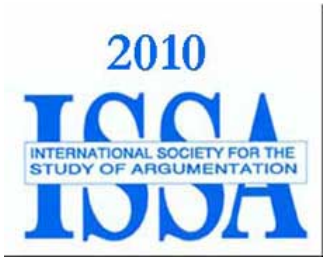
ISSA Proceedings 2010 – Critique And Controversy In Digital Scientific Communication: Regulative Principles And Praxis



1. Introduction

"Controversies are indispensable for the formation, evolution and evaluation of (scientific) theories, because it is through them that the essential role of criticism […] of scientific theories is performed" (Dascal 1998, p. 147). Of the many questions related to this claim, which we accept, we should like to focus on the question how present-day interactive digital media can be used as vehicles of *public* controversy in the sciences.

Historically, *new media* have often played a decisive role in facilitating public controversy. A case in point is the revolution in scientific communication caused by the introduction of scientific journals like the "Journal des Sçavans" or the "Acta Eruditorum" in the second half of the 17th century. These journals appeared at relatively short intervals and provided the opportunity to report on one's own research or, by writing reviews, to report and criticize the work of others, for scientists all over Europe to read and to respond to. These new media changed three important factors of scientific communication:

1. the spread of scientific information,
2. the speed of publication,
3. the amount of interactivity between scholars.

Maybe the most remarkable result of these changes was the opportunity provided for a multitude of lively public controversies in the Republic of Letters, which contributed to the confrontation and development of theoretical views and empirical research and thereby helped advance science in an amazing way.

Recent developments in digital technology have initiated changes in the practice of scientific communication which, arguably, are comparable to the 17th century revolution in scientific communication.**[i]** What is remarkable is that factors

similar to those three hundred years ago play a significant role in the use of recent new media, i.e. wide distribution, speed of publication, and a high degree of interactivity.

As observers of scientific communication today we are in the happy position to be able to follow the progress of evolving digital media and genres of communication in our own present time. This is what we are doing in a project on "Scientific information, critique and controversy in digital media", which is being conducted at the University of Gießen (Germany) and which is funded by the VW Foundation.**[ii]** Our paper presents work done in the context of this project, focussing mainly on controversies in interactive digital formats like mailinglists, blogs, and open-review journals. As for our theoretical approach, we build on our earlier work in the pragmatics of controversies and on communication in the digital media (cf. Fritz 2008; 2010; forthcoming a; Gloning 1999; 2005).

2. On the attractivity and some problems of scientific controversies in interactive digital media

If controversies are considered an efficient motor of scientific progress, then it could be a measure of the success of the new digital science media, if these media encourage fruitful controversies. There is, however, so far no simple answer to the question if this is the case.

Generally speaking, there is an interesting tension between the fact that many scholars are quite reluctant to participate in controversies on the internet and the fact that we do find many attractive and worthwhile controversies in these formats. As for the reasons for this reluctance, scholars we asked mentioned the following, among others:

– Controversies are too time-consuming.
– Controversies can be harmful to your reputation.
– Collaborative efforts like the participation in controversies don't pay out in terms of the academic reward system.
– Theoretical controversies are less useful than the collection and analysis of empirical data.

These and similar reasons seem to be obstacles to active participation in scientific controversies. Obviously, what is considered an obstacle differs according to subject or discipline. For example, open peer review has been practised in Physics and other sciences for about 20 years now, whereas Arts subjects still tend to

stick to traditional reviewing of papers. This is an interesting point which we shall, however, not discuss in this paper.

In spite of these obstacles, many interesting controversies are conducted in digital formats. From what we have seen in our research so far, there are especially two types of contexts where lively controversies tend to arise. The first is topics and domains where scientific research and public interest meet, e.g. climate controversies or controversies on creationism and similar topics. The second context is reviews of scientific writings and reactions to such reviews. We shall briefly mention an example of the former type and then go on to summarize two case studies on controversies sparked off by reviews.

Discussions on topics on the borderline between science and politics and ideology are often quite animated and informative, there is, however, a tendency for ideological dogmatists and other destructive participants (so-called "trolls") to intrude on and even to dominate such discussions, which makes them less attractive for "genuine" scientists. We should like to give an example of this kind of thread in the medium of blogs.

On July 30th, 2008 a paper with the title "Dinosaurian Soft Tissues Interpreted as Bacterial Biofilms" by T. G. Kaye and his collaborators appeared in PLoS ONE, an interactive open-access journal for the communication of peer-reviewed scientific and medical research.**[iii]** This paper was a critical reaction to earlier studies, which had claimed to have identified and isolated soft tissues from a 68 million year old fossil bone. On the day of its publication in PloS ONE, Tara C. Smith, an Assistant Professor of Epidemiology, summarized the article by Kaye and part of the earlier controversy on her own blog *Aetiology* and explained its main point to non-specialists.**[iv]**

This blog was commented upon in 20 postings within two days. Two of the postings are particularly interesting from our point of view, because they show part of the process which contributes to the wide distribution of contributions on the internet. The first is by Tom Kaye, one of the authors of the paper

Hello All,
Tom Kaye here from the paper. Since this seems to be the blog with the most activity, I will offer to answer any questions for the group.
Tom

Posted by: Tom Kaye | July 30, 2008 5:11 PM

The second one is by the owner of the blog, Tara C. Smith, who directly addresses Tom Kaye and mentions another blog, where there is a lively discussion on the same topic going on:
Hi Tom –
Thanks for stopping by! There's also a good discussion over at Panda's Thumb, where I cross-posted this. If you can ignore the trolls (the creationists etc.) there are some good
questions you may be able to respond to over there also.
Posted by: Tara C. Smith | July 30, 2008 5:56 PM

The relevant discussion on *Panda's Thumb*, a scientific weblog on questions of evolution, comprises 122 comments within a fortnight.[v] Among these postings there are quite a number of serious, scientifically-informed contributions, to which the author answers in longish replies. But there is also at least one obvious anti-evolutionist, who introduces a fairly polemical tone. To this the author of the paper remarks: "I see there is the usual ID (i.e. Intelligent Design, GF) spam going on but if we can work around that I am willing to answer any reasonable questions". So what we get on this blog is a mixed bag of serious discussion and facile polemics. And much of this is happening on the very day the Kaye et al. paper was published. So, whatever the merits of this discussion in terms of scientific progress, the author of the paper certainly received a remarkable amount of "attention space" (cf. Collins 2000, p. 38f.) for his research within a short period of time.

3. Reviews and replies
Now to the question of controversies sparked off by reviews. We shall give two examples from case studies from our project, one taken from a mailinglist and one from an open peer review journal.

3.1 A review and an ensuing controversy on a mailinglist
The first example consists of material from the Linguist List section on "book discussion" which we shall briefly present and analyse. The Linguist List is the biggest website for academic linguists, providing mailing lists for various sub-disciplines.**[vi]** The purpose of the book discussion section is presented as follows: "We strongly encourage discussion (including book authors if they so desire and their response is appropriate) of reviews. We do this because we feel

the electronic medium allows us to provide a service that print sources cannot" (posting by the moderator in charge of reviews). A later notice by the moderator sounded even more inviting to authors: "What follows is a review or discussion note contributed to our Book Discussion Forum. We expect discussions to be informal and interactive; and the author of the book discussed is cordially invited to join in" (Andrew Carnie, in a posting of Oct. 3rd, 2000).

This is the exact opposite of the principle that an author should *not* reply to his reviewer, which is still well established in scientific journals today, although historically, this is by no means necessary, as the early history of reviewing in the 17th and 18th centuries shows.**[vii]** So, in this respect, we are back to the exciting days of the late 17th century!

We shall now give a short analytical summary of a controversy which took place few years ago, and which nicely shows the potential of the mailinglist format for this kind of exchange.**[viii]**

On July 3rd, 2002 Joybrato Mukherjee published on this list a review of the "Cambridge Grammar of the English Language" by Rodney Huddleston and Geoffrey K. Pullum, published in 2002 by Cambridge University Press. The following controversy consisted of three further contributions, a response to this review by Pullum, posted on July 15th, a reply to this response by Mukherjee on July 20th, and a final reply by Pullum on July 22nd. Looking at these dates, we already notice one characteristic feature of this kind of exchange, namely, the relative speed of reaction in the interactive process.

The content of the review can be described as follows: Mukherjee starts off by praising the "admirable achievement and the monumental quality of this volume" and then goes on to give a survey of the content of the chapters of the grammar. After these largely descriptive passages, Mukherjee turns to a critical evaluation. His main points of criticism concern the presumed fact that this grammar is mainly based on *one* grammatical model, i.e. Generative Grammar, and that it is not "a genuinely corpus-based description of English". There are also some minor objections, which we shall not mention here.

In his response to this review, Pullum starts by mentioning Mukherjee's two main objections: "He criticizes [the grammar] for not being corpus-based, and for

adopting analyses on grounds of dogma rather than evidence." He then criticizes Mukherjee for failing "to show respect for textual evidence", the latter remark being a classic tit-for-tat move. He then asserts that "all his negative criticisms of [the grammar] rest on false claims" and decides to "offer a brief response to half a dozen especially egregious ones". He now numbers his objections from 1 to 6 and deals with each one in detail. (This practice of numbering objections is a classic procedure, which goes back at least to the 16th century.)

In his rejoinder, Mukherjee first accuses Pullum of presenting his reviewer as "someone who lacks even basic reading skills" and announces his intention to correct this picture. He then takes up all Pullum's objections and deals with them point by point in the order presented by his opponent. This procedure is again a traditional pattern of topic management in scientific controversies. Mukherjee's rejoinder, which amounts to 3698 words, includes the discussion of conceptual problems, theoretical arguments against Pullum's position, and the giving of counterexamples and references. So this contribution to the controversy is very much in the tradition of scientific writing as we find it in books and articles, but not normally in a defence of a review.

In the final contribution to the controversy, Pullum uses a very interesting strategy, which consists in claiming that "despite the trappings of squabble and a charge of "strangely offensive tone", much agreement emerges on matters of fact". He then goes on to enumerate 10 points of agreement, which he briefly deals with in the course of his posting. Looking at these points closely, one realizes that his presentation of "agreement" mainly serves to assert his own position in the controversy. At one point, he admits that in the discussion he "took the liberty of a little ad hominem dig in the ribs against Mukherjee". And finally, he acknowledges that "Mukherjee's review made numerous positive statements and generous remarks". So, in spite of a polemical note here and there, politeness and a factual tone prevail.

Now, how do we evaluate the quality and the usefulness of this controversy? One would probably agree that this exchange of arguments came up to the standards expected of scientific discussions and that it contributed to the clarification of the positions involved. For the opponents, the discussion provided an opportunity to broadcast their views, and for novice grammarians and non-specialist linguists it provided an introduction to a major conflict in present-day grammar writing

between theory-based and corpus-based conceptions. Considering in addition the comparative speed of publication and its wide distribution, this type of review-cum-discussion on mailing lists or blogs can certainly be considered a useful addition to the formats of scientific dialogue. One of the most interesting features of this interactive procedure is that it causes changes in the roles of reviewer and author, as both have to envisage a course of events in which they might become participants in a serious controversy.

3.2. Public peer review

A different type of communication between reviewers, authors and the scientific public can be found in open peer review journals, which aim to make the reviewing process for research papers more transparent and, in some cases, publicly accessible. Among the new open access journals we find different versions of the reviewing process, which vary as to the amount of interactivity and transparency in the different phases of the reviewing and publication process.

A fully developed interactive reviewing process was introduced in 2001 by Atmospheric Chemistry and Physics (ACP), "an international scientific journal dedicated to the publication and public discussion of high quality studies investigating the Earth's atmosphere and the underlying chemical and physical processes".**[ix]** "Atmospheric Chemistry and Physics has an innovative two-stage publication process involving the scientific discussion forum Atmospheric Chemistry and Physics Discussions (ACPD). […] In the first stage, papers that pass a rapid access peer-review are immediately published on the Atmospheric Chemistry and Physics Discussions (ACPD) website. They are then subject to Interactive Public Discussion, during which the referees' comments (anonymous or attributed), additional short comments by other members of the scientific community (attributed) and the authors' replies are also published in ACPD. In the second stage, the peer-review process is completed and, if accepted, the final revised papers are published in ACP."**[x]**

I shall now sketch some observations on one of the most lively controversies conducted on the ACPD discussion forum, the discussion on a paper by A. M. Makarieva and two collaborators "On the validity of representing hurricanes as Carnot heat engines" (Atmos. Chem. Phys. Discuss., 8, 17423-17437, 2008). After the preliminary reviewing process, the paper was published as a "discussion paper" on Sept. 19th, 2008. As they state in their abstract, the authors "argue, on

the basis of a detailed critique of published literature, that the existing thermodynamic theory of hurricanes, where it is assumed that the hurricane power is formed due to heat input from the ocean, is not physically consistent, as it comes in conflict with the first and second laws of thermodynamics." They claim, in fact, that this theory makes a hurricane a perpetuum mobile. In the second part of their paper they outline an alternative explanation based on the description of an "atmospheric process occurring at the expense of condensation of water vapour that creates a drop of local air pressure". It is interesting to see that in the following discussion the main point of attack is the challenge presented by the authors to the widely accepted "standard theory" of hurricane formation.

For reasons of space, we cannot here go into details of this controversy, which consists of 35 postings, taken all together.**[xi]** We should, however, like to comment on a few aspects of the external structure of the controversy, which can be seen in the following survey given in the ACPD archive:**[xii]**

AC: Author comment RC: Referee comment SC: Short comment EC: Editor comment

AC S7325: 'Response to preliminary criticisms', Anastassia M. Makarieva, 20 Sep 2008
RC S7915: 'Review ', Anonymous Referee #1, 03 Oct 2008
AC S7947: 'Response to Review of Referee 1', Anastassia M. Makarieva, 04 Oct 2008
RC S8170: 'Follow-up', Anonymous Referee #1, 12 Oct 2008
AC S8193: 'Response to Follow-Up by Referee 1', Anastassia M. Makarieva, 13 Oct 2008
AC S9182: 'Final Response: Heat Release to Space', Anastassia M. Makarieva, 16 Nov 2008
SC S7609: 'Latent work', Anastassia M. Makarieva, 29 Sep 2008
SC S8318: 'Motion from condensation', Semen Sherman, 17 Oct 2008
AC S8340: 'Latent work: Convective potential energy', Anastassia M. Makarieva, 18 Oct 2008
SC S8164: 'The novel hurricane physics', Andrei Nefiodov, 11 Oct 2008
RC S8531: 'Review ', Anonymous Referee #2, 25 Oct 2008
AC S8904: 'Condensation as Air Circulation Driver', Anastassia M. Makarieva, 10 Nov 2008 RC S9081: 'Extraordinary novel atmosphere physics', Anonymous

Referee #2, 13 Nov 2008
SC S11826: ‘Considerations of turbulent friction’, Anastassia M. Makarieva, 22 Mar 2009
RC S8627: ‘This paper is incoherent’, Anonymous Referee #3, 29 Oct 2008
AC S8635: ‘Response to Referee #3’, Anastassia M. Makarieva, 30 Oct 2008
SC S8669: ‘The Sun does not orbit around the Earth.’, Paulo Nobre, 30 Oct 2008
SC S8916: ‘paper contains bad physics’, Antoon Meesters, 10 Nov 2008
AC S8923: ‘Bad physics: Latent heat does not warm’, Anastassia M. Makarieva, 10 Nov 2008
SC S8979: ‘latent heat in the atmosphere’, Antoon Meesters, 11 Nov 2008
AC S8998: ‘Latent heat is irrelevant’, Anastassia M. Makarieva, 12 Nov 2008
AC S8931: ‘On carelessness and responsibility’, Anastassia M. Makarieva, 10 Nov 2008
SC S9060: ‘dissipative engine etc.’, Antoon Meesters, 12 Nov 2008
SC S8953: ‘The “subtle” issue of perpetuum mobile’, Semen Sherman, 11 Nov 2008
AC S11647: ‘Comment on the dissipative heat engine’, Anastassia M. Makarieva, 15 Mar 2009
AC S9342: ‘Final Response to Dr. Meesters’, Anastassia M. Makarieva, 20 Nov 2008
AC S11254: ‘Final Response: List of Revisions’, Anastassia M. Makarieva, 14 Feb 2009
AC S11260: ‘Revised manuscript, part I’, Anastassia M. Makarieva, 14 Feb 2009
AC S11275: ‘Revised manuscript, part II’, Anastassia M. Makarieva, 14 Feb 2009
AC S12153: ‘Appeal to the ACP executive committee’, Anastassia M. Makarieva, 02 May 2009
EC S12168: ‘Editor Report’, Peter Haynes, 04 May 2009
EC S12406: ‘Final Editor Comment (ACP Exec. Editors)’, Ulrich Pöschl, 14 Oct 2009

Apart from the authors and three reviewers, there are four more participants in this controversy. Three fellow scientists post short comments in which they support the views of Makarieva et al. A fourth scientist, a Dutch physicist and meteorologist, posts a longish comment, in which he puts forward a number of objections against Makarieva’s paper and gives arguments in favour of the standard theory. This posting is answered in detail by Makarieva, which leads to a mini-discussion within the total controversy. It is this thread of postings which

shows to advantage the potential of the ACPD system for involving specialists outside the circle of reviewers in the open reviewing process.

Of the many interesting aspects of this controversy we shall now pick out one point of conflict which highlights some problems and principles of open peer review. On Oct. 29th, the third reviewer posts his first public comment and asserts that he finds "this paper to be incoherent at the least" and that it "is not worthy of publication in any respectable journal". He furthermore states that the strong criticism of the classical theory was not well-founded and claims that much of the Makarieva paper was incomprehensible and what he did understand was wrong. He concludes by repeating his harsh judgement.

By this highly polemical posting, the third reviewer creates a rather difficult position for Makarieva and colleagues, who still count on having their paper published. In their reply of Oct. 30th they use a double strategy of attempting to convince the reviewers of the well-foundedness of their criticism and of reflecting on the course of the discussion itself. They start out with a polite move, appreciating the call for serious justification of their criticism. They then go on to point out their arguments and where they are given in detail and also expand on some of these arguments. We will skip this bit, which contains a lot of technical detail, and go to the last part of their reply, which is particularly interesting, as it concerns the style of the controversy and fundamental principles of open peer review:
"Finally, we would like to note that, in our view, the open discussion platform of the EGU journal sets up a new and high ethical and cultural standard of the peer review process. In this context, statements like "this paper is not worthy of publication in any respectable journals" should perhaps be viewed as atavisms of the background private communication between the editor and referee during conventional close review process. When such statements are made in open public discussion potentially read by hundreds of people, especially in the view that the referee cannot follow "much of the argument here", they can be classified as a public assault to both the authors as well as to all those discussion participants who sign their names under very different opinions as well as to the ACPD journal itself (who did publish the paper).

Moreover, in our view, the above statement of referee 3 goes against the journal's interest not only in its form, but also in its essence. We believe that the main

target of this discussion is to reveal the scientific truth. The discussion paper is citable, covered in Scopus and available for analysis. Indeed, we come up with a rare claim that a framework published in high-profile journals is based on the concept of a perpetual motion machine and is fundamentally incorrect. Our arguments are all here. In our view, if our paper were published in ACP, then the responsibility to respond to our critique would go to the author of the criticized framework, as the normal practice in scientific literature goes. If, on the other hand, the ACP declined our paper for publication in the second stage, as recommended by Referee 3, future readers of this discussion would ultimately decide whether or not the journal actually signed its official name (while Referee 3 remaining anonymous) among the defendants of perpetuum mobile and against a new approach to hurricane physics. In any case, however, we believe that this discussion has a very substantial value. We are very grateful to the journal for letting us express our views on its pages."

This is a remarkable document, touching on various basic aspects of open peer review, e.g. politeness and fairness principles, the responsibilities of the participants, the anonymity of reviewers, the burden of proof in scientific argument, and the question of who is "judge of controversies" in science.**[xiii]** It shows that many of the fundamental principles of scientific discourse acquire particular relevance and salience in public peer review and public digital controversy in general. This is especially true of principles guarding against face-threatening acts.

It is worthy of note that in the end the paper was not accepted for publication, as the objections formulated by two of the three referees appeared so fundamental to the managing editor that, on close reflection, he did not believe that the paper in its present form reached the standards required for publication and that he did not see "a straightforward route to changing it to make it publishable" (editor's report). However, the chief executive editor considered this case exceptional enough to decide to re-assess the judgement of the referees and the managing editor some months later, bringing in two additional referees, and to give a final statement on the procedure and its results. In this final statement, he writes: "I am not a specialist in atmospheric dynamics and meteorology, and I found the exchange of arguments between authors and referees interesting and challenging. In this regard, I would like to express my appreciation for the clear formulation and mathematical precision of the line of arguments and comments of

Dr. Makarieva and co-authors. – After all, however, I have come to share the specialist referees' concerns that crucial assumptions underlying the arguments, comments and manuscript of Makarieva et al. appear not to be justified." Obviously still feeling some misgivings about the outcome of the reviewing process, he finally reflects on the principles of open peer review, which, whatever the outcome of the reviewing process, are meant to secure a high degree of transparency. One of his final remarks is as follows: "In the present case, free speech and public documentation have already been achieved by publication of the discussion paper in ACPD, and Makarieva et al. have also taken the opportunity of publishing a revised version of their manuscript in the form of interactive comments in ACPD. As mentioned above and detailed on the ACP web pages, the discussion paper as well as the interactive comments will remain permanently archived, accessible and citable."

Generally speaking, this kind of exchange shows the potential and scope for fruitful public scientific discussion in this type of reviewing process. As for the different participants, this type of interaction provides new opportunities, but it also poses new communicative tasks. *Reviewers* have to keep in mind that their reviews will be publicly available for criticism not only by the authors, but also by the relevant scientific community at large. This calls for a high level of rational argumentation and commits the reviewers to principles of politeness and objectivity. So, in a way, reviewing is harder in this kind of framework. And, of course, having to answer objections to your review can be hard work. This might be one of the reasons why finding a sufficient number of qualified reviewers is one of the major problems of open peer review. *Authors* have the opportunity to have their work closely scrutinized before it is finally put in print and they have the chance to receive attention – once their paper has cleared the hurdle of access review –, whether their paper is finally accepted or not. On the other hand, they have the obligation to answer objections in public within reasonably short time, which can be quite a challenge and possibly a problem for their reputation. For *authors of short comments* this option provides the chance to take part in a public scientific discussion without having to produce a paper of one's own, and for *the lookers-on* it provides the opportunity to recognize conflicting views and to observe the arguments for these views being presented in actual performance.

So, to sum up, these forms of interactive reviewing seem to present a healthy challenge to the participants in the reviewing process. As yet it is mainly in the

field of natural science that open peer review has been adopted. We shall see if in the future the arts and humanities will follow suitable.

4. Conclusion

We should like to conclude with some reflections concerning the potential of digital formats for fruitful scientific controversy and the conditions under which digital-format controversies will be productive.

Generally speaking, speed of publication and the wide distribution of postings, which are both characteristic properties of communication in digital formats, seem to be ambivalent factors that can be either favourable or unfavourable to high-quality scientific controversies. Speed of publication, including speed of reaction, often creates a certain "flow" of interaction, which may stimulate a lively discussion. On the other hand, rash replies increase the risk of injury that is always present in controversies. Therefore, members of lists or commenters on blogs are sometimes advised to count to ten, before they hit the reply key. Wide distribution and open access may be helpful in attracting qualified disputants, but it may also attract unqualified and disruptive participants. So balancing these factors seems to be an important task of the respective communities.

From what we know today, the following three conditions play an important role in generating productive controversies:

1. Prospects for useful controversies seem to be particularly good in fairly close-knit scientific communities with a reasonable number of active participants. It is in such specialist communities that the motivation to actively contribute to discussions and the ability to deal rationally with conflicting views appear to be highest. This observation seems to be in conflict with the view that open access for a wide scientific public is a strong point of digital formats. But in practice, it is often a small group of persons who dominate the actual interaction, quite independent of the large number of "lurkers" that may passively participate.
2. A second condition of good controversy is close attention to topic management. Initiating relevant and attractive topics and keeping a discussion on track without restricting creative developments is an important task of the contributors. In many cases this is accomplished naturally and without an extra effort by participants, but rambling or disruptive postings are always a risk to be aware of. The observation that it is often *reviews* which spark off good discussions is probably connected to the fact that both authors and reviewers are genuinely motivated to defend their point of view and to the fact that the book or article

under review provides a natural topic focus.
3. Finally, it is often the moderators of mailinglists or the owners of blogs who contribute to the development of good controversies on their lists or blogs by suggesting salient topics, by organizing round tables or blog carnivals, and by generally trying to sustain a well-organized procedure by which the "vices of confused disputes" (Leibniz 2006: 1-6) can be avoided. So being organized by an active and responsible moderator or owner can be a decisive factor for the success of a digital format in facilitating fruitful controversy.

Certainly, these or similar conditions are not exclusively relevant to digital formats, but may also play a role in any format of scientific communication. However, under the specific conditions of digital scientific communication, which we mentioned above, they acquire particular salience.

Trying to weigh up the potential and the risks of digital scientific controversy, we seem to face a similar situation as the 17th-century pioneers of research journals we mentioned at the beginning of our paper. It remains to be seen, if, in the long run, the members of the scientific community will avail themselves of the potential of the new formats with the same enthusiasm as their 17th-century forebears did.

NOTES

[i] Some authors have emphasized the influence of these new media on recent developments of science by using the expression "cyberscience" (e.g. Nentwich 2003).

[ii] More details on the project can be found on the project website: Website: http://www.zmi.uni-giessen.de/projekte/zmi-isteilbereich4.html

[iii] URL: http://www.plosone.org/home.action (25.02.2010)

[iv] URL: http://scienceblogs.com/aetiology/ (25.02.2010)

[v] URL: http://pandasthumb.org (25.02.2010)

[vi] URL: http://linguistlist.org/ (25.02.2010)

[vii] For the history of critical reviews and replies to reviews („anti-critique") in early scientific journals, cf. Habel (2007).

[viii] The review and the responses are available on the Linguist List Review Archives (issue numbers: 13.1853, 13.1932, 13.1952, 13.2005) (10.07.2010).

[ix] For some of the ideas behind the introduction of public peer review, cf. Pöschl (2010), an article by the chief executive editor of ACP.

[x]

URL: http://www.atmospheric-chemistry-and-physics.net/home.html (25.02.2010)

[xi] A detailed analysis of this controversy is presented in Fritz (forthcoming b).

[xii] URL: http://www.atmos-chem-phys-discuss.net/8/17423/2008/acpd-8-17423-2008-discussion.html (05.07.2010). The dates of the individual postings show, among other things, how quickly the authors reacted to the various queries and objections.

[xiii] For some early reflections on "the judge of controversies", cf. Leibniz (2008), Ch. 8.

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