

The Rhetoric of Science in Practice – Experiences from Nordic Research on Subject-Oriented Texts¹ and Text Cultures

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Background: The Scandinavian subject-oriented texts projects and the study of scientific writing

During the 90's three extensive projects studying the development and characteristics of the text cultures of non-fictional writing or "subject-oriented texts" ("sakprosa" in Nordic languages) was carried out in Norway and Sweden. All three projects followed a consistent multi-disciplinary approach, in spite of the fact that the composite field of discourse analysis showed itself to be attractive for many of the involved researchers. These projects had *three* dominant characteristics in common (Berge):

Firstly, one wished to study systematically different text cultures in a society where subject oriented texts constituted and defined the culture. Consequently a society was to be understood with reference to its communication patterns. This goal was animated by the ambition to study the constitution of text cultures regarding non-fictional texts as a study of the development and establishment of modernity in Sweden and Norway. As a result, the projects chose the 18th Century as their starting point in time. This is the century when the principles of freedom of writing is beginning to be implemented in the Nordic kingdoms, a free press producing journals and newspapers is developed, permanent publishing houses are being established and scientific academies advocating free thinking and interest-free research are promoted. Finally literacy increasingly becomes a common resource for the masses as a result of the development of a relatively advanced school system, democratic institutions and a liberal economy. As a consequence the Nordic countries are today characterised by a strong democratic tradition, emphasis on education and written culture, an innovative and enterprise-oriented business culture, and well as substantial welfare states. A common perspective of all three projects was that this historical result might partly be explained by the development, distribution of, access to and broad use of subject oriented text cultures in Scandinavia since the 18th century. In fact the term "sakprosa" is a word invented in Scandinavia (by the Finnish linguist Rolf Pipping), and was originally (1938) established as a term referring to objective, value-free, precise and clear language, as opposed to the subjective, personal, metaphorical and emotional language of the belle arts and political discourse. There is an ideological relation between the philosophy of language of the inventor of the "sakprosa"-term and the logical positivism tradition. This approach implied that the Nordic projects were interested in the relation between the use of texts and norms for text production on the one hand, and the advanced distribution of power typical of modern societies on the other. Consequently, influential non-fictional texts such as manuals for political work in mass organisations dominating politics and cultural life in the 19th and 20th century, and all-embracing text cultures such as state bureaucracies, were viewed as relevant research phenomena for the projects. A special feature of the Nordic situation as compared with other countries, is that the Nordic nations have relatively small populations, and that these populations share a strong egalitarian ideology. Consequently the public spheres in these societies traditionally have been quite "transparent", establishing the ground for a close relationship between the intellectual elites and scientists on the one hand and the rest of the general public on the other.

Secondly, the aim was to develop theories and methods necessary for a comprehensive study of subject-oriented text cultures and texts. The characteristic features of cultures where subject-oriented texts were created were studied. The types of textual practices dominant in the various subject-oriented text cultures were also studied, as well as the texts themselves. The dominant focus was on textual structure, however, though language styles and registers of the texts were also investigated.

Thirdly the projects desired to study the relation between textual practices and text norms on the one hand and a sample of important institutions constitutive of modern societies on the other, such as the already mentioned bureaucracies and the complex textual practices of mass-recruiting political organisations. In the research projects there was a significant interest in the text cultures of modern science. As is common in the in the Nordic language tradition, the term "science" here, refers to the natural sciences, the social sciences, as well as typical humanities academic disciplines. In contemporary science an overwhelming part of the knowledge used in the government of complex societies and states, in the development of industries and trade, in medicine and health care and in intellectual reflection and debate has been developed since the 17th Century. This "scientification" of all parts of society is not only due to the writings of the scientists themselves. Very few people have actually read Galileo's, Pasteur's, Einstein's or even Darwin's scientific works. The dominance of science in modern societies may of course be explained by the intensive and long-lasting schooling of the population. In two important contributions to the Nordic projects professor Per Ledin of Örebro University demonstrated that the development and popularity of journals and magazines from the beginning of the 19th century onwards, could be explained by these popular text cultures' dominant scientific approach to the reality of natural facts and human experiences. In these written texts the man in the street learnt that home remedies of different kinds, from the treatment of illnesses to the acculturation of the agricultural tradition, could not be trusted, but had to be replaced with knowledge developed by advanced science. This was a type of knowledge that for most people was incomprehensible and unattainable. Even the powerful political right-wing movements of the 20th century in reacting to the modernization of society, were immersed in scientific thinking, clearly demonstrated by the scientific argumentation behind racist politics in Germany, South-Africa and elsewhere in long periods of the century.

In this article I intend to present some prominent tendencies in the study of academic and scientific texts and text cultures by the Nordic projects. An important point of reference for the projects' studies of academic text cultures was the discipline of the rhetoric of science. This is a discipline that is well established in the international research community, especially in the United States. Within the rhetoric of science field there is a strong tradition of studying the relation between the dominant goal of science - the quest for unbiased truth - and how such truth is established through various forms of semiotic mediation, such as written texts (text books, articles), oral presentations, illustrations, animations, films etc. The discipline is also concerned with how the truth of scientific utterances is accepted and established as a fact in the

¹ The Scandinavian word "sakprosa" is translated to "subject-oriented texts". This is a translation recommended by AILA (the International Association of Applied Linguistics) when the Nordic projects were presented at the AILA-conference in Tokyo in 1999.

research community. Thus, the study of the rhetoric of science is concerned with persuasive communication, and is also interested in the relation between text and power in any specific text culture. To have power in the scientific community is to be able to persuade the community of the correctness or probability of one's own truth claims.

This approach to scientific text cultures and academic writing is however not without some specific intellectual and moral problems. Many scientists may well understand a rhetorical approach to scientific communication as being in conflict with the ethos of scientific work. It might be viewed as an invitation to epistemological relativism and an end to scientific communitarianism, to claim that the question of truth in science can be explained by reference to persuasion. Issues of this kind were intensely discussed during the so-called Sokal-debate. Given the ideological link between the original intended content of the word "sakprosa" and logical positivism, it might also be regarded as a paradox that the rhetorical tradition should be regarded as a relevant theoretical framework for Nordic projects studying subject oriented texts. However, these projects did not question the notion that a constitutive feature of science is the search for unbiased truth. And the reality of natural and mental worlds irrespective of our ideas regarding them, was certainly not questioned. However, the researchers associated with the projects were interested in finding out how truth claims in various fields of sciences were presented and represented as texts. They were also interested in how persuasive work was done in ways that are in accordance with ethical standards of specific scientific text cultures. But before we venture further into how the rhetoric of science was studied in the Nordic projects, it will be relevant to discuss how scientific textual practices may be understood as rhetorical activities without being inconsistent with the ethos of an unbiased science.

Textual reality, truth and epistemology – is the rhetoric of science consistent with scientific realism?

As previously mentioned, the rhetoric of science is a controversial discipline, especially among certain representatives of the natural sciences and philosophers who defend an orthodox scientific realist position. Some of these representatives spot in this new discipline a new version of an outrageous idealism, such as the one advocated by the Irish philosopher Berkeley who insisted that "To be is to be perceived or to perceive" ("Esse est aut percipi aut percipere"). In response to those who sceptical about a discipline such as the rhetoric of science, though, the slogan would be "to be is to be uttered in language or to utter in language". In fact, one of the most prominent spokesmen of the rhetoric of science, Allan Gross, has used formulations that may be interpreted as close to an idealistic position in proposing for instance that "rhetoric is constitutive of scientific knowledge" (Gross 2006: 5).

What is at stake here is that the rhetoric of science does not accept without further ado one of the basic premises of the realist position, the so-called "correspondence conception of truth": i.e. that any utterance or text that is independent of the semiotic resources used for creating it, is true if it *describes* facts that are true. Or to use a formulation typical of the realists: "A statement *S* is true if *S* describes the facts". Thus, in the realist tradition, any utterance or text is supposed to be a mirror image or icon of a non-textual reality, both natural and mental. The realist position gives privilege to utterances and texts that are *descriptions*. As we have indicated, it is typical of the rhetoric of science that it is concerned with how texts and utterances attain the position of such a descriptive "statement". The rhetoric of science understands this process as persuasive. For any competent language user to understand any utterance, text or "statement" as "true" he or she has to be *convinced* that it is "true" by means of the utterance or text. For a scientific realist the task of science is to check whether a "statement" that is proposed as "true" is "true" independent of the claim that it is "true". If I in a text propose as a macro-proposition that "the Israeli army is killing civilians in Lebanon" its truth may be ensured by investigating whether the Israeli army is actually killing civilians in Lebanon or not, irrespective of my descriptions of the situation in Lebanon in some utterance or text. The rhetoric of science then, accepts that science is governed by the quest for unbiased truth. It is not the position of the rhetoric of science that any sort non-textual reality is created by an utterance or text. A still weaker version of the idealist and constructivist positions may be relevant for rhetoricians who study scientific texts. An acceptable position to take would be to propose that any non-textual reality is given meaning or is understood via the utterance or text. The rhetoric of science then, does not accept that natural facts and mental states may be grasped individually and presented collectively without the help of semiotic devices such as language. The relevance of the rhetoric of science is thus based on the fact that even if science is defined by the quest for unbiased truth, or by checking that statements proposed as true are true or false, irrespective of propositions claiming they are "true", most people – scientists or not – are not able to replicate or repeat the necessary investigations. Therefore the scientific presentation of texts claiming to be "true" has to be based on a mutual agreement of *trust*. By means of any scientific text knowledge about, insights in and understandings of, any given reality is made probable for those who are not in the position to do this reality description work themselves. The task of the rhetoric of science is then to describe how such persuasive work is done through different forms of semiotic mediation. The task of rhetoric is *not* to assess whether what is presented as probably "true" is – in fact – true or false, or whether the mutual agreement to trust what is presented as "true" is in fact true, has been violated or not, but to investigate, describe and explain the textual strategies typical of the scientific truth-seeking culture in question, and its representatives. Such textual strategies may of course be very different in disciplines such as biology or social anthropology. In the Nordic research projects studying subject matter oriented texts, the epistemological position of the rhetoric of science was in this way considered consistent with the position of scientific realism (and therefore also with logical positivism), even if it challenged the dominant view of language and other semiotic means (such as graphs, illustrations and photographs) as iconic and descriptive in these traditions. A wide range of semiotic means is used, and must be used, in order to convince the scientific community of the probability of scientific truth-claims. The task of rhetoricians studying scientific texts and utterances, is thus to describe and explain how this work of making something appear scientifically probable is being done in different scientific communities.

Why study the rhetoric of scientific texts? An expansion of arguments

Even if the critical researcher should accept this modified view of the rhetoric of science as making it consistent with the basic tenets of scientific realism, it is not obvious that rhetoric should be regarded as a valuable and relevant theoretical and methodological tradition in the study of subject oriented texts. Of course "rhetoric" used to be synonymous with the textual practices of democracy in ancient Athens, as well as the long lasting pedagogical tradition that resulted from this. In the scientific literature, however, "rhetoric" has come to refer to several different types of phenomena.

Firstly, "rhetoric" is viewed as a particular kind of communication amongst many others, all characterised as persuasion. It was this understanding of rhetoric which made it unacceptable for Plato as an instrument for the development of epistemic knowledge. For him to be preoccupied with rhetoric meant to be engaged in that which might be presented as "true" though persuasive discourse, to the neglect of what

is in fact “true”. As we have seen, Plato’s opposition between “true” knowledge, independent of persuasion – “episteme” – and knowledge made probable through persuasive communication – “doxa” - is still relevant for discussions of whether rhetoric is an appropriate approach to the study of scientific texts and communication.

Secondly, “rhetoric” may be understood as a medium of enculturation (analogue to the German word “Bildung”) by means of communication. In this tradition one wishes to focus on rhetoric as a prototypical curriculum for the teaching of speaking, writing and communication, a field that is covered today by applied linguists. An interesting characteristic of the relatively new interest in how scientists construe and represent their work in articles, reports, papers, posters, oral presentations and books, is that it is often driven by a pedagogical interest in the teaching and learning of scientific writing. A lot of research into scientific texts and text production within an applied linguistics framework may be explained by the functional value of teaching students how to practice science using language as a tool. It is a common experience of most post-industrial welfare states that the new generation of young people attending the universities in huge numbers has problems in cracking the behavioural codes of science. Consequently, many universities include practical training in scientific writing and argumentation in preparatory courses. Since these courses create a demand for research-based knowledge regarding how scientists actually write, funding for research into scientific writing is made available. This research is seldom critical of the types of academic texts studied, and it only studies cursorily the wider context of culture in which scientific texts are produced. This strategy may also explain why the study of scientific texts in an applied linguistics framework seldom raises the epistemological questions that are the essential focal point of the rhetoric of science tradition.

Thirdly, “rhetoric” may be understood as coding specific types of genre knowledge. In this way “rhetoric” is understood as a textual norm system in specific text producing cultural institutions in the course of history. Historically, the rhetorical progymnasmata tradition has been considered irrelevant and useless for the development of textual norms in scientific writing. A rhetoric of science must consider the relevance of classical rhetorical theories and handbooks for the study of scientific communication, as well as taking into consideration the fact that researchers who established the Renaissance empirical tradition systematically distanced themselves from rhetorical models. In this respect, the applied linguistic approach may be considered closer to research communities’ own appreciations of what they are doing when they are communicating scientifically.

Fourthly, “rhetoric” may be viewed as a textual science in itself, delivering a comprehensive text theory and methods for the study of texts. The classical tradition has transmitted a fairly extensive literature classifying and describing the communicative practices of rhetoricians in Greece and Rome. Quite a lot of these texts are pedagogical prescriptions for how to speak to an audience, and how one can teach young people to behave properly in communication, a condition for a future position as a respected citizen. Still, some of the classical texts aspire to a more comprehensive theory of what rhetoric is. The classical work in this tradition is of course Aristotle’s “Rhetoric”. This work presents a definition of rhetoric that is a defence of the criticism raised by Plato, as well as a description based on this definition. Even in the introduction Aristotle presents his basic view of rhetoric as a specific field of human behaviour, which has its own rules and conventions:

“Rhetoric is the counterpart of Dialectic. Both alike are concerned with such things as come, more or less, within the general ken of all men and belong to no definite science. Accordingly all men make use, more or less, of both; for to a certain extent all men attempt to discuss statements and to maintain them, to defend themselves and to attack others. Ordinary people do this either at random or through practice and from acquired habit. Both ways being possible, the subject can plainly be handled systematically, for it is possible to inquire the reason why some speakers succeed through practice and others spontaneously; and every one will at once agree that such an inquiry is the function of an art.” (<http://www.public.iastate.edu/~honey1/Rhetoric/>)

Since all men “attempt to discuss statements and to maintain them, to defend themselves and to attack others” the task of rhetoric as a science is “to inquire the reason why some speakers succeed through practice and others spontaneously”. Rhetoric as a science then, describes what the elements of rhetorical behaviour are, and explains on the basis of this description why some are better at convincing other people than others. It is on the basis of this establishment of rhetoric as a science that it still has relevance in modern text research and discourse analysis. Many text researchers attracted to rhetoric still use the terms and definitions developed by Aristotle as methodological tools. Since Aristotle studied only the genres of Athenian democracy, it is of course disputed whether the same methodological tools are relevant for the description of other genres developed in completely different cultures with other communicative functions, such as that of scientific writing.

It is interesting that in the five criteria used to determine if scientific texts have rhetorical features - suggested by the influential rhetorician of science Lawrence Prelli - arguments are employed for a rhetoric of science that moves beyond the classical tradition. In Prelli’s book *A Rhetoric of Science. Inventing Scientific Discourse* published in 1989, scientific discourse is defined as “symbolic inducement”: The rhetoric of science enables the strengthening, clarification, evaluation, mediation in relation to other disciplines and non-researchers, and the creation of new scientific paradigms, i.e. models of explanation and constitutive features of scientific agreement. In this way the rhetoric of science enables understanding of constitutive and necessarily true premises or propositions, for instance by means of selective samples, examples, text books, exercises etc. In this way, the rhetoric of science makes clear premises and conclusions that enable possible criticisms. Prelli’s second criterion is that “scientific discourse is situational discourse”. Science takes place inside a more or less established culture with norms that regulate who may express themselves and in what way. Thus, the scientific community is a historic construction. Further, the rhetoric of science presupposes a certain ethos that is taken more or less for granted, articulated in Merton’s five criteria of scientific culture: *communality, disinterestedness, organized scepticism, originality, humility*. Prelli’s third criterion for a rhetoric of science is that “scientific discourse is addressed discourse”. The rhetoric of science is dialogical. It is discussion-oriented within a scientific community. The fourth decisive factor of a rhetoric of science according to Prelli is that “scientific discourse is reasonable discourse”. The rhetoric of science enables conclusions that are reasonable from the point of view of the paradigm that the participants in any given rhetorical situation adhere to, as well as communication between paradigms, making translation between them possible. The fifth and final criterion of a rhetoric of science in Prelli’s contribution is that “scientific discourse is invented discourse” The establishment of paradigms implies persuasion, according to Prelli. This example of a definition of the rhetorical characteristics of science by a prominent rhetorician has clearly illustrated that to define a new type of text-oriented discipline on the ground of the oldest one of this kind, rhetoric, demands certain adjustments relative to features of the text culture being studied. Any text researcher or discourse analyst might present four of five criteria without any reference to the rhetorical tradition. Still, the fifth criterion is a genuinely rhetorical one. By means of this criterion Prelli makes reference to the specialised rhetorical tradition of “topics”, which means, amongst other things, those themes which are presented as relevant, how these themes are understood etc. This modified use of rhetoric is also advocated by Allan Gross in his book *Starring the Text. The Place of Rhetoric in Science Studies* (2006).

Finally, the scientific literature views “rhetoric” as an instrument for ethical reflection on text. This position is inherent in the classical tradition. In fact, Aristotle’s *Rhetoric* is both a reply to, and an attack on, Plato’s refusal of rhetoric as a relevant and decent tool for the quest of knowledge, and a criticism of the tendencies to use rhetorical knowledge cynically in Athenian society as a means for making white black, and vice versa. By presenting rhetorical knowledge as a kind of practical knowledge everyone has access to, and as knowledge that has been made crucial for the development of important institutions in Athenian democracy such as the courts and popular assemblies, Aristotle demonstrates the need for an ethical reflection on the features and qualities of such knowledge and the way it is manifested in communication. By showing these features and qualities explicitly and discussing them openly Aristotle establishes the ground for a sound and decent discussion of the norms that should constitute the necessary premises for ethical rhetorical practice. By establishing such constitutive rules it should be possible to distinguish in a fundamental manner between rhetoric and propaganda, or between reasonable points of view and aggressive or unfounded agitation.

The relevance of rhetoric for the study of scientific texts and text cultures in the Nordic subject oriented texts, then, was not rhetoric as a general theory and method for the study of textual communication. Actually, only two arguments for the relevance of rhetoric were considered relevant in this context. First, rhetoric and the rhetorical tradition were necessary as a model for the study of scientific textual practices when understood as persuasive communication. As mentioned, the point of view advocated was that the scientific text made qualified knowledge of reality probable for those who are not in a position to do such reality description work themselves. Thus, of special interest in the rhetorical tradition was the science of proofs, indices and topics. Secondly, rhetoric and the rhetorical tradition were relevant as an instrument for ethical reflection on how scientific texts were executed. Important questions here were: What were the ethical norms for scientific utterances and texts in specific scientific text cultures, how and why were they established as they were, and in what way did representatives of specific scientific text cultures acquire these more or less articulated norms?

In this way the rhetoric of science was able to help broaden some general themes inherent in the three research projects, both the fact that the development of scientific text cultures are a precondition for modernity, and the fact that these text cultures have immense power in contemporary society. Let us take a further look at these two research themes in the context of the three subject-oriented research projects, in the light of the rhetoric of science:

As an autonomous text culture, science is characterised by being both a precondition for modernity, and one of modernity’s most characteristic features. By studying how science is mediated semiotically we are studying aspects of the dominant doxa of modern society. Thus, when we study how scientific text cultures have evolved and are evolving, we are witnessing the development of modern society. This point has been made by a number of scholars; most prominently by Jack Goody with his studies of the impact of literacy on the evolution of society and culture, and by Charles Bazerman in his studies of the development of the experimental article in the natural sciences. It is typical of scientific text cultures that they present a worldview that for the most part is inconsistent with everyday experiences of most human beings. Science does not believe what is told. Scientific argumentation is based on this presumption. Scientific argumentation and persuasion is therefore characterised by being a de-naturalised type of language use, and by a type of enculturation that uses normative resources that are quite different from those used in every-day spoken interaction. Scientific texts reflect a distrust in common human communication, substituting the conventions of everyday speech for new textual norms. It is a common experience in most studies of scientific text cultures in the Nordic research projects to discover that textual norms are adapted to the dominant doxa of the particular scientific discipline. We shall return to some examples of such experiences at the end of this article. These textual norms are established on the basis of what is considered to be the “truth” in actual scientific text cultures. Since this quest for “truth” always demands a consequent scepticism towards established truths – formulated most prominently in Karl Popper’s falsification principle, stating that every genuine test of a scientific theory is an attempt to refute or to falsify it – these norms are always considered to be changeable. Textual interaction in science, then, is prototypically viewed in accordance with its instrumental features. Thus, a scientific community in principle is never a tradition-oriented community, but a community devoted to modernity and intellectual change. If a scientific text does not fulfil its task as an indication of the doxa of a specific scientific text culture, it will inevitably be considered irrelevant, and its norm resources dysfunctional.

Perhaps paradoxically, this fact is the reason for the stable and robust text norms operative in the most established sciences, such as medicine and the natural sciences. The strict conventionalisation indicates of course that the doxa of medicine and the natural sciences is something settled and not to be negotiated. These text cultures have developed advanced text norms, often grammaticalised in handbooks. The manual of the Norwegian-language journal for doctors - *Tidsskrift for den norske lægeforening* - comprises 150 pages with detailed instructions for authors. The prototypical natural science article follows the standards of the IMRAD-norm, thoroughly studied in the literature on scientific writing. The situation is quite different in many of the more artistically oriented human sciences. Of course textual norms are developed in such communities as well, but they are seldom legislated in the way that the norms of natural sciences are. In human sciences disciplines individualisation is the norm, and one is sceptical about the standardisation that characterises the natural sciences. In fact this apparent liberalism reflects the obvious instability of the doxa of the humanistic scientific traditions. A Norwegian study of the development of the text norms of literary science (Bakken) that we shall present later in this article, demonstrates that codification of norms happened mainly at the level of topics and of linguistic style and register. Text norms for composition at more global textual levels were not developed at all.

Since the breakthrough of liberal politics in the 80’s the outcomes of scientific work are more and more becoming accepted as commodities. It is becoming increasingly more accepted that state-funded universities capitalize their products and ideas. Scientific articles printed in journals or downloaded from quality sites on the web are commercially traded as products. Increasingly, single scientists’ excellence is being assessed in terms of their capacity to produce texts that are published in prestigious journals or book series. Traditional authorship is becoming neglected in favour of a system where important participants in research projects are presented as the co-producers of articles. At the University of Oslo one article was written with 150 researchers named as co-authors. This ongoing industrialisation of scientific writing has already had its local scandals. In Norway it was discovered that one of its most prominent and respected medicinal researchers had faked the data used in articles by him (often with many co-authors mentioned) published in attractive journals such as *The Lancet* and *Nature*. We can observe in this commodification of scientific writing a tendency towards what we might label “scientific fetishism”. This tendency is indicated by the fact that the IMRAD-model, originally developed in the natural sciences as a text norm adapted to the doxa of these sciences, is even being imitated in sciences that investigate cultural facts and use the interpretation of human behaviour as a basic method. An example of this trend is the development of scientific writing in linguistics. As shown in one of the Norwegian subject oriented research projects, linguists are trying to imitate the IMRAD-model and the doxa that comes with it, even though this entails that characteristics of the available data are being violated. Interestingly enough, these writing strategies result in complicated textual patterns that attempt to compensate for the incompatibility between textual norms and doxa.

Studying scientific text cultures – fundamental methodological concerns

A common denominator in the Nordic subject-oriented research projects was that the study of texts and the normative resources used in creating them should be accompanied by studies of the relevant cultural and situational contexts, as well as the interactions between institutional qualities of these contexts, the texts themselves and the text norms typical of these contexts. This approach was chosen not least in order to underline that the texts were not understood as a superficial expression of these cultures, but as a constitutive feature of such cultures. Without advanced text cultures – which do not necessarily have to be mediated by written texts – it would not be possible to establish complex institutions at all. This understanding implicated that methodological strategies would be inspired not only by semiotics, text linguistics and discourse analysis, but also by anthropology, thus constituting a textual anthropology.

The methodological program for one of the projects was presented by summing up some of the fundamental positions of a possible text anthropology:

Firstly, textual categorisations need to be understood from within the activities in which they are used. Text categorisations are indexes of various activities in a specific culture where texts are produced. These categorisations could be conceived of as a map covering all the genres used in the culture, as well as all kinds of texts used, and the semiotic systems used as resources for creating them. This meant that scientific activities had to be studied not from a universal point of view, but as textual practices typical of the specific science in question. Therefore all sciences can, and should, not be studied according to the same scientific standards and models, or from the point of view of specific scientific disciplines. There is a strong tendency in new types of public management to assess all scientific activities using highly institutionalised medicine as a standard. This political position indicates insensitivity towards the variation typical of activities in different fields. It was necessary to document this variation.

Second, different sciences were considered to be different text cultures. These cultures could be more or less institutionalised. Of course some sciences have a long history of institutionalisation, while others are only recently established and consequently underdeveloped. This last type of situation is typical for much research in the field of discourse analysis, while physics is of course a typical discipline with a very long tradition. Research in certain areas of the sciences has been industrialised, with most of the research taking place in private enterprises, and some important sciences are a constitutive part of the international war industry, while others exist only in the seminars of professors and students and in the articles and they produce, without any broad recognition in society. These huge differences need to be considered when acknowledgement interests, truth concepts, probability criteria, textual strategies and textual norms of various text cultures are investigated.

A third methodological insight was that the borders between different scientific text cultures could vary considerably. Many well-developed sciences are characterised by an extreme specialisation that makes it impossible for only a small and exclusive group of researchers to understand and assess the quality of the work being done. The evolvement of semiotic resources is a constitutive feature of such specialisation. The development of advanced pictorial and visual resources for creating meaning, together with access to advanced computer and communication technologies has established the ground for even more complexity and specialisation. This advance is of course typical for many of the research fields in contemporary medicine. On the other hand, for some sciences the borders between the scientific text cultures could be considered open, and the sciences involved characterised by theoretical and methodological multi-disciplinarity and innovation. An example of a scientific text culture of this type was the so-called Tartu-school in semiotics. This tradition was established after the death of Stalin at the University of Tartu in Estonia in the then Soviet Union. The Tartu-school developed an original mix of ecological biology, Saussurian and Hjelmslevian linguistics, and information theory. Another prominent example of interdisciplinary interaction and invention is the field of ethnomethodology, which established a genuine study of spoken interaction for the first time in history. In this way a reaction to, and revolt against, the dominant doxa of mainstream sociology led to a paradigm shift in linguistics.

As mentioned at the beginning of this article, the research projects' interest was in an investigation of the unique qualities of texts produced in different scientific text cultures. A fundamental point made was that a text is a finite realisation of some meaning potential in a specific situation. The text creates new meaning, but it is normally constructed in such a way that this meaning should be understood. Any text is an utterance, and is therefore unique. At the same time it utilises normative resources that are more or less conventionalised in the culture of origin. The variation with regard to how different researchers or research groups position themselves and their model readers in different scientific text cultures is an important arena for research. In another article in this volume, professor Johan Tønnesson demonstrates how the writing of history implicates the evaluation of various sources, each presented as different voices in historians' texts. This positioning may vary from writer to writer, from researcher to researcher, and it may also be governed by disciplinary textual norms. Any scientific writer has to adapt himself or herself to the specific text norms of the research community on hand. An important task in the project was of course to make explicit these norms and assess their degree of standardisation and grammaticalisation. We shall return to examples of this work at the end of this article.

The list of methodological positions is longer than stated above, but the rest of these are not directly relevant to the arguments put forward in this article. More important for discussion of methodological strategies in the three Nordic projects are the characteristics of the doxa of any specific science on the one hand, and the strategies chosen for sampling of text cultures and texts on the other. Let us first present differences in the scientific doxa.

An important experience emerging from the three Nordic projects is that different branches of science require different approaches to the study of the rhetoric used by them. As mentioned earlier in this article there is a strong relationship between the paradigmatic positions of science, what kind of topics may be discussed, and the relationship between these topics and understandings of reality, i.e. the doxa, and the way norms for textual strategies are constituted. An important difference is apparent between sciences that study natural laws and social conventions that determine behaviour on the one hand, and sciences that study unique phenomena on the other. The first kind of scientific paradigm is normally referred to as "nomothetic", while the other, regarding unique phenomena, is called "idiographic". In addition, a distinction is made between nomothetic sciences that study natural laws that make prediction possible, and nomothetic sciences that study cultural norms that may explain observable meaningful behaviour. Established knowledge of the first kind is based on the expectation that its formulated laws and rules are unconditionally true in all situations, while established knowledge of the other kind is based on the expectation that the norms and conventions described present probable explanations to observed behaviour in a specific society. In a nomothetically oriented discipline like linguistics many conflicts between researchers might be explained by the distinction between these two types of nomothetic science. In idiographic science on the other hand, phenomena are studied in their specific context of situation, and the strategy is to explain the behaviour in that context, and not in wider cultural contexts or in terms of natural laws, of course. Radical idiographic sciences such as deconstructivism in the discipline of literary criticism give up explanation altogether, and substitute it with a descriptive and

argumentative exegesis of individual interpretations. The rhetoric strategies in sciences with such huge paradigmatic differences of course vary greatly from science to science, as we shall soon demonstrate with examples. The basic text types: explanation, description, argumentation, and narrative are represented in scientific texts according to the constitutive differences created by the two types of nomothetic science on the one hand, and idiographic science on the other. According to one study (Aas) produced by one of the Norwegian subject oriented research projects, a crucial difference between writing in mainstream natural sciences and post-modern literary criticism showed itself in the way interpersonal resources were used. In the natural science texts the researcher was committed to a non-cultural reality, and to how insights from this reality could be utilised to the greater advantage of the community. Thus, the scientist also had a social commitment. These combined commitments were observable in the use of modality in the texts studied. The natural scientist prototypically uses a vague and negotiable deontic, epistemic modality, underlining what “probably” is true, and what “probably” might be utilised of the presented findings. The interpersonal strategies in post-modern literary criticism are somewhat opposite. New interpretations are presented as more relevant than others, and these interpretations are understood as a part of an ideological debate regarding different understandings of the cultural world. Since the researchers are not committed to an external reality, only to interpretations of disputed cultural facts, interpersonal relations are characterised by non-negotiable positioning and a strong obligation to the addresser’s positions. The doxa presented in these different scientific practices are, respectively, a naturalistic and an idealistic discourse. It may be a paradox for some that the argumentative, descriptive and explicative parts of the post-modern literary critics text are characterised by strong truth propositions, non-negotiable meanings, and few concessions, while the natural scientists rhetorical strategies are much more open to different interpretations. The naturalistic doxa presented in the rhetoric of the representative for nomothetic science is characterised by uncertainty, doubt and insecurity, while the idealistic doxa of the representative for idiographic science is characterised by its opposite.

In the rhetoric of science tradition the conventional data selection strategy has to been to study canonical, outstanding contributions to science, such as Newton and Darwin’s seminal works. In the Nordic projects, however, mainstream everyday scientific practices have been the object of study. Thus, the data that has been collected has been viewed as representative of the researchers themselves. These materials have not been statistically selected, as in the KIAP-project presented elsewhere in this volume. In this way the sample selected consists of utterances defined as typical texts by the researchers themselves. When the rhetoric of an individual researcher has been investigated, the motive for this has been that the researcher in question has a prominent position amongst his colleagues in terms of constituting a special school or tradition. These methodological strategies are of course motivated by main objective of the project previously presented in this article: to study the evolvment and institutionalisation of scientific text cultures in Nordic societies. It is also motivated by an interest in how scientific text cultures becomes accepted and embraced by all members of the society, thus constituting a contemporary societal power hegemony. This research focus explains the interest in the scientification of everyday life by means of weekly magazines, official information services and the popular mediation of science. In many of the studies in the Nordic projects the focus has been on apparently “trivial” scientific texts such as the composition and use of text books at all levels of the educational system, almanacs and discourses on contraceptives and birth control (Melander & Olsson). Another consequence of this approach is that it has been of special interest to study socialisation processes where people internalise scientific knowledge in different cultural contexts, such as schools, universities and people’s colleges. Even though the primary purpose of this research on uses of scientific literacy in all parts of society has not been a pedagogical one, the applied linguistics and writing research traditions have been of great interest in developing these projects.

How to study the rhetoric of scientific texts? Some analytic dimensions represented by Nordic project examples

The results of the Nordic subject-oriented projects studying scientific texts strongly emphasize that different kinds of science and different scientific activities imply quite different approaches to the study of scientific rhetoric. “Science” is text culture consisting of different discourse communities with different communicative goals, different textual traditions, different genres, different truth-concepts, different types of interaction with society, as illustrated in John Swales’ textographic study of scientific practices in an university building in his book “Other Floors. Other Voices”. Let us now have a look at some analytic dimensions studied by a few of the research projects directly initiated by, or associated with one of the Norwegian subject-oriented projects. The first example demonstrates how a prominent criminology professor establishes a common ground in a scientific text by positioning the model-reader in relation to a specific paradigm, closing access to other alternatives. The second example is drawn from a study of how argumentative structures in the disciplines of medicine, history and linguistics are realised, and how these realisations relate to, and configure, the specific doxa of the discipline. The third example illustrates the rhetorical strategies of two paradigms of the same scientific tradition in conflict. This example is taken from a study of how the discipline of literary criticism has been established at Norwegian universities.

Paradigmatic positioning in criminology

In his book “Thomas Mathisen on trial” (Norwegian: *Kan Thomas Mathisen forsvareres?*) Magne Gjerstad analyses the Norwegian criminology professor Thomas Mathisen’s book “Prison On Trial”. Gjerstad follows a three-step strategy as he dissects Mathisen’s rhetorical strategies.

Gjerstad’s first move is to define the position of the text studied in what he calls “the textual hierarchy of scientific texts”. With the help of a thorough analysis of the position of the book as a university text book at home and abroad, in translation, and through reviews in relevant national and international journals, and even more important its position in international citation indexes, Gjerstad is able to show that Mathisen’s book has acquired a prominent place in the text hierarchy of the social field of criminology. The aim is *not* to try to define the book as a canonical text, comparing it with the seminal works of outstanding scientists as they are normally studied in the rhetoric of science, but to demonstrate that the position of the book in the text hierarchy defines its power in the criminology text culture. If the position of the text in the text hierarchy may be understood as empowered, the text is relevant for rhetorical analysis. In this way Gjerstad does not accept the communicative rationality proposed by the norms of the scientific society. The book is not considered as empowered because of its inherent scientific qualities, but because of its position in the hierarchy of texts.

The next move is to show how Mathisen establishes the text’s scientific ethos by making an analogy between the conventions studied in social sciences as well as their functional explanations, and the predictions and laws in natural sciences. Gjerstad tries to show that

Mathisen's deductions and statistical reasoning do not possess the truth-value Mathisen ascribes to them, but rather that Mathisen's inferences are based on selective samples, controversial interpretations and abductive reasoning presenting probabilities.

The final move is to unveil what Gjerstad calls "the identity work" in the rhetoric of the text. Gjerstad shows how the author establishes textual roles and positions for different participants and the relations between them. This investigation is based on a polyphonic analysis of the different participants in the text, whether they are institutions, persons representing institutions, or persons; whether they are given voices, or are represented through other voices etc. Gjerstad manages to show that Mathisen establishes a gap between the social scientist's understanding of the social world, and non-scientists – or so-called "ordinary people's" – understandings of the same world. The ideology of the criminological text repeats the classical distinction – between doxa and episteme, and the acknowledged interest of Mathisen's text is to demonstrate that a non-scientific understanding of how prisons function is false, and has to be substituted by an understanding based on science proper. Gjerstad also proposes that Mathisen simplifies the stances of participants given roles and voices in the text, using an obviously patronising strategy.

Needless to say, Gjerstad's rhetorical scrutiny of Mathisen's prominent and much-respected text was, and is still, controversial. The author who was studied, professor Thomas Mathisen, reacted strongly to the analysis, and wrote a comprehensive reply to it. A long and heated public debate followed. Much of the anger in the debate could be explained by Gjerstad's obvious interest in unveiling what he considered to be Mathisen's problematic ethical standards. Mathisen on his side refused to accept Gjerstad's authority and insisted that a rhetorical analysis of scientific texts had to be based on a professional knowledge of the discipline, a knowledge he could not, and did not want to, assign to Gjerstad. Gjerstad's analysis and the debate following it demonstrate both the interesting and problematic qualities of a rhetoric of science that criticises fundamental positions of respected scholars. Gjerstad's strategy in many ways resembles Robert de Beaugrande's harsh criticism of Noam Chomsky's rhetorical positioning of controversial, however seminal, contributions to linguistics. In both Gjerstad's and de Beaugrande's cases the problematic aspects of their analytical strategies are due to their apparent dislike of the epistemological position of their respective research objects. They do not accept the fundamental scientific values advocated by their research objects through their texts. This position makes reflective dialogue almost irrelevant, and impossible to achieve. Still, the analytical strategies they present both initiate a more profound discussion of the epistemology in question, as well as establishing a discussion on how strong proponents of specific paradigms should present their opponents positions.

Text structures and scientific doxa in articles in medicine, linguistics and history

A significant contribution to Nordic studies of scientific writing is Kjersti Breivega's PhD-thesis "Scientific Argumentation Strategies" (Norwegian: *Vitskaplege argumentasjonsstrategiar*), published as a monograph in the Norwegian *Sakprosa*-series. In this study Breivega detects a fundamental difference between what she calls "humanistic" and "natural scientific" genres, by studying the distribution of argumentative superstructures as well as more global strategies which cover the interaction of argumentative as well as descriptive and narrative superstructures constituting different superstructural configurations. Somewhat superficially presented, humanistic articles are characterised by one global argumentative strategy where a problem at a lower level in the text structure is solved at a higher level through salient dynamic argumentation, characterised by explicit enunciative traces of the author and declarative performatives. The natural science genre is characterised on the other hand by two superstructural configurations at the same level, one static descriptive configuration and one dynamic argumentative configuration. In this way research data and the interpretation of them is systematically held apart.

An important observation made by Breivega is that the use of genres normally correlates with the object of study of the discipline. Texts written in the textual culture constituted by historical science systematically use the humanistic genre, while articles in the field of medicine routinely utilise the natural science genre. The relation between text structure and doxa seems determinative. Still, the relationship between doxa and text structure is contingent. Breivega observes that amongst the three disciplines she studied, sciences that investigate cultural facts may adopt the textual norms of the natural sciences, while the opposite does not occur. Researchers in the field of linguistics may utilise both textual norms while researchers working with cultural data in medicine, for instance psychiatrists, never use the textual norm of the humanistic tradition.

Breivega explains these findings by referring to the textual traditions in the different disciplines, and that the text norms constituting distinct genre-formats at a superstructural level, have attained an autonomy that leaves researchers working inside the different sciences insensitive to the relationship between scientific paradigms and their doxa and rhetorical strategies. Essentially, one writes as one is supposed to and has been socialised to through one's university training. From a rhetorical point of view a functional explanation is also relevant. The text norm the researcher selects in writing his or her text is the one that is understood as the most convenient resource for an article capable of persuading the participants of the relevant text culture. When researchers who analyse cultural data utilise the text norms of the natural sciences, adapted to describe and explain naturalistic data, as linguists occasionally do, and psychiatrists always do, this may imply that the text norms of the natural sciences are considered more empowered, and therefore more prestigious than others. The text norm of the natural sciences tradition may be understood as a prescriptive model for other scientific writing. It may also implicate that researchers using this text norm want to redefine what has normally been understood as cultural phenomena as natural facts, indicating a shift from a hermeneutic tradition in favour of a naturalistic one. This is of course typical of the prominent tradition in linguistics, especially since the breakthrough of chomskian linguistics.

Thanks to Breivega's study two interesting ethical problems relevant to the rhetoric of science have been explicated. First of all that textual variation is due to different doxa, and that this ecological variation inside the complex field of science must be recognised and respected. At the same time, the study indicates that there seems to be a genre hierarchy at stake attributing different status to different texts. Breivega seem to support the impression presented elsewhere in this article, that the scientification of society together with the commodification of science at universities as well as in society at large, has led to a strengthening of the cultural status of the natural science genre, and a weakening of the status of the humanist tradition. In popular opinion, natural science articles objectively describe the facts of life, while humanist articles interpret them subjectively. This opposition establishes important political issues regarding the position of research in society where the rhetoric of science may present important insights.

Paradigms in conflict: the textual norms of two competing schools in literary criticism

As mentioned earlier, the Nordic projects studying the subject oriented text cultures in Norway and Sweden, were focused on describing the historical development of different text cultures, including those of science. In the international literature the historical development of the text norms and registers of the experimental article has received a prominent place. Less studied – if studied at all – is the development of text norms and registers in the humanistic disciplines. It is probable that this reality might be explained by our prior conclusions that the genres of natural sciences lie at the top of the status hierarchy. The development of modernity is characterised by the fact that the natural sciences and the technologies that partly result from research done in these disciplines, have taken over the position of the humanistic disciplines, especially regarding rhetoric. The disciplines of the human sciences are becoming redefined from their being the main instrument for enculturation of human beings, to having the status of sciences that are supposed to deliver arguments in favour of distinct national or regional cultures. It is in this historical context that the discipline of literary studies or literacy science (as it is called in Scandinavian societies) has been developed and established. This establishment started in the end of the 19th century, and the approach in the first decades was dominantly historical. The aim of these sciences was to document literary texts construed in different nations or regions in the course of time. Thus, the discipline was originally known as “literary history”. In the 1930’s an alternative tradition appeared advocating a completely different doxa, based on the autonomy of the literary work, combined with the assumption that some literary works represented eternal, and therefore universal, aesthetic values and ideas. It is important that this alternative aesthetic-philosophical school was not an import of international trends, but originally developed in Norwegian scientific communities. In both these traditions the artefacts studied were considered valuable texts. The selection of texts from the era of Romanticism on, was more or less reserved for the belle arts of poems, dramas, novels and short stories. These were written and published mainly in book format, and selected, printed and distributed by publishers and sold in quality-oriented book stores

In Jonas Bakken’s PhD. thesis “The Rhetoric of Literacy Science” (Norwegian: *Litteraturvitenskapens retorikk*) he studied whether the hypothesis holds that different text culture communities dominated by different doxas develop different text norms. As the KIAP-project articles in this volume demonstrate, the variation of a number of stylistic features’ co-varies with the science of the text more than with the language used. Bakken criticises this approach, as well as the idea that there should be a necessary relation between doxa and text norm, a hypothesis presented and discussed by Breivega. Instead he opts for a rhetorical approach where the text norms utilised in the different scientific text cultures are explained by the hypothesis that a researcher will unconsciously adopt the textual strategy that is the most persuasive in a given cultural context. Consequently, the scientific writer is adapting to the established text norm. This is of course a functional explanation of a specific behaviour. But as Bakken shows, intentional explanations are also possible: a researcher may use an alternative textual norm that suits his aims in a specific context, representing in that way a deviation from conventional practice. Bakken’s analysis of the two text cultural communities fighting for hegemony in literature research indicate that this model is a relevant description of what happens when text norms are developed and utilised. It is then possible to have conflicting text norms in the same field of science, reflecting fundamental differences in doxa. That this is a relevant approach for the rhetoric of a number of sciences that study man and culture is obvious. Most of these sciences are involved in serious epistemological debates and conflicts, and one may therefore assume that there are variations in rhetorical strategies. Studies such as Bakken’s also present the evidence necessary for the study of textual cultures and the interactions within, as well as between them from a power perspective. In the Norwegian case, conflict between different schools, representing different doxa and utilising partly different text norms and registers, went on for decades at all possible levels of the university system. Seen from this angle, in these particular cases scientific articles were used as weapons in an intellectual and academic battle. It was only at a superficial level that these articles demonstrated testable descriptions of a reality external to the texts, or open and reasonable forms of argumentation.

Lessons learnt from Nordic research on subject-oriented texts: challenges and further research

In this article I have presented studies of scientific and academic writing and texts in a context of Norwegian and Swedish research on subject oriented texts from a rhetoric of science position. I have demonstrated that rhetoric of science does not necessarily represent either a subjective idealism or a radical constructivism, but is consistent with the basic propositions of scientific realism and the ethos of mainstream science, as formulated by Merton. However, these Nordic studies of scientific text cultures and academic texts demonstrate clearly that there is a massive degree of diachronic and synchronic variation in how different scientific disciplines represent themselves in texts and how they interact with researchers who are competent - and therefore considered participants - in these specific disciplines. This variation reflects different concepts of truth, different doxa, different communicative goals, and different practices. The experience of these Nordic research projects on subject-oriented texts shows that in Nordic countries as well as internationally, research on this variation is limited and incoherent. The lessons to be learned from this experience are that this research must be developed and a text-anthropological strategy must be adopted, where more global and local contextual studies are combined with studies of communicative practices, as well as of the utterances and texts that are the outcomes of such practices. In the Anglo-American cultural sphere researchers such as John Swales, Charles Bazerman, Carol Berkenkotter and Catharine Shryer have delivered important contributions to this potential new discipline. But even in this important and dominant cultural sphere it is relevant to note that the research is sparse.

But why should we study the rhetoric of science from an text-anthropological angle? It is of course important as a traditional documentation project, or as a field of research that delivers the raw data for practical and instrumental uses in the acculturation of new students or researchers. As demonstrated in this article, the Nordic project has developed a another aim which is unique to them, however influenced by and established within the broader rhetoric tradition: the analysis of rhetorical strategies of researchers as a basis for ethical reflection on the influence and power of science, scientific communication and thought, both in scientific text cultures themselves, as well as in society at large. The advanced democracies of the west are now in a post-industrialist epoch, with the concurrent development of a so-called “knowledge society”. In such a knowledge society, science is even more important than before as a way of thinking, and as a way of acting. This acknowledgement is fundamental for the education and research policies of all Nordic countries. The power of science has of course been considerable for many centuries, but in post-modern society science has transgressed its borders, and established itself as the most influential source and background for political as well as intellectual debate. Science has become commodified and society has become scientified. Through the educational system in all post-industrialised societies our children are preoccupied with science for at least 13 years of their lives, if not more. A broad text-anthropological discipline that interacts with the rhetoric of science-tradition could deliver a fundamental means for understanding, reflection upon and active criticism of this kind of society. That is the fundamental lesson to be learnt from these three Nordic research projects on subject-oriented texts, and that is probably the best argument around for the centrality of the study of the rhetoric of science.

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