

STS-R2 performs the same kind of reading that brings the manuscript in relation to a not yet realised article by pointing out what the author could do to realise its potential.

“The article “Learning to Become a Science Talent” (...) addresses the process of talent ‘production’ in a Danish talent training centre. The paper is well written and presents a coherently argued constructivist perspective on talent training in Denmark. It is interesting to read about this topic and it merits publication. However, I feel that the author(s) can be somewhat more ambitious in their findings and conclusions. Moreover, the methodological section of the paper is somewhat unclear, and needs to be re-written.”

Based on her reading, she notes that the manuscript represents a promising perspective on talent development, that the method section has some flaws, and that the manuscript could make a stronger contribution to the academic field with a more ambitious conclusion. The pattern of relations performed in this review connects the manuscript M to a potential manuscript Mp by extending it with a rewritten method section, an ambitious conclusion and a clearer statement about how it contributes to the academic field. In her comments within the document, STS-R2 even specifies her criticism of the method section. STS-R2 finds it unclear in which field the author has chosen to gather data. She finds that information about the informants' age and school grade is lacking as well as an explanation of the type of data that were gathered during the fieldwork. This reading evaluates the paper's methodical statement according to the academic standard and finds it lacking. However, whereas the criticism of the method section by the reviewers from MONA led to the study being rejected as non-research, this criticism specifies two requirements that the author is actually able to meet, and which therefore do not put an end to the becoming of the article.

STS-R2 clearly reads the texts from the perspective of how the author can develop the unrealised potential of the project. This is most evident in her annotations about how the conclusion can become more ambitious:

“In the empirical section I felt like the emphasis on selling your idea and being able to adapt to the market place was much stronger than is reflected in this conclusion. I think it can be emphasized more strongly, and especially as this has a strong impact on defining what types of talent and knowledge are seen as valuable...”

This comment illustrates a very different reading from the ones in which the peer reviewer evaluates the elements of the study according to an external academic standard. Here, STS-R2 reads the manuscript on the terms of what it is about to become. In this case, STS-R2 finds that the analysis makes a much stronger point than the author formulates in the conclusion. In order to realise the analytical potential that STS-R2 sees in the manuscript, she advises the author to extend the conclusion with the critique brought forward in the analysis section.

In line with this suggestion, STS-R2 also feels that the author’s language use in the conclusion is too cautious:

“This sentence is vague, and is mainly reiterating words from assemblage theory/ANT. I would recommend trying to formulate the findings using your own voice/words based on the empirics. E.g. emphasizing how the programme was teaching these students how to “talk the talk and walk the walk” of the start-up, new-tech, business scene in Denmark.”

STS-R2 suggests that the author rewrite the conclusion in his own voice, because she has identified a more authentic voice in the other sections of the manuscript which is absent in the conclusion. Therefore, she suggests that the author work on developing the internal linguistic uniformity of the manuscript. This suggestion extends the pattern of relations

performed with a stylistic dimension. Based on this criticism, the author rewrote the conclusion entirely using a more critical tone, and he argued that the camp's approach to knowledge production and the use of knowledge encourages the participants to protect their knowledge rather than share it with others.

This is exactly the type of assessment that makes an author want to thank peer reviewers for their valuable comments. STS-R2's identification of the lack of coherence between the critique in the analysis and the conclusion and the vague language used in the conclusion had the effect that the author established a different common thread throughout the manuscript than the one he had intended. The comments made it possible to see an unrealised potential in the manuscript. Caution had found its way into the manuscript partly due to the author's desire to make a nuanced theoretical contribution to Mialet's understanding of talent as an effect of distribution and centring, as pointed out by SSS-R3. The critical comments affected the author to throw caution aside and instead develop the critical potential of the study. Thus, the manuscript transformed from a theoretically nuanced input to a critical contribution to the discussion about how the concept of talent and talent programmes change science students' interactions with knowledge and the ways in which they understand their role as knowing subjects.

Summary

This article has shed light on different ways of performing peer reviews and examined the effects they have on the author's opportunities to improve the manuscript and ultimately on the future life of the manuscript. A peer review cannot be reduced to a peer reading a manuscript based on a set of generally accepted assessment criteria. Using the concept of patterns of relations, the analysis has provided insight into which other actors are involved in the peer review and how they affect the interaction between peer reviewer and author. Based on the notion that R-M-A is part of a larger socio-material network that is activated in a peer

review, I have examined what is being performed, and critically discussed which performances contribute to moving the script closer to being accepted as a scientific article.

In order for a manuscript to succeed in being transformed into a scientific article, a suitable pattern of relations must be performed. It is important to keep in mind that the comments the peer reviewers attach to their assessment of the text must be linked to the author's professional commitment and ambition to develop the manuscript further. The author himself is rooted in a larger actor-network in the academic world, which, for example, sets specific requirements for staff publication (scope and type), ranking of journals and local publishing strategies in research programmes etc. The same goes for peer reviewers. They are also already rooted in a scientific network that they activate through the work of judging a manuscript. For example, a peer review can be based on voluntary work, or it can be driven by curiosity and/or a sense of duty. If a manuscript fails to engage the peer reviewer personally or professionally, then it can become a real chore. This can probably affect the peer reviewer's tendency to invest her professional creativity in further developing a manuscript. In addition, both the author's and the peer reviewer's anchoring in scientific traditions and environments can activate divergent paradigms in relation to the assessment of a given manuscript. Therefore, for a peer review to succeed in bringing a manuscript closer to publication, the manuscript must connect the peer reviewer's and the author's personal and professional worlds. We cannot take it for granted that these worlds are connected prior to the reviewing. Instead, we should ask if the review process succeeds in creating a pattern of relations which allows the manuscript to continue its development.

If we want peer reviews as an institution to ensure a high quality of new knowledge within a given field, then my analysis shows that it takes place in two different ways: Either by preventing contributions of insufficient quality from being published or by helping the author to develop his manuscript to a sufficient level for it to contribute to our common

knowledge. By regarding a peer review as the creation of different patterns of relations, one sharpens one's gaze in terms of what is going on between the actors in a network – how they affect each other, the way they interact etc. I have analysed three different ways a peer review can be performed: By creating engagement or disengagement between academic interests, by measuring the study against a standard for what a scientific article should look like, and by focusing on what the manuscript is about to become, but not yet is.

We usually think of the author as an authoritative figure who has control over his manuscript. The Latour-inspired version of transmethodology, which I have tried out here, instead suggests thinking of the author as a subject who, like his text, is being created. Depending on the patterns of relations that are performed, the author may appear as someone who is committed, professionally competent and potentially able to make a scientific contribution, or as someone who is engaged in the wrong field, lacks professional skills and is unable to develop the manuscript into a scientific contribution. Transmethodology also breaks with the notion that the author is an autonomous figure who is the unique originator of a manuscript. The analysis has shown how the transformation from manuscript to published article is a collaboration between the author and a number of peer reviewers as well as an editor and countless other human and non-human actors who are part of the pattern of relations that is performed in a given evaluation. The author has certainly written the manuscript, but it is the whole network that helps him transform the manuscript into an article qualified for publication in a journal.

In the analysis, it appears to be central whether the peer reviewer treats the manuscript as a stable and immutable materiality or whether she treats it as a dynamic potentiality. As a stable materiality, it can be measured against a standard that the peer reviewer represents by virtue of her role. A relationship is created between R and A where R is the natural professional authority and A is a novice trying to live up to the standard that R represents. If,

on the other hand, the peer reviewer treats the manuscript as a dynamic and mutable entity, then it changes the relationship to a collaboration where R is not only an external assessor but also a co-author. R becomes someone who thinks about how the text can be further developed, and a more equal relationship is established with A. The assessment goes from being definitive to conditional on whether A can realise the potential in the text that R has identified. The peer reviewer's attitude to the manuscript is crucial to which R-A relation is being performed. The performance of the authoritative peer reviewer draws a sharp line between R and A. The performance of the equal peer reviewer obscures the boundary, whereby R and A become entangled. The common reference point is shifted from the text-external standard to text-internal options. However, this does not mean that R relinquishes her authority. It is performed by the ability to think one step ahead, for example by making suggestions for changes that will improve the text.

It is hard not to fall back into a simplistic representation of bad reviewers who evaluate a manuscript by a fixed standard and good reviewers who manage to see the potential in a manuscript. This is how it can be experienced when you receive a negative or evaluation of a manuscript as an author in a peer review process. It is also much more pleasant to receive a positive evaluation by a reviewer who suggest text-internal improvements to the manuscript. This is exactly where a transmethodological approach can be a help by decentralizing the research focus to include a larger network in which the assessment takes place. By following the same manuscript through several assessments, it becomes possible to understand networks as varying and make it part of the study of a manuscript's biography, to look at how changing networks are brought together and what effects they have on the various actors involved. Herein lies a refusal of the notion that there are good and bad peer reviewers per se. Not all networks allow the reviewer to perform the role of the creative co-author. It depends, among other things, on whether the submitted

manuscript can engage the reviewer and whether her other work tasks leave time to invest much energy in developing the text. The trans-methodological approach also allows a complex understanding of what kind of feedback manages to bring a manuscript forward. It is not only positive readings on the manuscript's own terms, but can easily be assessments that combine several types of readings, including critiques of the use of method, theory or empirical material that do not live up to the academic standard in a particular domain. The decisive factor is how a given assessment is included together with other actors in a review event in question. It may be that the critique is included together with constructive instructions on how the article can come up to standard or, conversely, plays together with the critical assessments by the other peer reviewers, which in effect deprives a manuscript of its existence. However, it also means that we cannot determine whether a manuscript is good or bad without taking into account the network in which it is judged and projected into the future as subject to rejection, revision or publication.

The study of reviewing as the creation of different patterns of relations stays close to the level of practicalities involved in peer reviewing. This approach is sometimes accused of being empiricist (Sørensen, 2007). I would argue, however, that it is an expression of a predilection for seeking insight into procedures, continuity and consequences. It is an interest in understanding the local. I propose to understand peer reviews as local performances that produce special effects rather than understanding them as a universal institution that guarantees a uniform treatment of manuscripts and thereby scientific quality. The validity of peer reviews does not simply lie in their ability to judge the text itself based on a generally accepted standard, but also in what they enable the text to become. Thus, transmethodology changes our understanding of scientific quality from something that lies in a text that an external assessor must decide on the quality of, to something that lies in the relationships between several actors involved in the peer review and which the peer reviewer himself

contributes to creating by extending the thoughts set in motion. It is a function of peer review that has been pushed into the background of the prevailing practice of preventing contributions of insufficient quality from being published. That is a point that goes far beyond the sequence of the methodological circle I have dealt with here. Further research from a transmethodological perspective could, for example, study the effects created by the existing publishing model in relation to bringing knowledge to relevant readers. To what extent is the effect to stop trains of thought rather than lengthening trains of thought, to inhibit scientific creativity rather than stimulating it, and to inhibit collaboration between researchers rather than creating collaboration? A trans-methodological perspective on peer review softens the boundary between assessment and (co-) production, between authorship and critique and between manuscript and finished article by emphasizing creativity, collaboration and knowledge sharing as an integral part of academic quality assurance.

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