'Theoretical subtleties' or 'text modules'? German researchers' language demands and attitudes across disciplinary cultures

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ABSTRACT

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The article identifies and discusses different language and disciplinary demands that non-native English-speaking researchers face when writing and publishing in English and how these relate to their (perceived) writing difficulty. By drawing on 24 interviews conducted with German researchers from four disciplines, the concept of disciplinary culture is invoked to investigate how research paradigms, writing conventions and value systems affect non-native English-speaking researchers in different fields when it comes to writing in English. The article highlights several factors that may play a role in the language demands made on researchers, such as the degree of rigidity of genre and language, the distribution of writing tasks and the ratio of native-speakers of English to non-native speakers in a given field. The results suggest that what could be considered sufficient language competence for research publishing in English varies across, but also, depending on researchers' career levels, within the four disciplines studied, i.e. biology, mechanical engineering, German linguistics and history. It is also argued that research on academic writing can benefit greatly from understanding writing as a disciplinary practice and that ethnographically-oriented research could be one way of shedding more light on the relationships between language and disciplinary cultures.

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1. Introduction

It is an indisputable fact that English is the dominant language of research publication. Although this trend is less pronounced in the social sciences and humanities, processes of internationalisation and the anglicisation of research communication seem to be at work here, too. This has been confirmed by a considerable body of literature, dealing with topics such as the extent to which English has become the default language of research publications (e.g. Ammon, 2001), how this affects scholars' careers (e.g. Flowerdew, 2007) and also other languages used for research publication and dissemination (e.g. Hamel, 2007). Another indicator of the dominance of English in academic communication is the growth of English as a medium of instruction in higher education (e.g. Ammon & McConnell, 2002), a tendency that is both a consequence as well as a driving force for academic anglicisation (Coleman, 2006; Gnutzmann, 2012). Although English has undoubtedly attained an unprecedented presence at universities, this does not necessarily mean the complete exclusion or redundancy of other languages of instruction (e.g. Haberland & Mortensen, 2012).

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Germany, like many other non-English speaking countries (Björkman, 2013; Bolton & Kuteeva, 2012 for Sweden; Flowerdew & Li, 2009 for China; Gnutzmann, 2008 for Germany; Lillis & Curry, 2010 for Portugal, Slovakia, Spain and Hungary; Okamura, 2006 for Japan) has experienced a surge in writing and publishing in English over the last few decades. A survey of doctoral dissertations written at the University of Braunschweig,[1] a medium-sized German university with a strong orientation towards the natural sciences and engineering disciplines, but also with faculties for the humanities and social sciences, may serve as a bibliographic indicator of this anglicisation: only 7.5% of 281 dissertations written in 2000 were in English. This number has since increased fivefold. In 2005, 29.1% of 251 dissertations were published in English, and in 2010, this number rose to 38.1% of 265 dissertations. Although these are aggregate numbers and it is therefore not possible to tell which disciplines were most anglicised, they clearly show an increasing orientation to English even in the earlier stages of research careers, suggesting that the situation is even more striking in later stages and in genres such as the research article.

While there is a substantial amount of research available on the challenges non-native speakers of English typically face when publishing in English (e.g. Ferguson, 2007; Lillis & Curry, 2010; Pérez-Llantada, Plo, & Ferguson, 2010), the influence of disciplinary cultures on the writing and publishing process is only occasionally taken into consideration when addressing this question. This paper therefore explores the importance of disciplinary cultures for language demands made on multilingual scholars who are writing and publishing in English. It is argued that researchers, depending on the discipline they are active in, hold very different views on English as a scientific language and the difficulties they perceive when writing in English. Our analysis of the language demands made on researchers suggests that what could be considered sufficient language competence for research publishing in English varies across, but also, especially depending on researchers' career levels, within the different disciplines.

2. Disciplinary cultures and language

Along the lines of an inductive approach to qualitative data analysis (Thomas, 2006), the assumption that language demands made on researchers may vary across disciplines first emerged through case comparisons involving researchers from different disciplines. One such comparison was made between an unequal pair – a physicist and a political scientist (cf. Table 1 below) – and it was intriguing to see that the researchers perceived the challenge involved in publishing in English very differently, although both had had considerable experience in writing and publishing in English and had been on longer stays in English-speaking countries.[2]

These two researchers clearly have a different view on where their difficulties lie and this is what eventually led to further, more systematic investigations. However, before presenting the research method and data in detail, it is important to elaborate on how disciplinary cultures may be connected to language demands. Although the focus of this article is on academic writing and publishing in English, which is often globally oriented (hence terms like 'off-networked scholars', Canagarajah, 2002b), communication in national languages and its role in constructing disciplinary cultures also deserve more consideration. There seems to be a discrepancy between the wider reach of some scientific discourses, as in international journals, and the predominantly 'local' socialisation of researchers through practices such as talking and writing in educational contexts (Hyland, 2009, p. 51). A myriad of formal and informal conversations, meetings, classes, laboratory internships etc. take place every day at universities worldwide, which is why their impact on the construction of researchers' identities and disciplinary cultures should not be underestimated: "Participation shapes not only what we do, but also who we are and how we interpret what we do" (Wenger, 1999, p. 4). This calls for investigations on a local level, where processual and social characteristics are more likely to emerge than in the finished product, i.e. published articles.

Disciplinary cultures, such as those found within the natural, engineering and social sciences as well as the humanities, are given a prominent position in this article. In a more general understanding, culture "embodies the traditional and social heritage of a people; their customs and practices; their transmitted knowledge, beliefs, law and morals; their linguistic and symbolic forms of communication and the meanings they share" (Becher, 1994, p. 152). Applied to an academic context, this means that factors such as epistemological positions, research methods and the data they produce as well as ideologies can vary considerably between disciplinary cultures and this makes them an influential factor in investigating academic writing and publishing. So the term "disciplinary culture" encompasses more than the term "discipline"; it includes a social dimension among its members that is not contained in the notion of "discipline". This comprises commonly held attitudes and beliefs, ideologies and everyday acculturation practices. At the same time, "language is intimately related to the different epistemological frameworks of the disciplines and inseparable from how they understand the world" (Hyland, 2013, p. 59; cf. also Mauranen, Pérez-Llantada, & Swales, 2010, p. 645). Nevertheless, the notion of disciplinary culture does not necessarily entail uniformity or homogeneity. Like all concepts describing a group of people, it should allow for heterogeneity and individual identities (Prior, 2003). A case in point are the researchers who work within the sub-fields of more general disciplines. These sub-fields often have their own phraseology and methodological preferences. This, however, does not mean that the persons participating in a disciplinary sub-field all think and act in the same way. It is all the more interesting that in spite of participants coming from different sub-fields and career levels (and hence different 'times of exposure' within a given

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[1] These bibliometric numbers were surveyed using the OPAC catalogue of the university library, which allows queries for specific genres (such as dissertations) and language of publication (https://opac.lbs-braunschweig.gbv.de/DB=1/LNG=DU/).

[2] All the interview examples cited in the text are our translations of the German originals.

Table 1
Juxtaposed view of two interviewees' opinions on writing difficulty (emphasis added).

Physicist	Political scientist
There are of course certain **fixed phrases** that one uses all the time. […] Basically, you could see them as **text modules** where you only replace the content and, of course, the discussion. (#1)[a]	It is much, much harder to write a historical, theoretical article including **subtleties** and such, if you are not a native speaker. (#2)

[a] The number following the English interview excerpt (e.g. #1) is used to index the quotations. The German original interview excerpts can be found under the given number in the Supplementary online data.

disciplinary culture), there were still some observable tendencies that seem to hold true across the various sub-fields of a discipline; for instance, historians commonly perceived a greater need for a native English-speaking proofreader than the other researchers surveyed here. In the words of Becher, who employs a biological metaphor, "even between different institutions in the same system, the phenotypical variations can be substantial, but […] one can nonetheless clearly identify genotypical cultures in a particular setting" (Becher, 1994, p. 155). It therefore seems advisable to employ the notion of disciplinary culture with care so as not to generalise unduly. Nevertheless, the term is also a powerful concept for tying together commonly held notions of knowledge, language(s) and attitudes as well as writing and publication practices. In the next section, we will elaborate on the study design and the method used to investigate language and disciplinary demands.

3. Study and method

Studying academic writing and publishing by employing methods of genre or corpus analysis allows for a precise representation of the actual language being used in academic genres and these approaches are an indispensable way of contributing to a linguistic and functional description of special languages (Gnutzmann, 2009). However, the focus on published texts also implies a certain neglect of the wider context of academic writing and publishing, since many conventions of disciplinary cultures are unwritten and have to be reconstructed through other methods. In order to provide a more 'holistic' view of academic practices it would seem necessary to focus on the "activities surrounding the production and reception of texts and how participants actually understand what they are doing with them" (Hyland, 2012, p. 37). One way of shedding some light on these surroundings is to investigate how disciplinary cultures and academic writing are constructed and negotiated through social and discursive practices (Canagarajah, 2002a, p. 29), including the roles that different languages and language attitudes play in that construction. Since qualitative ethnographically-oriented data obtained through interviewing provide information on participants' practices and views, they seem to be the best way to investigate the issues described above. The methods that participants employ in order to be accepted as credible researchers can be reconstructed, as well as their attitudes towards language(s), science and society in general, which are usually mirrored in such constructions.

The dataset that is being explored here stems from an overarching research project, *Publish in English or Perish in German?* (PEPG), which aims at investigating the challenges, problem-solving strategies and attitudes of German researchers when using English for publication purposes. Drawing on a well-balanced interview corpus, the major aim of this project is to uncover the importance of English and German as research languages today and to provide access to researchers' views on these issues. The focus lies on researchers from four disciplines, i.e. biology, mechanical engineering, German linguistics and history. It is expected that attitudes and practices related to the academy differ greatly across disciplines and that they are connected to the participants' perceptions of what it means to be a researcher. In addition, it was deemed important to include researchers from different career levels, so as to incorporate a socialisation perspective. The current interview corpus thus consists of 24 interviews with researchers from four disciplines and three career levels. Of the six researchers from each discipline, 2 interviewees have roughly the same level of academic experience, i.e. they are either doctoral students, post-doctoral researchers or professors, respectively (cf. Table 2 below).

In order to be more representative of German universities in general and to cater for maximum anonymity, researchers were interviewed at several German universities. It was also required of participants to have published at least one article in English. The use of an interview guideline meant that interviews could be more easily compared with each other, while explicitly allowing deviation from the guideline assured that both, the interviewer as well as the interviewee, were always at liberty to pursue topics of relevance coming up during the interview. This way comparability was ensured as well as an adequate degree of openness. All interviews were conducted in German and audio-recorded; the mean length of interviews was approximately 48 min.[3]

After the full transcription of all interviews according to standard German orthography with some additional spoken language characteristics such as pauses and false starts, a combination of inductive coding and clustering was employed to structure and condense the interview data. In more general terms, the aim was to "allow research findings to emerge from the frequent, dominant or significant themes inherent in raw data" (Thomas, 2006, p. 238). In a first step, this involved listening to the interviews and reading the transcripts for utterances pertaining to issues of language and disciplinary demands. These were marked and labelled, i.e. they were coded. Then, all marked interview passages were extracted from the original interviews and arranged so as to group similar cases together as well as identifying differences (Kluge, 2000, p. 8; Witzel, 2000,

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[3] Prior informed consent was obtained for all interviews conducted.

Table 2
Number, disciplines and career levels in the interview corpus.

	PhD students	Postdoctoral staff	Professors	Interviews
Biology	2	2	2	6
Mechanical engineering	2	2	2	6
German linguistics	2	2	2	6
History	2	2	2	6
Total Interviews				**24**

p. 26). Since a basic assumption was that disciplinary cultures play an important role in the language demands posed on researchers (cf. the example of a physicist and a political scientist above), it was also determined whether certain language demands were more or less commonly found across disciplines. Finally, most occurrences were integrated into several major themes and, for reasons of readability, grouped together where possible. In order to make our argumentation and data more accessible to the reader, we have included transcriptions where necessary.

4. Findings and discussion

Four main themes related to the language demands made on researchers have emerged from the investigation, these will be discussed in turn. In the first part of this section, the focus lies on how the interviewees perceive the form and language of research articles in their disciplines.

4.1. Rigidity of genre and language

One question all researchers in the interview corpus were asked was whether there was a basic article structure they followed in their particular field. The six researchers in *biology* unanimously stated that they all adhere to variations on a basic IMRaD (i.e. Introduction, Methods, Results and Discussion) pattern, which they said was generally demanded by journals, with variation mostly referring to technicalities such as the use of footnotes or the resolution of figures and diagrams. In *mechanical engineering*, there was also a dominance of basic IMRaD variations (5 out of 6 interviewees), with three interviewees (E3, E5, E6) adding the proviso that the main part of a paper could be arranged relatively freely, depending on whether it was experimental as opposed to theoretical or applied in nature. In *German linguistics*, the sub-fields that researchers were active in played an important role concerning the rigidity of genre. 3 out of 6 interviewees (L2, L3, L4) said that 'classic' linguistics allowed more freedom in organizing one's article, whereas more experimental sub-fields such as psycholinguistics followed stricter IMRaD patterns. This suggests that these interviewees had some experience in both 'strands' of the disciplinary culture. 2 interviewees (L1, L6) stated that there was no strict pattern, but suggested a structure along the lines of theoretical background, analysis and implications for theory with a great deal of variation possible. These results reflect the position of linguistics between an empirically-experimental science and a more humanities-oriented discipline. 5 out of 6 interviewees in *history* reported that there was either no obligatory pattern or merely a rough structure, consisting of an introduction, a main part and a conclusion. The genre structure was reported as being very variable, depending on factors such as the publication language, the audience and personal preferences.

Lexical bundles and phrases commonly used in a discipline are not only of interest in corpus-linguistic research or language pedagogy, but also seem to be "a key way that particular disciplines produce community-specific meanings and contribute to a sense of distinctiveness and naturalness in a register" (Hyland, 2013, p. 64). Without being directly asked about this topic, 5 interviewees in biology (B1, B2, B3, B5, B6), 2 in engineering (E1, E3) and 1 in linguistics (L4) explicitly stated that the language used in their fields was very formulaic and rigid; there was no requirement to stray from the conventional format and style. A doctoral student in biology put it like this: "If I read a publication and I don't know whether the authors are German, Asian or American, I don't think I would be able to identify its source because, as regards style, they all write in the same way. Every paper reads almost the same – of course there are different values and figures, but the style is always very similar." (B5, #3) Many of the interviewees mentioned above argued that rigid language patterns contributed to a certain ease in writing and publishing in English.

As far as the rigidity of language is concerned, there seems to be a common practice, often referred to as "language re-use" (Flowerdew, 2007, p. 19). Practices of reusing language described by the interviewees ranged from the copying of complete phrases from existing papers and simply replacing data or values to systematically collecting phrases which can later serve as a 'language pool' when writing articles. Since language re-use seemed to be most prevalent in biology, some quotes from the biology corpus may help to illustrate this common practice:

- Once you've read enough papers, you know there is a fixed term and […] you simply adopt it, right? Or there is one sentence written there. This sentence must be there, because [the experiment] was conducted like this […]. So you just copy what's written there, and that's it. (B1, #4)
- I've got a collection of phrases, taken out of their context, that pop up in all papers, which help me out when I can't come up with something. (B3, #5)

- You become better and faster of course, because you have these sentence templates. Initially, for my first poster presentations I needed two weeks – now I write one in three days. (B5, #6)
- Especially for the introduction I use other publications to look for phrases. But also for figure captions, to check how others have done it. (B6, #7)

At the other end of the disciplinary range, there seems to be *history*, where researchers reported greater freedom to structure papers in a way they wanted (see above); however, this also means that they have less genre-structural 'guidance'. Moreover, nobody in history reported using ready-made phrases, which might make writing in a foreign language more strenuous for them.

We can thus hypothesise that a higher degree of rigidity of genre and language may be one contributing factor with regard to lower language demands made on multilingual scholars. From the data presented above, one could infer that the more rigid the structure of a research article is, the less freedom writers have to deviate from its prescribed form and the more formulaic is the language used in it. Further evidence supporting this reasoning is that the vocabulary used in the field of biology was perceived to be very limited: "I don't want to say you can make do with 100 words, but probably with 200." (B3, #8) The high degree of fixedness found in biology is probably due to a more experimental orientation (see Section 4.4. on data and methods) and the ensuing communication patterns which stipulate that experiments have to be described in a way that others can replicate them. This results in a structure that is "more highly standardised and less discursive, drawing on semiotic resources which are graphical, numerical and mathematical rather than simply textual" (Hyland, 2013, p. 64). One implication is that articles (or some of the parts of them) are much easier to write for non-native speakers of English in some fields than in others, since they can use and adopt most of the language needed from existing articles as, apparently, nobody in their field expects them to write 'creatively' or in a varied manner. The next section addresses the theme of writing modes prevalent in different disciplinary cultures and how they affect language demands made on researchers.

4.2. Different writing modes

All six interviewees in *biology* said that they were working within a hierarchy of teams composed of professorial and post-doctoral staff, doctoral students and technicians. Everybody in a given research team seemed to have a specialised function, and work was distributed according to their speciality and hierarchy position. Responsibilities are clearly distributed across career levels, with doctoral students doing most of the lab work and only little writing (cf. also Pérez-Llantada et al., 2010, p. 7), post-doctoral researchers doing most of the writing in addition to coordinating the experiments and providing feedback on the writing of doctoral students, and the professors often working from an "article that is 80% finished" (B3, #9), using their overview and knowledge of the field to further improve the 'strategic parts' of a paper, such as introduction and discussion. This is described in detail below by one postdoctoral researcher, but was echoed by all biology interviewees:

> Our institute is relatively large, with one professor directing it and then there are several scientific staff with long years of experience, who look after doctoral students or younger postdocs. This means they are the first contact if you, for instance, want to discuss the order of the results section. Once you have come up with something, you'll discuss it with them, then you write and they will correct it. Depending on how much time there is and how interested the professor is in the project, she will either get involved at this point or only work on the article towards the very end. (B6, #10)

In *mechanical engineering* there also seems to be a division of labour and writing, which is slightly different from the one found in biology. All six interviewees from engineering reported that they regularly write and work in teams, although usually smaller ones (not more than 2–3 authors) and the distribution of writing is not always as specific as in biology. One writing model described by four interviewees (E2, E3, E4, E5) was similar to the one in biology, with doctoral students contributing the data and some of the writing, and postdoctoral researchers and the very senior scholars doing most of the writing and coordinating. Another model described by two interviewees (E1, E6) involves two researchers working on an equal footing on different parts of a paper and then correcting and modifying each other's drafts in the process of writing. In the more 'classic' realms of *German linguistics* writing seems to be predominantly done alone and sometimes in small groups of two (L1, L5, L6), especially when a doctoral student is involved. But other writing modes can also be found, especially in the empirical 'branch' of German linguistics: each co-author contributes a separate field of expertise (L2), several authors distribute writing and content work hierarchically (L3) or divide an article into several parts which each co-author drafts on their own and then exchanges with the others (L4). Writing modes more typical of the humanities as well as those more likely to be found in the experimental sciences were thus identified. It comes as no surprise that four out of six interviewees in *history* (H1, H2, H4, H6) stated that they write alone for the most part. Exceptions are rare and in our corpus either refer to coordinating the content of articles in an edited volume before actually writing them or involve proofreading services once the manuscript is in an advanced state. The doctoral students (H3, H5) both reported that they get feedback on their drafts from their supervisors to improve their writing. In this respect, especially historians after the doctoral phase may not necessarily represent the type of "solitary researcher" (Becher, 1994, p. 158), but still seem to act as solitary writers. As regards the postdoctoral researchers in history, it would be interesting to see how they could benefit more from writing in cooperation with peers at their career level, a strategy that might help the 'lone writer' in a foreign language.

In some disciplinary cultures, especially biology and engineering, writing in larger teams seems to be the default writing mode. Since writing in these disciplines can be characterised as collaboration (Becher, 1994, p. 158; Pérez-Llantada et al., 2010,

p. 7), this may also eliminate some of the difficulties researchers from more individualistic or 'lone writer' disciplines such as history sometimes report when writing up research. What also became evident from the data is that being a *novice researcher* in the field of biology entails entirely different tasks and possibly lower demands on writing skills than writing in history does. This by no means implies that doctoral training for novice biologists is any less challenging, but they do not seem to perceive writing in English as a major problem, quite possibly due to the lower demands associated with drafting only a smaller part of a paper and having team resources at their disposal. Researchers in the natural sciences often state that the introduction, discussion or conclusion sections are the most difficult parts to write in an article (Moreno, Rey-Rocha, Burgess, López-Navarro, & Sachdev, 2012, p. 168; Pérez-Llantada et al., 2010, p. 7), but since the involvement in the data collection and writing process differs considerably depending on the respective career level, this should also be taken into consideration when evaluating the difficulty researchers perceive.

4.3. Language norms

One hypothesis we would like to put forward here is that the ratio of natives to non-natives may influence the language norms valid in a given discipline, which in return may reduce the language demands made on non-native English-speaking researchers. However, it is not so much the sheer number of non-native English writers that brings about this change in language norms, but rather a high number of non-native English discourse participants in 'privileged' positions, such as editors and reviewers (cf. Tardy, 2004, p. 250). In our corpus, this was most noticeably the case for the *mechanical engineers*: As a first piece of supporting evidence, 4 out of 6 mechanical engineers (E1, E2, E4, E6) explicitly stated that there is, internationally, a majority of non-native English academics, as well as editors and reviewers, in their field. To take one interviewee's utterance, "[t]here aren't that many English native speakers in the field. That's why the reviewers are often Germans or other Europeans." (E1, #11) An interesting practice found in two engineering interviews, which could be considered a 'renegotiation of correctness norms' also seems to be connected to this dominance of non-native English-speaking scholars in the field. 2 professors (E2, E3) stated that they spend less time on 'improving' their English-language manuscripts because of their being non-native: "Sometimes you say: 'Ok, just leave it be. I'm not going to rework this sentence three times, I am German after all. If it isn't 100% perfect, so be it. They know, when they look at my address, where I'm from. They can't really expect a 100% correct text'." (E3, #12) A further example supporting the idea that a dominance of non-native English editors and reviewers may affect correctness norms was stated by another engineer, who, although he acknowledged that IEEE (Institute of Electrical and Electronics Engineers) guidelines are the *de facto* standard in the field, deviates from some of the prescribed norms:

> It says there 'write short sentences', 'do not use the passive', but the tradition is to write 'here are to be found', to write as much as possible in the passive. So if one sticks to these guidelines and recommendations, you look like you don't know English – because all the others – because most people at conferences are not Americans – they are Germans, too, or Indians or others, so this has become quite common. (E4, #13)

Considering the sum of these pieces of evidence, it seems that English has been appropriated to some extent by our group of mechanical engineers. One possible explanation for this could be that the dominance of non-native English-speaking editors and reviewers in the field has allowed for more leeway in terms of language correctness and writing style, leading one interviewee to conclude after being asked about her attitude towards English: "English is simply our language. We use it in science and that's OK." (E2, #14)

In our *history* corpus, this situation is effectively reversed. There seems to be a dominance of native-speaking editors and reviewers of English in the discourses these historians were aiming for, leading to quite different language and writing demands. This had a lot to do with the topics the interviewees were dealing with, often relating to American, British, migration or colonial history. Hence, most of our interviewees in history felt compelled to publish in *Inner Circle* (Kachru, 1985) contexts. Three of them (H1, H4, H6) reported that there were only few or no German journals or conferences addressing their topic, so they felt they had to publish internationally to be recognised: "Because otherwise I wouldn't get noticed in the research domain I want to be noticed in" (H4, #15). According to the interviewees, this publishing behaviour is not representative of the subject of history as a whole but mainly limited to the branch of 'international history'. Several of the interviewees (H1, H3, H4, H5) felt that sticking to national borders in historical research was not an option for them and that "the borders of nation states do not necessarily define events, but everything could be connected to other things lying beyond these borders" (H3, #16). So while they could not always find an academic forum for their research in Germany, they also had to meet high language demands when publishing internationally. One indication of a strong orientation towards native-speaker norms is that 4 out of 6 historians (H2, H4, H5, H6) explicitly said that they needed a native English-speaking language editor in order to publish in English, e.g. "I should add that it is not possible for me […] to prepare a manuscript on my own that is actually ready for submission. I always have it proofread by a native-speaker." (H4, #17) While language competence is certainly a relevant issue here, the fact that three out of four of these interviewees had had longer stays abroad strongly suggests that it could also have to do with other factors such as a low amount of formulaic language in history articles or a lack of writing cooperation.

In *biology*, putting too much emphasis on language correctness was perceived as standing in the way of scientific work (cf. Airey, 2012 on similar attitudes of Swedish physics lecturers), as one interviewee, who also is a journal editor, reports: "It's become more and more a standard procedure to wave through articles […] where one says, all right, the English is not perfect,

but […] if the scientific results are fascinating and interesting and good, one doesn't want to be so arrogant as to say 'learn English first and come back later'." (B2, #18) However, it should not be concluded from this that there are no rhetorical rules in biology discourses, since the absence of discursive elements commonly found in other disciplines is in itself part of the positivistic rhetoric in this disciplinary culture (cf. Hyland, 2013, p. 62). While there seems to be agreement among our interviewees (see section 4.1 above) that the language of the field is very restricted and limited in vocabulary size, a factor that may make publishing for non-native speakers of English easier, there also seems to be a paradoxically strong orientation to native English-speaking countries, or more precisely, *Inner Circle* countries. Three interviewees (B2, B5, B6) mentioned the significance of postdoctoral studies in one of these countries (preferably the US) for a career, which can be taken as an indicator of how disciplinary requirements (i.e. learning from and with the best) are linked to language-related issues: "Because the US is just, well, the people there are ambitious and when they have a good idea they try to put it into practice. […] And I think that is the most important thing you can learn and at the same time of course the language part, too." (B2, #19) So although the US seems to figure as a role model for these biologists, this does not imply they adhere to native English-speaking standards in biology writing, which could in return mean that the interviewees' conception of language correctness may well be accepted if not shared by *Inner Circle* biologists.

In *German linguistics*, there seems to be a less dominant position of English native speakers in the field than in history, at least with regard to the more empirically oriented sub-fields: "We linguists are rather modest people when it comes to language matters. […] And the style or rhetoric in which results are published is not of major interest in linguistics. We are mostly an empirical-analytical science – there is a problem and one wants to analyse it and our colleagues do it the same way." (L4, #20) This viewpoint seems to collide with interviewees' opinions stating that the linguistic superiority of native-speakers is widely accepted,[4] but it is not necessarily seen as problematic when an article may not be "the rhetorical highlight it would be if a famous English linguist had written it, but I think it fulfils all the relevant standards reasonably well" (L4, #21). Although the interviewees clearly saw native speakers of English as being advantaged, they also said that for their publishing needs it would suffice to hand in "grammatically correct and stylistically acceptable, but not brilliant" (L1, #22) papers, thereby stressing that subject-specific demands take priority over native-like standards. However, to some extent at least, they still rely on native speakers to correct their manuscripts. Two of six interviewees use only native speakers of English for proofreading papers (L1, L3), two ask natives or non-natives depending on the importance of the article (L2, L4) and only two German linguists rely on non-native feedback only (L5, L6).

To sum up, in biology there seems to be a strong orientation towards *Inner Circle* countries for career advancement; nevertheless, there was a distinct culture of highlighting content over form. In German linguistics, a majority of participants in the field are non-native speakers of English, but there is still some dependence on native English-speaking corrections. An opposing trend can be reported from mechanical engineering where there is a dominance of non-native English-speaking researchers and, as a consequence, language norms seem to be more negotiable than in the other disciplines studied here. In history, interviewees are effectively participating in a discourse dominated by native-speakers of English and thus have to fulfil native-speaking standards when publishing in English. Mauranen's (2012, p. 10) optimistic outlook that "[e]diting, traditionally performed by native speakers, is losing its hold on academic publication" seems to be true for mechanical engineering but fields such as history still seem to be less independent from native-speaker editing and language norms. We will now turn to how data used in the disciplinary cultures may influence the language demands researchers have to meet for publication in English.

4.4. Nature of data under study

An influential factor in determining the language demands in a given disciplinary culture is the nature of the data under study. There seems to be a cline between data that can 'speak for themselves', such as visualisations of experimental data, and data that need to be carefully interpreted and argued by means of writing. Interviewees in *biology* often perceived language as "a subordinated activity, following the 'real' work" (Lehnen, 2009, p. 281, our translation), referring to data collection and analysis. This can be observed when biologists describe their writing procedure and the importance that writing takes in it. A view not uncommon in the natural sciences seems to be that writing is mainly about "facts, facts, and facts" (B1, #23) or "facts strung together" (B4, #24), i.e. that writing is merely the textualisation of objective, language-independent results.[5] The experimental data used by the biologists under study may have a large role to play in this perception and it needs to be pointed out that this seems to be less pronounced in other subfields of biology, where, lacking an experimental orientation, no adherence to the IMRaD structure was observed (Samraj & Swales, 2000, p. 42). The researchers in our corpus though usually conduct experiments in the laboratory and in the process of the analysis create tables, chromatograms etc. and later contextualise these data with running text. This is also reflected in the interviewees' utterances. All six biology interviewees stated that their writing and publication process usually starts with planning and conducting experiments. This does not

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[4] Some of the purported advantages the linguists saw for native English speakers: *grammatical intuition, idiomaticity* (L3); *only the scientific counts because the language is mastered* (L5); *brilliant phrasing, language play* (L2); *better text coherence and use of connectives* (L1).

[5] However, this stance also forms part of experimental biologists' disciplinary culture and their professional identity, partially established by distinguishing themselves from other disciplinary cultures: we should also mention the two interviewees (B1, B3) who described the typical writing style in their discipline as sober and functional and claimed that it had nothing to do with the "prose" or "flowery" style found in other disciplines.

mean that the writing process is necessarily seen as linear, since researchers said that they often have to repeat experiments or rewrite parts, but still experimental data are central to the writing process:

- We basically write around figures and diagrams. […] This is to say we have a table or image we made, or some chromatograms or something like that. […] And around these we have to write fill-in text, explaining what it is and how it can be interpreted and so on. But the figures and diagrams are basically the most important part of the article. (B1, #25)
- Then [after the experiments and the creation of images] I wrote the results section around them and then the introduction. (B6, #26)

In *mechanical engineering* we can find some similarities concerning the relation of data and language demands, such as a strong orientation to experimental data, but also to mathematical models. As in biology, writing in this disciplinary culture is also commonly seen as starting after some form of empirical result has been created (E1, E3, E4, E5): "When all the results are there, that is all the graphs and equations that are to be included, then all you have to do is, as it were, write the text around them. And then there is not much that can go wrong anymore." (E3, #27)

As has been pointed out before, the shape of *German linguistics* as a disciplinary culture seems to be somewhat 'split' between more experimental and more text-based data. While some of the interviewees reported that they worked with strictly experimental methods (e.g. L2, L3, L4), others used more 'traditional' methods of language analysis. Two interviewees (L1, L2) stressed that they can also make use of their knowledge of German and German language data when publishing in English and that this helped them to contribute to the international discourse. Although the more experimentally-oriented linguists published almost everything in English, there was still some importance attached to German as a language of science: 3 interviewees (L4, L2, L6) mentioned that positions at university are usually located within German departments and that the publishing of a few German-language articles would go a long way in showing that one takes German as a language of science seriously by demonstrating the "ability to explain scientific issues in German" (L4, #28). This goes to show that institutional requirements can have an influence on publishing behaviour and can either work toward or against maintaining scientific language competences in languages other than English (cf. Petersen & Shaw, 2002, p. 372). While this topic is not of central importance in this article, further investigation of how maintaining academic bi-literacy affects language demands made on researchers may be merited.

Historians seem to mainly rely on language-as-data, which is reflected in their predominant use of primary sources. One interviewee succinctly describes the difficulty this entails for publishing in English as a non-native speaker:

> History is based on language mostly and that's why the mastery of language is essential to convey one's thoughts and arguments. There are barely any numbers, statistics or such – you aren't basically using another language anyway and you just comment on the data, but it's really, well, mainly language. And if you, as a non-native speaker, do not have a full command of it, you are always disadvantaged. (H1, #29)

Similar perceived disadvantages were commonly shared by most interviewees in history, as the regular employment of native proofreaders mentioned above underlines. However, four of the six historians (H1, H4, H5, H6) also reported using German-language sources to feed into the 'international' discourse by incorporating primary sources not accessible to non-German-speaking researchers. This, however, implies the need for translation skills in order to make these sources available and suggests, all in all, relatively high language demands for historians publishing in English.

In conclusion, it can be said that the form of data employed also helps to shape the language demands made on researchers, with, it would appear, biology and engineering mainly relying on experimental data. This, on the other hand, may contribute to a disciplinary attitude where content takes primacy over form, which may in turn result in lower language demands made on these researchers. Contrary to these views, writing in history is perceived as central to knowledge creation and, here, language seems to serve as an instrument of cognition as well as an object of inquiry. Linguists' working practices seem to vary more widely than in the other disciplinary cultures, with elements of more experimental as well as more language-based methods.

5. Conclusion

The article set out to investigate how disciplinary cultures relate to language demands made on German researchers when publishing in English. We tried to show how the notion of disciplinary culture, including typical scientific methods and data, shared attitudes and institutional characteristics, interacts with the language demands made on individual scholars. In a number of interviews it was found that what could be considered sufficient language competence for research publishing in English varies across, but also, depending on researchers' career levels, within the four disciplines studied, suggesting that increasing anglicisation in the academy has varying effects on researchers from different disciplinary cultures.

Since the interview corpus is relatively small, the findings cannot always be generalized for each discipline. This has already become clear for biology and history, where the interviewees represent a disciplinary culture, but are not necessarily representative of all the 'branches' of a more encompassing discipline. In order to gather more comprehensive data, the interview corpus included researchers from a number of German universities and was, in some aspects, more wide-reaching than is usually the case, e.g. doctoral students seem to be less often included in such studies (Pérez-Llantada et al., 2010, p. 3;

Moreno et al., 2012, p. 162). There are, however, good reasons for including novices in research pertaining to academic writing and publication, since more and more doctoral students also need to publish as a graduation requirement (Hyland, 2012, p. 38) and because these doctoral students are also often members of writing teams. The main findings can be summarised as follows:

- *Historians* in the interview corpus had to cope with the highest language demands. There is a strong dependence on help from native speakers as language editors. They work bilingually and also benefit from this work format, but in return need to meet higher language expectations in writing, because they work with language-encoded data only, i.e. historical sources, and mainly take part in US/UK discourses. They do not cooperate much when writing, and cannot benefit from rigid genre or language patterns.
- Our *biologists* operate within very rigid genre and language patterns and seem to do quite well without much help from native speakers. Hierarchical writing cooperation and distribution is the default writing mode. There also seems to be a relatively strong orientation towards *Inner Circle* countries when it comes to training and career, but apparently less so for language norms.
- The *mechanical engineers* surveyed may benefit from a majority of non-native English-speaking reviewers and editors in the field, which in return seems to affect valid language norms. The rigidity of genre and language seems to be relatively high owing to experimental and mathematical data being used. Cooperation in writing seems to be prevalent here, too.
- *German linguists* seem to form a more varied disciplinary culture, which is probably due to the hybridity of the field. Depending on the sub-field, they employ different writing and cooperation modes, sometimes united in the same person. While some interviewees could benefit from their German native-language skills in contributing to the discourse, they also had to publish in both German and English.

Although this study focuses on German researchers publishing in English, the findings may well have a bearing on other non-native English-speaking academic contexts. Disciplinary practice, especially when focussing on international discourses, creates a commonly shared space with some similarities and overlaps in the lives of academics in other countries. Some factors may vary from country to country, such as 'non-discursive' (Canagarajah, 1996) or institutional requirements (as stated by some German linguists in section 4.4 above), but it also seems likely that engineers in other European countries share some elements of this disciplinary culture, simply because they all engage in the same discourses. It would therefore be interesting to find out more about the extent to which disciplinary cultures vary in other countries and how this affects writing practices.

Although, quite clearly, individual differences in language and writing competence do play an important role in publishing in English, these are not the focus of the paper. Our aim was to find out how immersion in a disciplinary culture entails either higher or lower language demands made on researchers. So while language competence remains an important factor, it should also be considered that what emerged from the interviews suggests that some researchers require a considerably higher language competence in order to publish in English than others. We would also like to emphasise that the native/non-native distinction remains a useful heuristic in the investigation of researchers. The burden of being non-native, though, seems to weigh somewhat heavier on researchers from disciplinary cultures with language-as-data and more native speakers of English participating in the discourse rather than on researchers from disciplines with experimental or statistical data and a larger number of non-native English-speaking researchers in gate-keeping positions.

The language norms described by engineering interviewees seem to indicate that they are moving towards something similar to non-native English language norms, owing to factors such as a strong non-native presence in the field and the perception that writing is primarily about sharing data. Re-negotiating existing language norms in international discourses, by giving non-native participants a say in what the discourse norms should be like (Mauranen, 2012, p. 10), could be a very first step towards truly global scientific discourses. This would also go far beyond Ammon's (2000, p. 111) demand for more openness towards "linguistic peculiarities" of non-native English-speaking researchers. Ultimately, however, it is up to the agents in the disciplinary cultures, especially editors and reviewers, to decide what standards they would like to see imposed in their field.

With regard to the teaching of academic writing, the concept of disciplinary culture should receive greater attention, a fact borne out by the reported prevalence of formulaic language as well as the reduced responsibility for articles by novices in the field of biology. Lastly, this also implies that attitudes towards English or other languages of science have to be seen through the perspective of the various disciplinary cultures in order to better understand the dynamics of research publication.

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Appendix A. Supplementary data

Supplementary data related to this article can be found online at http://dx.doi.org/10.1016/j.jeap.2013.10.003

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