Hybridism, edutainment, and doubt: Science blogging finding its feet

Anna Mauranen, University of Helsinki

Abstract
Blogs have become everyday acquaintances in digital life. Although personal, political, and fashion blogs may be the best known, academics also engage in blogging about research. With fast-expanding digital publishing of all kinds, we may have to rethink the status of blogging in relation to our on-going research. This article discusses the perception of science blogs, and their status as a genre. It explores some blog threads talking about research blogging: are blogs a great way to improve outreach, or just dumbing down? Should we use blogs for publishing serious findings, or brush them aside as edutainment – preferably done by somebody else? Research blogs are explored in the context of science communication and research writing traditions, and their old and new features discussed.

1. Introduction

Blogs have only been with us for about a dozen years or so, but in this short time they have established themselves as a permanent feature of digital life. Politicians have adopted their use, celebrities, businessmen, and perfectly ordinary people set up their own. Blogging is a regular mode of public communication carried out by self-selected individuals. Academics also blog – but they have not been at the forefront of this development, many still appearing to harbour deep-seated doubts about the whole business, as recently illustrated by a blogging course for researchers at Cambridge University (Parr 2012). Meanwhile, blogs proliferate, and their functions expand to new domains and topic areas.

The personal blog is undoubtedly the best known, perhaps the prototypical representative of the species in public awareness, and it has also attracted the most research interest. This may also influence the common perception of blogs as a 'non-academic' activity. But since the blog has also made its way to the academic world, it is worth a closer look for linguists, especially those who take an interest in academic writing: in a world where information-seeking has moved almost entirely to the web, where do new digital text types fit in, and how do they affect academia? Academic writing has been thoroughly analysed in its

Mauranen, Anna. 2013. "Hybridism, edutainment, and doubt: Science blogging finding its feet." *Nordic Journal of English Studies* 12(1): 7-36.

prototypical forms, above all the research article, from all angles (e.g. Swales 1990; Berkenkotter and Huckin 1995; Fløttum et al. 2007). Popularisations of science have also become a well-established research topic over the last few decades (Gunnarsson 1993; Gregory and Miller 1998; Koskela 2002; Irwin and Michael 2003). However, science blogging by researchers themselves does not fall into either of these categories (see also Blanchard 2011), and is therefore worth attention.

Universities are increasingly encouraging their staff to blog. Even though much of university blogging is concerned with commenting on university policies, blogs are increasingly recognised as a means of boosting outreach and visibility, both of vital concern to universities in times of economic austerity and widening debates about public spending. The London School of Economics boasts of being a pioneer in this activity, having launched its first blog in 2010 (Elmes 2012). The central mission of their European Politics and Policy blog is stated as "to increase the public understanding of social science in the contexts of European governance and policy making" across Europe. Many other universities have followed suit; for example the University of Stockholm's Rector in his university newsletter column (January 2012) urged researchers to take up blogging to disseminate their findings. Obviously, research is the flagship of universities in the public eye – it is what rouses curiosity and invites confidence in universities working for the common good. It is also worth noting that the Eurobarometer on Scientific Research in the Media (from 2007: http://ec.europa.eu/public_opinion/archives/ebs/ebs_282_en.pdf) indicates that the majority of Europeans would rather receive scientific information from scientists than journalists (52% vs. 14%, respectively). With digital publishing now mainstream, and increasing interest in ensuring public engagement with science, potentially effective web genres should be a central interest to academia. Professional science journalists have long made their presence felt on the web, but not so many active researchers write about science to the wider population. In the light of public opinion, this situation is not ideal.

Despite university encouragement, the scientific community has been slow to warm to blogging. The question then arises why blogging should be of interest to a linguist. The answer is: for several reasons. First of all, as a central domain of digital publishing, blogs provide excellent data for exploring the effects and limitations of the medium on

writing. Second, blogs have been found to possess register features with systematic variation (Grieve, Biber, Friginal and Nekrasova 2011), which shows traces of mixing features of more traditional spoken and written registers. This register research also makes a linguistic contribution to blog typologies otherwise based on content analyses (e.g. Krishnamurthy 2002; Herring, Scheidt, Wright and Bonus 2005). Moreover, blogs develop specific discourse characteristics (Myers 2010), and since written text is typically accompanied by visual and auditory material on the web, blogs lend themselves well to multimodal discourse analysis. In addition, the web is multilingual, and although English clearly dominates, it is used as a lingua franca more than a native language, which makes it interesting not only to ELF scholarship, but to language change more generally. Finally, for discourse and genre analysts, the blog poses the question of its generic nature – is the blog a genre, and if it is, on what basis can we identify it as one, and does it challenge our conceptions of what determines generic status?

This paper is concerned with the research blog, produced by active researchers who write about their own work, and the comment threads that the blog entries generate. It is not concerned with science journalism, even though science journalism probably accounts for the best part of popular writing on science. The paper argues that the blog is a cluster of genres, some of which are highly relevant to present-day academia, and that the research blog has long roots in genres that relate to the advancement of science and scholarship. It also suggests that a focus on blogs alters the established perception of genres in relation to communities. Finally, it is argued that researchers blogging about their own work may be heralding new communicative practices in academia, simultaneously drawing on the very origins of science communication in the process.

The paper focuses on two blog sites kept by researchers keenly involved with some recent scientific controversies, where the discussion also drifts to the topic of blogging itself. It uses the blog postings and the comment threads to illustrate the genre changes in progress, and how they are seen in the research blogosphere. The first two sections discuss the common types and generic nature of blogs, after which the example blogs are shown to give rise to controversy over the relationship between blogging and science. The final section illustrates the connection

between blogging and early science communication, together with novelties brought up by the research blog.

2. Blog preliminaries: Typology and the issue of genre

The origin of blogs dates back to the mid-1990s, when websites with commentaries and online diaries began to appear on a regular basis. They were termed *weblog*s by Jorn Barger in 1997 "to describe the daily list of links that 'logged' his travels across the web" (Barger 2007). A recent definition delineates a blog succinctly like this: "A blog, short for a weblog, is a website containing an archive of regularly updated online postings." (Grieve et al. 2011: 303). Terms such as "links" and "postings" already reflect the openness of form in blog texts, and terms like "daily" and "regularly" point to the centrality of the frequent appearance of new items. Both features seem rather distant to the traditional academic paper.

Early bloggers tended to be designers or programmers in the technology industry. It was only around 1999 with easy-to-use editing tools appearing on the market that the larger public adopted the blog medium, and in the first wave of enthusiasm, blogging grew by over 600% from 2000 to 2001. Since then, continuing if occasionally fluctuating expansion has given the blog a steady position in digital discourse. At the same time, blogs have diversified, and it is pertinent to ask how far we can talk about one type of discourse – or genre – any longer.

Previous research has identified types among blogs, either based on their content matter (Blood 2000; Krishnamurthy 2002; Herring et al. 2005), or, less commonly, their linguistic features (Grieve et al 2011). The first content-based division comes from the early days of blogging; Blood (2000) was quick off the mark in weblog research, and found two major types. One that she recognised as the original type, the 'filter-style', which was link-driven, with usually the weblogger's comments on the interesting links they had found and wanted to convey to others. The other, a later development, she called 'blog-style', which was more varied, but basically an outlet for expressing the personal experiences of the writer. Slightly later, Krishnamurthy (2002) identified two styles, which he labelled 'thematic' and 'personal', and along similar lines, Herring et al. (2005) distinguished the thematic type (with further

subdivisions into 'filter' and 'knowledge' types), and the personal, diary-like blog. In contrast to these content-based categorisations, a more recent study by Grieve et al. (2011) adopted a form-based approach, and carried out a multivariate analysis of the register features of blogs. Their analysis discovered two major types, and one minor: thematic and personal were the major ones, and a minor kind was what they termed an 'expert blog'. A further blog type distinction was suggested by Miller and Shepherd (2009) between the personal blog and the 'public-affairs blog'. While they did not put forward a complete typology, their categorisation differed from the others in being based on typified social action rather than content or linguistic features, and the distinction they drew includes two types, one of which, again, is the personal blog. In all, despite different approaches, the ensuing types are surprisingly convergent: the principal distinction is drawn between the 'personal' and the 'thematic'. Clearly, it is the 'thematic' – or non-personal – type that bears the most relevance to science blogging.

Even though content-based and register-based analyses collude on a broad typology of blogs, we may still wonder whether blogs constitute one genre or many. Digital media have rekindled interest in the study of genres, traditionally already a prominent field of discourse analysis. Scholars have asked what happens to genres when they migrate to the web and assume new shapes, and whether the digital genres are really new, not just new guises for established ones (Bruns and Jacobs 2006; Giltrow and Stein 2009; Rowley-Jolivet and Campagna 2011). Instead of one genre, it might be more reasonable to talk about several blog genres – maybe even an unlimited number, given that new kinds of blogs seem to crop up sooner than anyone can really hope to keep up with. Would the thematic blog be a genre? Or would some of its subcategories, say, the political blog, or the science blog, be genres in their own right?

2.1 Is the blog a genre?

A new medium of communication provides an excellent opportunity to re-think our established analytical categories and their basis – such as genre. Among linguists and discourse analysts, some scholars (for instance Stubbs 1996; Biber 1988) make no distinction between genre and register, but use the terms interchangeably. This could be taken as a 'unificationist' position. Others, again, see genre as social action

(Berkenkotter and Huckin 1995; Martin 1997; Miller 1984; Swales 1990), which in principle opens up a possibility of looking at the linguistic forms of texts separately from their social functions. We might call this a 'dualist' position. The more linguistics and discourse analysis have moved away from analysing the surface of text and towards seeing all text as embedded in social contexts (see, e.g. Hyland and Paltridge 2011; Belcher, Johns and Paltridge 2011), the better a dualist approach seems to correspond to their research interests. It is important to recognise the correlations typically attested between situations and their register features (see, e.g. Biber and Conrad 2009); thus we might do well to talk about the co-evolution of typified social action and the linguistic features that characteristically go with certain social situations. Nevertheless, register features need not stay consistent throughout a genre event (cf. Ventola 1987; Biber, Connor and Upton 2007), and regarding the social and the linguistic as logically independent allows a more nuanced perspective on their interrelations than assuming an axiomatic relationship.

Thus, we might start our inquiry into the generic status of blogs by taking a look at the social action they perform. In this, we can follow the lead of Miller's seminal paper (1984) and take genre to be a type of social action recognised in a speech community or context. Community recognition of a type of discourse is best in evidence in the naming practices attached to them. Clearly, 'blog' is a name that is widely recognised for a type of communicative action, even among people who never blog themselves. But what in this case would be the 'community'?

Miller and Shepherd (2004) talk about "self-organized communities that support blogging". Indeed it appears to be the case that certain blogs or related (often interconnected) blogs attract networks of like-minded people around them. Blood (2000) already talked about bloggers in the personal blog tradition referring to other blogs to their liking, and conversations being carried out between groups of blogs. People who actively follow and contribute to a particular blog or a set of related blogs form a kind of self-selected, possibly also self-organised, group. By this token, they would fit into Anderson's (1991) 'imagined communities', with members who may never meet face to face. They would also fit in nicely with the notion of Community of Practice, or as Eckert and McConnell-Ginet (1992: 464) put it, "an aggregate of people who come together around mutual engagement in an endeavour".

However, the self-organised networks or groups around blogs are in principle completely open, members often remain anonymous, and blogging does not really seem to *arise* out of these communities. Blogs in this reading would hardly count as genres in Swales' (1990) sense of belonging to, or being possessions of, their discourse communities – rather, if we accept that a group of regular followers of a blog constitute a community of some kind, then the relationship would rather be the other way around: it is the genre that determines the community (as suggested in Mauranen 1993). This possibility can also be detected in the notion of 'context' or 'situation' that Miller (1984) stressed, which seems a far more suitable point of departure for an amorphous network bundle such as the Internet. The web is unmistakably a communicative context, even if not a community. Within that context, 'blog' is an identifiable and widely recognised name for a type of communicative activity. Seen in this way, the intuitive solution of the blog as a genre is supported. At the same time, adopting this view is compatible with the notion that social contexts spawn communities around them rather than being necessarily embedded in the activities of pre-existing communities.

The question remains whether there is one genre or many. Blogs have diversified enormously during their dozen or so years of existence, and despite sharing a generic name, their communicative ambitions can take different directions, as suggested by the typologies based on content and language (see Section 2 above). Miller and Shepherd (2009) identify the personal blog and the public-affairs blog as separate genres, based on essentially situational concerns – nevertheless leaving open the possibility of them being clusters of closely related genres. In the end, whether we call the blog a genre or a supergenre or genre cluster consisting of separate genres is a matter of the analyst's decision – in folk terms, the blog is the prototypical genre name, and all the other types discussed here result from applying the analyst's perspective.

3. Ancestry of blog genres

Starting with the working hypothesis that blogs are genres, it is a good idea to situate research blogs in the context of other genres. An apposite point of departure is a historical one, and in this we can benefit from Miller and Shepherd's excellent work (2004) on ancestral genres of the blog. They drew up a large family tree for blog genres, where the major

branches were (1) filtering and directory services, (2) commentary, and (3) journal and diary. Of these, the journal and diary genres, leading to the personal blog, seem the least relevant to the science blog, while the filtering and directory services (such as the clipping service and the edited anthology), together with commentaries (the pamphlet, the editorial, and the opinion column) look more promising. I shall look at the last two briefly, illustrating them with research blog examples. The examples are drawn from one of the two blog sites I am using as data in this paper (see further Section 4 below), namely Tommaso Dorigo's blog (hereafter TD) on issues relating to quantum physics (http://www.science 20.com/profile/tommaso_dorigo).

3.1 Filtering and directory services

This set of genres is related to collecting and organizing information, such as the edited anthology and the clipping service that make information available to others. The edited anthology, according to Miller and Shepherd, has its roots in the mediaeval passion for collecting and commenting on texts. The clipping service takes a step further, selecting, reorganising and interpreting information for others. This filtering service was also the original blog function identified by Blood (2000) in the very early days of blogging, and it clearly constitutes a major undertaking: the point is not to 'make information available', because information is already there. It is the immense quantity of information available to anyone that tends to be a problem. Thus, what blogs seek to do is information management work, in effect to sort out information that is relevant for a given purpose from that which is not, a task of growing importance in a world where the volume of new information is overwhelming. Information management is thereby also a major source of influence, and possibly of power.

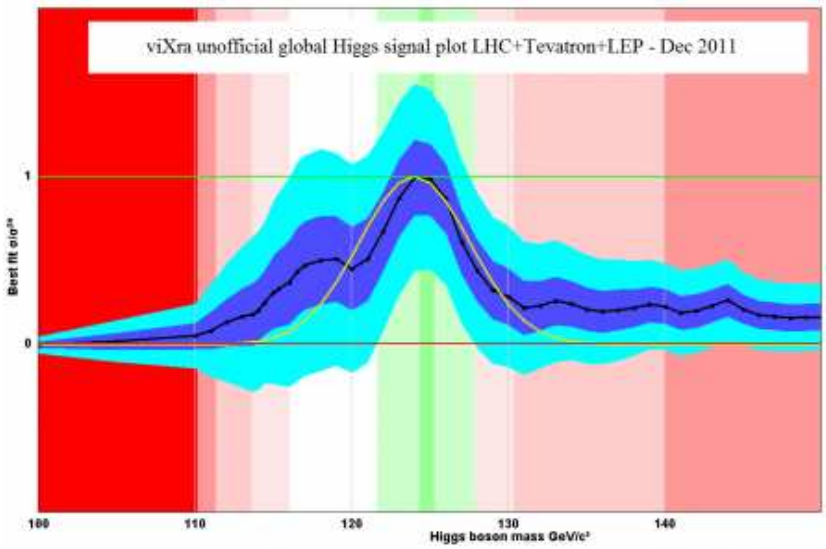
An example of links to related texts from a blog site explaining certain properties of the (then controversial and 'undiscovered') Higgs Boson from 2011 illustrates this well (Example 1). The links are chosen from among a vast range of possibilities by the blogger, and no doubt provide relevant further enlightenment on the Boson. The selection is nevertheless small and does not contain interpretations that question the existence of the Boson or the legitimacy of the search for it.

(1)
RELATED ARTICLES ON SCIENCE 2.0
Plot Of The Week: Improved Projections On ATLAS Higgs Reach
The Plot Of The Week - The 327 GeV ZZ Anomaly
New ATLAS Limits On Higgs Mass
Five New Higgs Searches By CMS!
New CMS Limits On Higgs Mass (TD)

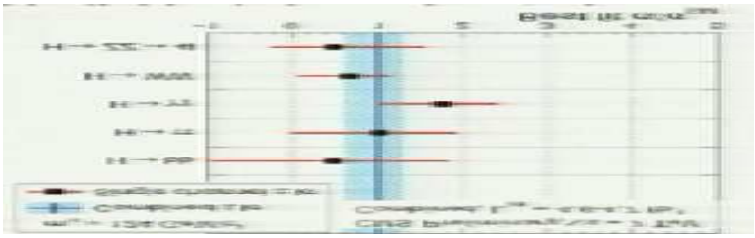
3.2 Commentary

The other major ancestral branch on Miller and Shepherd's tree is the commentary, comprising genres such as the pamphlet, the editorial, and the opinion column. Commentary is manifest not only in blogs themselves, which typically provide reviews of recent science news or findings, but also in the further comments they beget. In this respect, the great-great-grandchildren have reached far beyond their early ancestors, as free commentary has become the landmark of web activity. Example (2) illustrates a case of research commentary. Here the commentary is the main purpose of the blog entry, and provides the matrix text within which object text is embedded (underlining outside the web links is mine and refers to the language points taken up below).

(2)
Firm Evidence Of A Higgs Boson At Last!
By Tommaso Dorigo | December 13th 2011 07:18 AM | 92 comments | Print | E-mail | Track Comments **Tweet**
- Philip Gibbs does a great job, as always, at combining -albeit approximately- the results of different experiments in the Higgs search. He now has even a full combination of LEP II + Tevatron + CMS + ATLAS, where the signal strength, in SM units, fits absolutely bang on for a Higgs mass of about 125 GeV. Please see his article at the link above; but I cannot resist from stealing his most intriguing picture (sorry Phil!):



If Phil did his homework correctly, the combination fits well the signal hypothesis and is over three sigma away from the no-Higgs hypothesis at that mass... This reinforces my belief that what we saw today does constitute "firm evidence". My opinion, sure.
[. . .]
Perhaps the most interesting plot by CMS is the following one, showing the best-fit signal cross section from each individual channel, compared with the one expected for a Higgs boson of 124 GeV (blue line): there is full compatibility with the Higgs!



(TD)

The text abounds with evaluative language (cf. e.g. Hunston & Thompson 2000; Mauranen 2002), assessing the import of the scientific data (*albeit approximately; absolutely bang on*; *the most interesting plot; full compatibility*) the status of the assessment (*my belief; my opinion*), and people's performance (*does a great job; if … did his homework*

correctly; his most intriguing picture). Some of the evaluation has a hedging effect (*approximately, opinion*), some a boosting effect (*absolutely, bang on, great*). Punctuation with exclamation marks, quotation marks, and sequences of three dots adds to the strong appraisal effect, distinguishing the interpretations from more scientific passages and diagram material.

Commentary from the readers on the blog, itself already a comment, is where blogs take a new departure compared to their ancestry. This 'metacommentary' is shown below (Example 3), a sequence of four consecutive comments selected simply for their brevity, taken from the first responses to the blog entry above:

(3)

- This title will probably backfire.
  Thanks for making some of the plots available. The video broadcast was unfortunately very difficult to follow.
  Anonymous (not verified) | 12/13/11 | 09:40 AM

- I'd say things are still fairly inconclusive. From the 'looks' of things, we'll need 10fb-1 of data to be comfortable with any yes/no evidence. I'm disappointed in your uncharacteristic optimism :)
  Anonymous (not verified) | 12/13/11 | 09:50 AM

- Atlas has a Higgs signal at 100GeV in gamma-gamma that looks equally strong than that at 126. strange...
  chris (not verified) | 12/13/11 | 10:10 AM

- Put me in the remains to be convinced camp. When either Atlas or CMS gets well over 4 sigma i'll be persuaded. I believe there have been numerous 3 and even 4 sigma bumps over the decades which end up being background and I'm uncomfortable with the combining of the two datasets. (TD)

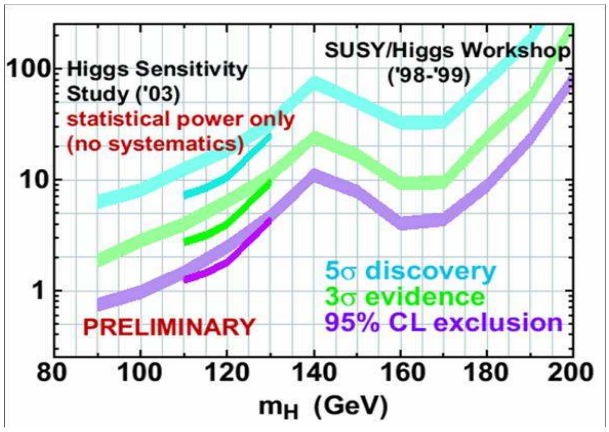
The comments give a quite spontaneous feel, since there is little in the way of politeness conventions, and they are not prefaced by much orienting material such as metadiscourse (apart from ***I'd say*** *things are*…). It seems from larger samples, though, that dialogic metadiscourse is used more when something unusual or sensitive appears in the situation, or around beginnings (Mauranen forthcoming).

3.3 The conference talk

Besides the ancestral genres of blogs that Miller and Shepherd identify, I would like to add one that is specifically relevant to the research blog, namely the conference paper. In essence, many research blogs follow surprisingly closely the typical structure of a conference presentation (Ventola, Shalom and Thompson 2002; Mauranen 2013): the first stage is the core element, a prepared presentation, and the next a discussion section. The latter is optional, but as it indicates audience interest in the first part, it is vital to make the whole successful.

Presentations on blogs resemble those at conferences: they are short and succinct, showing images and diagrams together with associated textual explanations (Example 4). Their register follows largely the conventions of written academic prose.

(4)



Let us consider only the purple band: it shows, as a function of higgs mass, the amount of data (in inverse femtobarns, on the vertical axis) that, if collected by CDF and DZERO, could be predicted to yield an exclusion of the corresponding mass (on the horizontal axis), at 95% confidence level: id est, a limit **R<1**. We can take that luminosity and compare it to the luminosity used by CDF to obtain their latest Higgs limits combination -that of November 2009, which is shown below. [. . .]

As the discussion starts, there is a clear shift in register towards less formal features, closer to spoken dialogue (addressing interlocutors by their first names, starting sentences with *and*, and so on), with questions from the audience and answers from the original presenter, as below (5):

(5)
What about combining LHC and Tevatron results? Would that help give a chance of discovering a low-mass Higgs, say 120 GeV, before the LHC shutdown?
Francis Bursa (not verified) | 02/08/10 | 05:00 AM

I do not see that happening, Francis, unless there is significant evidence on both datasets. And this is highly improbable. There are also other, more "political" reasons for not doing it.
Cheers,
T.
Tommasso Dorigo| 02/08/10 | 05:29 AM (TD)

Blog moderators act as chairpersons of a kind – if not giving out speaking turns, nevertheless monitoring the direction of the discussion. In the next example (6), the moderator passes an evaluation on the relevance of a comment in the thread, rather in the manner a chairperson in an academic conference might act, even though the wording obviously would be different in a conference. Both are unmistakably instances of interactional management talk.

(6)
Dear Leo, off-topic comment. Please no replies to it, or I will have to take it down...
Cheers,
T. (TD)

Along with the similarities, there are obvious differences between the conference presentation and the research blog. The principal one is the audience. Conference audiences consist of members of the same discourse community, they are presenters' peers, and themselves experts in the field. Blog comments can come from anyone, as commentaries are normally open to all users of the Internet. Although commentators on science blogs seem generally to have some background in the field, at least an amateur's interest, the nature of the discussion is highly variable, ranging from peer comments from fellow researchers to questions by complete outsiders. Nevertheless, the affinities between the conference talk and the blog are clear enough to warrant a family resemblance, even though it would seem hard to try to fit them into the same genre exactly. But somewhere along the evolutionary line of a research blog, traces of the conference talk are detectable.

3.4 In sum: Blogs and their generic ancestry

In all, then, blogs appear to have a long and respectable lineage, and research blogs can readily be identified as descendants of the filtering tradition as well as the commentary tradition. Moreover, as a relatively recent (post-mediaeval in any case) predecessor we find the conference presentation. In contrast to the others, this last one is not written discourse. That is, it is not the published conference paper that resembles blogs; it is the live presentation and the ensuing discussion. This adds a strand to the much-discussed mixing of spoken and written registers on the Internet.

A fundamental feature of this digital medium is the possibility – and active use – of open commentary, as we saw in the above examples. This is a genuinely new feature in scientific and scholarly traditions. While peer commentary has been desirable, the scientific community has been open to members only, and consequently these discourse communities (Swales 1990) have been essentially closed, with a variety of gatekeeping practices in place. In blogs, audiences are multifarious and heterogeneous; they are not mere observers or receivers of scientific communication, but active commentators and participants. This also sets blogs apart from traditional popular science where scientists' and scholars' texts were edited with the general public in mind (see, e.g. Russell 2010). In terms of social action, this open participatory possibility implies a distinct change to the generic nature of the blog in comparison to its ancestry.

Apart from the analyst's perspective on research blogs, it is of interest, in the best traditions of genre analysis, to try to capture something of the actual communities or users' perspective, too. For this study it seemed a good point of departure to look at blog site comments on research blogging itself. Therefore, to get a glimpse of what might be going on in bloggers' own view, I turned to two research blog sites, and looked for bloggers and their commentators talking about blogging as an activity. At the outset, one might imagine that merely by exploring blogs, as opposed to, say, interviewing people, there is very little to go on in the way of comments on blogging. But as it turns out, science blog discussions talk a good deal about blogging itself, in addition to science.

4. How do science blogs talk about blogging?

I followed two blogs, both of some duration (two to five years), and concerned with well-publicised recent scientific controversies. The main criterion for selecting these was that they both had an active scientist blogging on his or her own on-going research. These two blogs were a pilot for a larger study on research blogging that was at a preliminary planning stage in 2011. I wanted to explore their characteristics and wanted them to be different: they came from different disciplines, included a non-native speaker of English as well as a native speaker, and both genders. The larger research corpus that was then planned is currently being compiled (www.helsinki.fi/englanti/elfa/wrelfa.html), and will enable more extensive investigations into research blogs. I thus ended up with one blog in theoretical physics (TD, from which the examples in the previous section were taken), and another in microbiology. The first (Tommasso Dorigo's blog "A Quantum Diaries' Survivor" in Science 2.0), was concerned with the search for the Higgs Boson, engaging in lengthy disputes around its existence. The second (Rosie Redfield's "RRResearch", hereafter RRR) was concerned with arsenic-consuming bacteria, a widely publicised piece of science news since the publication of a paper on the discovery of such bacteria in *Science* in 2010 (Wolfe-Simon et al). Both blogs are kept by researcher scientists involved with the empirical work themselves, writing about their own and related research in their fields. Neither therefore represent more conventional science journalism, where professional journalists report on findings originating in the work of scientists and scholars. There is a difference, then, between first-hand science reporting as in these blogs, and the second-hand reporting of conventional science journalism, which is a well-established field of writing, and extends from dedicated newspaper sections to specialised journals and, increasingly, websites, podcasts, and other social media channels.

Both blogs still continue, focusing on the same and related topics, after dramatic turns in the debates. It seems that the Higgs Boson has been getting the most headlines after the declaration of its 'discovery' by the heads of the research communities working on it, although the arsenic-eating bacteria were a major media event two years earlier. The acceptance of the arsenic blogger's paper on the topic for publication in Science took place almost simultaneously with the public confirmation of the Higgs Boson, but did not cause an equal stir in the public media.

Although at the time of writing this article (July 2012) both topic threads thus seem to have enjoyed remarkable triumphs at last, the controversies are by no means over. No final truths have been settled on, but uncertainties in findings and their interpretations are claimed, despite the substantial amount of new evidence that has been accumulated – in brief, a strong resemblance can be seen to how we are used to understanding cyclical progress in science: by research, results, questioning, and more research.

In the following, I focus on the comments that appeared in the blog threads on the relationship between science and blogging. I sampled the blog sites over about two years on these topics, and went on to categorise the data items according to their stance towards blogging (whether they evaluated it positively or negatively in relation to science), and with regard to the finer distinctions among science blogs that participants also made. I show examples to illustrate these categories from the discussion threads as well as the actual blog postings, so as to capture the topics that any active participants in addition to blog writers consider worth talking about.

One notable feature in both blog threads is that they engage in discussion about science – what it should or should not be, and what it contrasts with (see (7). Every now and then low esteem for blogs comes out, as in (8) but also its invigorating potential as an alternative to traditions that are perceived as having seen their best days, as in (9).

(7) What bothers me most about that episode is that the discussion was mostly about politics [funding, who owns data, etc.][1] and not about physics (TD)

(8) Yes, I realize that this is just a blog, but… (TD)

(9) I concur with your bottom line. I think that conferences have become a rather sterile ground lately: people are afraid to speak up, lively discussions never arise because the agendas are too tight, and moderators cut out anything that seems controversial. Fortunately, there is the web :) (TD)

Writers do not shun strongly evaluative, even emotional expressions in discussing controversies over scientific issues. The debates concerning the relationship of blogging and science can become heated, as web discussions tend to, but conference discussions more rarely. The

[1] My own clarifications or deletions are marked with square brackets.

following comment, within which an earlier one is embedded, illustrates the attitude and the tone (10):

> (10)
> **L.M. said...**
> S. M. says, *This whole thing is grossly inappropriate. You should have sent this to the journal of record FIRST, where it can be properly reviewed. You're not some advanced hobbyist layman with a good idea but no standing. You'd almost certainly be given a full hearing in the appropriate forum.*
> What planet are you from?
> We're talking about a major press conference designed to promote a study funded by [xx]. Blogs are the appropriate place to counter such behavior. The science in the published paper doesn't get a free pass when it's presented as a major news story. (Or even if it isn't.) Your advice is tantamount to suppressing criticism on the grounds that peer review in science journals is the only way to counter bad science. That's absurd. (RRR)

The views aired here also show some other typical features of the discussion threads. Highlighting devices (such as upper case lettering), extreme evaluative expressions (*grossly inappropriate; absurd*) or dramatic counters (*what planet are you from?*) all remind us of open public debates on the web, but are rather distant from usual academic writing practices. On the other hand, it is common practice in academic discourse to cite the target of criticism if it does not immediately precede the comment. The major dividing line among the commentaries is also well illustrated in Example (10): blogs tend to be either constructed as disrupting best scientific traditions, or as replacing stale practices with aptly contemporary means. We can discern two opposing discourses in the discussions, one that might be termed ‘traditionalist’, and the other ‘radical’.

4.1 Blogs are harmful to science

The core of the traditionalist message could be summed up as ‘blogs are not real science’ (Extracts in 11): essentially this view holds that scientific issues should not be addressed on platforms like blogs, because such fora are not serious enough. Bloggers aspiring to publish science should instead resort to mainstream routes for publication, go through peer review and address their findings and questions to the proper audience, which consists of their peers, other scientists.

(11)
(a) you refute work with your own work, or your published criticism, which gets reviewed, not with a blog. (RRR)
(b) This is what needs to be debated through the peer reviewed process instead of on a blog. (RRR)
(c) … I'd like to respectfully voice my opinion that "science by blog" is simply not a good idea… (RRR)
(d) I think you are equally guilty of premature conclusions and using the media to create a circus. (RRR)
(e) Given that reality, expert public discourse of the type seen on this blog (with reckless speculations on scientific agendas and suppression of data) is not merely unhelpful; it may actually be dangerous and irresponsible. (RRR)

The views thus range from comparatively mild rebuttals (*simply not a good idea*) to warnings about peril (*dangerous and irresponsible*), and some also direct bloggers towards the right path (*needs to be debated through*…).

4.2 Blogs are beneficial to science

In contrast, the opposing, radical view holds that 'Blogs are at the heart of science' (Examples 12-13). These comments point out that free criticism is at the core of what science is about, and that publishing and publicising new results as fast and widely as possible is in everybody's interest.

(12) Blogs are just making this process more public and that's good thing. It's the way science has always operated. (RRR)

(13) The problem is we are in a transition period.
The way it has been for as long as anyone can remember is: Scientist collects data, analyses data, discovers something, then publishes one definitive account. The end. That made sense when we were working in paper and ink. Now we work in digital formats and have a ability to store every draft, every dead end, every misstep for posterity.
So what does that mean? Scientist collects data, blogs on it get's feedback, analyses data, blogs about it, gets more feed back, discovers something and publishes about it (with a pre print on arxiv to show the trackbacks) then people blog about the finished product. The way things are done now are more akin to an open source project than say the Manhattan project. (TD)

The much-debated flaws in the peer reviewing system were also brought up, sometimes with intense emotion (14), but also in calmer terms (15).

(14) …tantamount to suppressing criticism on the grounds that peer review in science journals is the only way to counter bad science. That's absurd. (RRR)

(15) If we are looking for a viable alternative to the current system of peer reviewed publications, which often screens IN bad science and screens OUT good science with null findings, I think we've found it. (RRR)

(16) I had argued that a number of research findings are fundamentally flawed even though they were approved by peer-reviewed process. It is high time that some of the practices in science need to be checked and scrutinized. (RRR)

Concern with the quality and ethics of research was also often voiced, and the danger that attention might be directed to poor quality science rather than high quality science. In the next example (17), this was linked to the need for the general public to get first-hand information about what is going on in science.

(17) Since this story has been so widely reported on in the media (with all the hype that NASA might have been aiming for), we as scientists now have a moral obligation to voice our concerns and criticisms in a publicly accessible medium, such as this blog. (RRR)

The notions that find expression in these comments thus range from claiming normality for blogging in scientific practice (12 and 13 above) to the opening up of new possibilities for remedying the perceived evils that have set in within the world of science, such as the problems of peer-reviewing (15 and 16). Peer reviewing systems have received a fair amount of criticism on many scientific fora, and the last couple of years have seen a revival in the critique again. In this, too, the blog issues reflect debates very much alive in the scientific community.

4.3 Genre awareness: Making finer distinctions

Comments and blogs from both camps showed a high level of genre awareness (see, e.g. Johns 2002): whether the writers were for or against blogging as a form of research writing, they certainly manifested staunch views of what blogs are. Moreover, many comments also showed sensitivity to finer divisions, making references to the 'typical science blog' and contrasting it to other kinds, as in Example (18). Similar distinctions were extended to people: qualified members of the scientific discourse community were differentiated from just any enthusiastic

layperson (*You're not some advanced hobbyist layman with a good idea but no standing* (RRR), and a serious blogger from 'some anonymous physicist blogging' (19). In this way, writers in the blogosphere were discerning fine distinctions not only among blogs, but even within the sphere of science blogs. Such commentary suggests genre status for the research blog, but not necessarily a unified or uniform genre.

(18) Not your typical science blog, but an 'open science' research blog. Watch me fumbling my way towards understanding how and why bacteria take up DNA, and getting distracted by other cool questions. (RRR)

(19) I think, […] society recognizes after more than a decade of blogging that there are varying levels of that also - you blogging is not the same as some anonymous physicist blogging or some physics amateur on the Internet. [. . .] (TD)

As a further indication of genre sensitivity, drawing the line between journalism and research blogging was raised, as the next two examples show. Both the commentator in (20) and 'Armonyous' in (21) make a clear distinction between journalism and science blogging. The writer of (20) also seeks a differentiating term or concept to distinguish science blogging from journalism on the basis of "knowledgeability" and from 'just blogging' on the basis of credibility.

(20) There needs to be an easier distinction between journalism, press releases, blogging and what you (and we - actual blogging is a tiny 4% of our content) do, because your work is a lot more knowledgeable than journalism and way beyond blogging in credibility. What is that term? Science 2.0 doesn't work because you it can't end in -ism or -ing but someone will come up with something. (TD)

In (21) the commentator indicates disagreement with the blogger about two things: his cavalier disregard of the distinction between journalism and science (*journalists checking out your blog; journals…write*) by using 'catchy' expression, and the lack of veracity of his message (*simply not true*). The blogger counters this by equating blogging with journalism, thus justifying 'catchiness', and drawing the distinction between his blog and 'other magazines' on the basis of superior content.

(21) You should be very cautious with titles like that, specially when you know you have journalists checking out your blog.

> What you say is simply not true but it sure sounds catchy. Don't complain afterward when journals (even as serious as The Economist) write carelessly about the LHC.
> Verified Armonyous (not verified) | 04/12/10 | 15:35 PM
> Armonyous,
> maybe you fail to realize it, but this is already a form of journalism... And as such, sometimes it uses catchy titles. I prefer my articles to those of new scientist or other magazines, which have catchy titles _and_ incorrect content.
> Cheers,
> T. | 04/13/10 | 02:30 AM (TD)

Clearly, then, there is awareness about the unsettled nature of the research blog as a genre, and controversy about what this entails. More importantly, these deliberations around the generic status seem to arise from spontaneous commentators who are interested in the topic areas, but only some of whom appear under their own names, or show other marks of community affiliation, such as references to each others' blogs, or being known to each other outside the blogosphere. Therefore, discussion of the above kind contributes a comment on what might define genres: it would seem, again, that genres are constructed in contextualised discourse, not necessarily in a pre-existing community.

5. Unique features of the science blog

We saw above that the research blog is firmly rooted in a long ancestry of respectable genres, and that despite its modern digital guise, it follows in the footsteps of its progenitors fairly faithfully. But that is not all: blogging also brings about new practices. In an intriguing way, doing science by blogging realises some of the ideals upheld in 17th century debates around the foundation of the Royal Society and rising experimentalism (Shapin and Schaffer 1985), with the ensuing modes of scientific rhetoric (Gotti 1996, 2003; Gross et al. 2002; Valle 1999). Blogs involve the collective witness, a group of experts or lay spectators who observe the experiment with their own eyes and are thereby able to agree on what constitutes Boyle's "matters of fact" (Shapin and Schaffer 1985:22). We can see a web-mediated version of this taking place in the examples below (22- 23), where the on-line immediacy gives blog followers a sense of seeing how the experiments take place step by step, and how the results gradually come into view.

Example (22) sets the scene, with the blogger explaining what the current state of the research is (*Any day now I hope to receive some preliminary results*…). The reporting adopts a narrative style: *I thought I should…; I got sidetracked;*

(22) Any day now I hope to receive some preliminary results from the mass spectrometry test for arsenic in GFAJ-1 DNA. In preparation I though I should at least attempt to understand the control data that the grad student doing the work sent me a couple of weeks ago. But I got sidetracked by the easier task of understanding some control CsCl-gradient data he also sent. This is a pre-analysis step, used to further purify the DNA before the analysis (RRR)

In (23) the narrative moves into free indirect speech, as if it were the writer's stream of consciousness (*Do we need to also consider* …). A passage of consulting Wikipedia (*What does Wikipedia say? Nothing about other ions*) has an air of spontaneity, with the bracketed sentence (*Ah, the correct term is*….) conveying a particularly powerful sense of immediacy.

(23) [. . .] Do we need to also consider contaminants that might have banded at a specific density in the gradient? The centrifugation is powerful enough to cause the heavy Cs+ ions to move down in the tube, might it also affect the distribution of other ions? What does Wikipedia say? (Ah, the correct term is 'isopycnic centrifugation'.) Nothing about other ions. CsCl gradients have typically been used to separate DNAs with different base compositions from each other (e.g. nuclear DNA from mitochondrial or plastid DNA); I don't know if anyone ever used them to separate DNA from soluble contaminants. **Bottom line:** If the LC-MS data shows arsenic in the DNA, we can polish up these DNA purification steps. If it doesn't, we won't need to bother. (RRR)

The reporting here seems to simulate the kind of eye-witness experience that was sought by early experimentalists like Boyle with collective observation: groups of experts saw experiments performed and were therefore convinced of the veracity of the results. Clearly, the Internet community is not physically present at the experiment, but the usual gap between the actual experiment and the written report, as in research articles, is much narrowed. Moreover, accompanying video material adds to the sense of participation in many cases.

On-line reporting of experiments is akin to the 'replicability' tradition, which has become a firmly established feature of scientific articles. This was also keenly advocated by Boyle, even though he

already saw it was not going to be easy. The tradition is maintained in research papers to satisfy the academic community that acceptable procedures have been followed and in principle the experiment could be carried out by someone else. Actual replication experiments tend to be rare, and performed only when findings are exceptionally controversial, as in the Cold Fusion case from 1989, or a recent case of neutrinos that were claimed to be faster than light in 2011. Our example comes from one such debate, where the experiments reported in RRR are being run in order to test the claim put forward by Wolfe-Simon et al (2010) that some bacteria can use arsenic instead of phosphorus as a nutrient.

Internet reporters, with their spontaneous style, graphs and video clips, leave out much technical detail, background preparations, earlier mistakes, and so on, just like any report of an experiment. They nevertheless show, demonstrate, and reflect on their on-going work in a way that lets spectators into the process beyond anything that a finished product in the form of a published article can attempt.

Shapin and Schaffer (1985) talked about the utilisation of 'knowledge-producing technologies'. One was the literary technology, by means of which the experimental events were made known to those not directly witnessing them. Here we can see the Web as a technology that enables a hybrid to develop between the actual live performance of an experiment on the one hand and writing it up on the other, with the inevitable distance of the latter from the demonstration. What is specific to the Internet is that the audiences are potentially enormous, and not restricted to a locality as in the case of eye-witnesses, or to a community of experts as in the case of research articles.

Equally importantly, the audiences are not confined to the role of spectators: one of the signature features of the digital medium is open commentary, and this is genuinely new. It has not been part of scientific discourse traditions before. The heterogeneous audiences are not only permitted to observe, but they are also invited to comment, ask questions, express doubt, criticise, and make suggestions. It seems that science blogs have features that take us back to the times when science journals were only about to start: the desire to bring the evidence right to interested audiences, almost performing the decisive experiments under their own eyes. At the same time, they make use of digital technologies in distributing this knowledge-production mechanism to wide audiences,

who can also participate in establishing the presented matter as knowledge – or rejecting it.

6. Conclusion

This paper has been looking at research blogging – how it relates to other blogs, how it relates to its generic ancestry, and how its traditional and new features intermingle to produce a recognisable text type. The question was raised whether the research blog should be seen as a genre of its own, a subgenre of the 'blog' genre, or a cluster of genres. Exploring the generic nature of blogs, it became clear that the relationship of community and context needs to be reconsidered in order to settle the question: the new medium does alter the terms of determining genre. It is the context that seems to create genres, and communities emerge around them. The concept of the genre-regulating, pre-existing community does not apply to web-based genres.

With regard to the generic status of blogs, it would seem that the blog is more like a genre cluster than one genre in itself. The different purposes and contexts blogs are used in do not warrant a single generic category. At the next level down the scale, however, it would seem more appropriate to take the research blog to constitute a 'basic level' genre. Blogs have introduced new practices in academic language and academic reporting. As Gilbert and Mulkay (1984) observed in their classic study of scientists' repertoires, researchers talk about their investigations (the 'contingent' repertoire) in ways that differ in important ways from the ways in which the work gets written up (the 'empiricist' repertoire). While constructivist analyses of scientific rhetoric (e.g. Bazerman 1994) already narrowed the gap between spoken and written representations by looking at the written report as rhetoric, blogs go further. In blogs we see researchers' comments on their procedures, reflections, and intentions, together with reports of what went wrong or did not work. This is a new practice, in making the 'contingent' public along with the 'empiricist'. Linguistically there is much of the informality and spontaneity of spoken language.

The unforeseen practice of involving audiences in open commentary means that unknown, heterogeneous, and varied audiences may participate in co-constructing research debates. This may not always be a

blessing (Blanchard 2011), but it provides a new opportunity of direct involvement for anyone who is so inclined.

In terms of science publication, the emergence of the science blog reflects tensions in the face of dramatic changes – notably between traditions established to uphold standards, and the reformist enthusiasm to tear down old edifices in the interests of the ideas that originally inspired scientific publishing. It also reflects new challenges to science communication when the Internet has become a prime source for all information seeking: to reach the desired audiences, what is the best policy for publication? The answer can be 'both', as one possibility already in use is releasing drafts and rough ideas in a blog or on a personal website first, and then developing them into a publishable version submitted to a traditional scientific or scholarly journal. We already discussed one such example above, and similar practices can be observed for instance in the humanities (see, for example http://tar.weatherson.org/; http://experimentalphilosophy.typepad.com/). One of the intriguing consequences is that the audiences can be very mixed, as we already saw in the examples. Some commentators are peers, others interested laypersons.

The blog discourses in this paper reflect many tensions currently in the air: the growing demand for outreach does not fit easily with all traditions of expert-based research communities, and publicity is not easily reconciled with the confidentiality that research ethics today require. Peer-reviewing traditions to uphold standards are not compatible with the critique that arises from releasing findings on the Web. Much research requires long-term investment of resources and effort, which is at odds with producing reportable findings at short intervals. Moving towards blog-type publicity also alters the practice of releasing findings only when they are ascertained and accepted after going through several stages, shifting the balance towards publicising work in progress.

Researchers offering their own work and findings on the web constitute a fresh alternative not only to academic research publication, but also to established science journalism. Science journalists are professional mediators, often with an educational background in the disciplinary area they write in; however, they constitute an extra step between the research and the wider audience. Their texts, clips, and programmes can be of high quality and interest value, but they inevitably lack some of the immediacy of direct contact between research and the

interested reader. Even if they invite comments and discussion, it is all distanced from the primary research.

Scientists are increasingly calling on the wider public to engage in crowdsourcing to help out with data collection and analysis. Citizen scientists want to participate as well as satisfy their curiosity; non-experts want to hear about new findings from researchers rather than from mediators. The ivory tower has long been crumbling, and research blogging could be one way of building new bridges between the interested layman and the professional expert.

References

Anderson, Benedict. 1991. *Imagined Communities: Reflections on the Origin and Spread of Nationalism*. London: Verso.

Barger, Jorn. 2007. Top 10 Tips for New Bloggers From Original Blogger Jorn Barger. http://www.wired.com/culture/lifestyle/news/2007/12/blog_advice/. Accessed 12 July, 2012.

Bazerman, Charles. 1994. *Constructing Experience*. Carbondale: Southern Illinois University Press.

Belcher, Diane, Ann M. Johns and Brian Paltridge (Eds.). 2011. *New Directions in English for Specific Purposes Research*. Ann Arbor: Michigan University Press.

Berkenkotter, Carol and Tom N. Huckin. 1995. *Genre Knowledge in Disciplinary Communication*. Hillsdale, N.J: Lawrence Erlbaum.

Biber, Douglas and Susan Conrad. 2009. *Register, Genre, and Style*. Cambridge: Cambridge University Press.

Biber, Douglas, Ulla Connor and Thomas A. Upton. 2007. *Discourse on the Move: Using Corpus Analysis to Describe Discourse Structure*. Amsterdam: John Benjamins.

Biber, Douglas. 1988. *Variation Across Speech and Writing*. Cambridge: Cambridge University Press.

Blanchard, Antoine. 2011. "Science Blogs in Research and Popularization of Science: Why, How and for Whom?" *Common Knowledge: The Challenge of Transdisciplinarity*. Eds. Moira Cockell, Jérôme Billotte, Frédéric Darbellay and Francis Waldvogel. Lausanne: EPFL Press. 219-232.

Blood, Rebecca. 2000. *Weblogs: A History and Perspective*. http://www.rebeccablood.net/essays/weblog_history.html Accessed 26 November, 2011.

Bruns, Axel and Joanne Jacobs (Eds.). 2006. *Uses of Blogs*. New York: Peter Lang.

Eckert, Penelope and Sally McConnell-Ginet. 1992. "Think Practically and Look Locally: Language and Gender as Community-based Practice." *Annual Review of Anthropology* 21: 461-490.

Elmes, John. 2012. "LSE Bloggers Divine the Future of Academia in European Politics." *Times Higher Education*, 19 April, 2012.

Fløttum, Kjersti, Dahl, Trine and Kinn, Torodd. 2007. *Language and Discipline Perspectives on Academic Discourse*. Newcastle: Cambridge Scholars Press.

Gilbert, G. Nigel and Michael Mulkay. 1984. *Opening Pandora's Box: A Sociological Analysis of Scientists' Discourse*. Cambridge: Cambridge University Press.

Giltrow, Janet and Dieter Stein (Eds.). 2009. *Genres in the Internet: Issues in the Theory of Genre*. Amsterdam: John Benjamins.

Gotti, Maurizio. 1996. *Robert Boyle and the Language of Science*. Milano: Guerini Scientifica.

Gotti, Maurizio. 2003. *Specialized Discourse: Linguistic Features and Changing Conventions*. Bern: Peter Lang.

Gregory, Jane and Steven Miller. 1998. *Science in Public: Communication, Culture and Credibility*. New York: Plenum.

Grieve Jack, Douglas Biber, Eric Friginal and Tatiana Nekrasova. 2011. "Variation Among Blog Text Types: A Multi-dimensional Analysis." *Genres on the Web: Computational Models and Empirical Studies*. Eds. Alexander Mehler, Serge Sharoff and Marina Santini. New York: Springer-Verlag. 303-322.

Gross, Alan, Joseph Harmon and Michael Reidy. 2002. *Communicating Science: The Scientific Article from the 17th Century to the Present*. New York: Parlor Press.

Gunnarsson, Britt- Louise. 1993. "Pragmatic and Macrothematic Patterns in Science and Popular Science: A Diachronic Study of Articles in Three Fields." *Register Analysis: Theory and Practice*. Ed. M. Ghadessy. London: Pinter. 165-179.

Herring, Susan C., Lois A. Scheidt, Elijah Wright and Sabrina Bonus 2005. "Weblogs as a Bridging Genre." *Information, Technology &*

People 18(2): 142-171. http://ella.slis.indiana.edu/~herring/itp.pdf Accessed 26 November, 2011.

Hunston, Susan and Geoff Thompson (Eds.). 2000. *Evaluation in Text: Authorial Stance and the Construction of Discourse*. Oxford: Oxford University Press.

Hyland, Ken and Brian Paltridge (Eds.). 2011. *The Continuum Companion to Discourse Analysis*. London: Continuum.

Irwin, Alan and Mike Michael. 2003. *Science, Social Theory and Public Knowledge*. Maidenhead: Open University Press.

Johns, Ann M. 2002. *Genre in the Classroom: Multiple Perspectives*. Mahwah, NJ: Lawrence Erlbaum.

Koskela, Merja. 2002. "Ways of Representing Specialized Knowledge in Finnish and Swedish Science Journalism." *LSP & Professional Communication* 2(1): 27-40.

Krishnamurthy, Sandeep. 2002. "The Multidimensionality of Blog Conversations: The Virtual Enactment of September 11." Presented at Internet Research 3.0, Maastricht, The Netherlands. http://www.citeulike.org/user/ladamic/article/2611295. Accessed 28 November, 2011.

Martin, James R. 1997. "Analysing Genre: Functional Parameters." *Genre and Institutions: Social Processes in the Workplace and School*. Eds. Frances Christie and J. R. Martin. London: Continuum. 3-39.

Mauranen, Anna. 1993. *Cultural Differences in Academic Rhetoric: A Textlinguistic Study*. Frankfurt: Peter Lang.

Mauranen, Anna. 2002. "'A Good Question': Expressing Evaluation in Academic Speech." *Domain-Specific English: Textual Practices across Communities and Classrooms*. Eds. Giuseppina Cortese and Philip Riley. Frankfurt: Peter Lang. 115-140.

Mauranen, Anna. 2013. "'But then when I started to think…': Narrative Elements in Conference Presentations." *Narratives in Academic and Professional Genres*. Eds. Maurizio Gotti and C. Sancho Guinda. Frankfurt: Peter Lang, 45-66.

Mauranen, Anna. Forthcoming. *Reflexively Speaking: Uses of Metadiscourse in ELF*. Berlin: DeGruyter Mouton.

Miller, Carolyn and Dawn Shepherd. 2004. "Blogging as Social Action: A Genre Analysis of the Weblog." *Into the Blogosphere: Rhetoric, Community and the Culture of Weblogs*. Eds. Laura Gurak, Smiljana

Antonijevic, Laurie Johnson, Clancy Ratliff, and Jessica Reyman. Minneapolis: University of Minnesota Press.

Miller, Carolyn and Dawn Shepherd. 2009. "Questions for Genre Theory from the Blogosphere." *Genres in the Internet: Issues in the Theory of Genre*. Eds. Janet Giltrow and Dieter Stein. Amsterdam: John Benjamins. 263-290.

Miller, Carolyn. 1984. "Genre as Social Action." *Quarterly Journal of Speech* 70(2): 151-167.

Myers, Greg. 2010. *The Discourse of Blogs and Wikis*. London: Continuum.

Parr, Chris. 2012. "Blog-standard Turn-offs for Social Media Neophytes." *Times Higher Education*, 1 November 2012 (No 20174): 13.

Rowley-Jolivet, Elizabeth and Sandra Campagna. 2011. "From Print to Web 2.0: The Changing Face of Discourse for Special Purposes." *LSP Journal* 2(2) http://lsp.cbs.dk

Russell, Nicholas. 2010. *Communicating Science: Professional, Popular, Literary*. Cambridge: Cambridge University Press.

Shapin, Steven and Simon Schaffer. 1985. *Leviathan and the Air Pump: Hobbes, Boyle and the Experimental Life, Including a Translation of Thomas Hobbes, Dialogus Physicus De Natura Aeris*. Princeton, NJ: Princeton University Press.

Swales, John M. 1990. *Genre Analysis*. Cambridge: Cambridge University Press.

Valle, Ellen. 1999. *A Collective Intelligence: The Life Sciences in the Royal Society as a Scientific Discourse Community, 1665-1965*. Turku: University of Turku.

Ventola, Eija, Cecilia Shalom and Susan Thompson (Eds.) 2002. *The Language of Conferencing*. Frankfurt: Peter Lang.

Ventola, Eija. 1987. *The Structure of Social Interaction: A Systemic Approach to the Semiotics of Service Encounters*. London: Frances Pinter.

Wolfe-Simon, Felisa, Jodi Switzer Blum, Thomas R. Kulp, Gwyneth W. Gordon, Shelley E. Hoeft, Jennifer Pett-Ridge, John F. Stolz, Samuel M. Webb, Peter K. Weber, Paul C. W. Davies, Ariel D. Anbar and Ronald S. Oremland. 2010. "A Bacterium That Can Grow by Using Arsenic Instead of Phosphorus." *Science* doi:10.1126/science.1197258

Primary data
Dorigo, Tommaso. A Quantum Diaries Survivor. http://www.science20.com/profile/tommaso_dorigo
Redfield, Rosie. RRResearch. http://rrresearch.fieldofscience.com/