Boundary Practices of Digital Humanities Collaborations

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One of the defining characteristics of digital humanities is its emphasis on interdisciplinary collaboration. In order to coordinate across disciplinary boundaries, the development of common ground is necessary to negotiate goals and practices. Yet how such common ground can be established, and whether the adoption of interdisciplinary practices and vocabularies results in participants drifting apart from their disciplinary cultures is underexplored. In this paper I investigate the boundary practices of digital humanities, referring to the interactions of scholars with cross-disciplinary collaborators and disciplinary peers, and how these are affected by disciplinary diversity and physical distance within collaborations. With an online questionnaire, which received 173 responses, I have found that there is often little disciplinary diversity in digital humanities collaborations, with participants and leadership coming mostly from the humanities. The physical distance is often great, and communication increasingly relies on email. I have not found that these dimensions affect the respondents' frequency of communication with collaborators or peers. My conclusion is that physical distance and disciplinary diversity cannot be confirmed to affect the frequency of boundary interactions of digital humanities. I furthermore conclude that digital humanities collaborations are biased towards the humanities rather than a balancing of the digital and the humanities. This paper thus provides an empirical grounding for discussions of digital humanities as a meeting place between the computational domains and the humanities.

Keywords: collaboration, common ground, communities of practice, survey, boundary practices, interdisciplinarity

1 Introduction

One of the defining characteristics of digital humanities is the emphasis on inter-disciplinary collaboration (Klein, 2014, Spiro, 2012). The different facets of digital humanities research, such as computer technology, data management and humanistic

inquiry, call for collaborations among experts from different backgrounds. While it is possible for individuals to develop interdisciplinary expertise, collaborations between disciplinary experts may be more effective at providing access to the full range of expertise and practices of disciplines (Siemens et al., 2011a, Stokols, 2006, Wilson, 1996). As a result, it has been argued that diversity of backgrounds in collaborations is a prerequisite for the generation of new knowledge in the digital humanities (Edmond, 2016). Yet how collaborations are conducted in the digital humanities is regularly hidden from view and therefore poorly understood (Griffin and Hayler, 2018).

It is most commonly assumed that digital humanities collaborations consist of a digital and a humanities side, a collaboration between computational experts and humanities scholars (Edmond, 2005). Digital humanities then is a 'meeting place' of these two sides (Svensson, 2011). McCarty (2012) has argued that this meeting should constitute a 'level ground' of mutual collaboration, truly working together rather than computational experts working in the service of humanities scholars. In order to achieve this, it has been argued that collaborators should develop a common ground of shared practices and vocabularies to coordinate goals and practices within the collaboration (Siemens, 2009, Siemens et al., 2012). As a result, scholars may learn to translate their humanistic research questions into computational terms (McCarty, 2012). To illustrate, through their continued interactions with computational experts, historians might start to think of their research as testing hypotheses against a historical dataset with the use of algorithms. This will make it easier for those historians to discuss their research with computational experts, but might make it more difficult to discuss it with other historians who are not part of a digital humanities collaboration.

Yet how such common ground can be established between different disciplinary discourses, and whether this leads to a drifting apart from one's original disciplinary background remain open questions. Therefore, it is necessary to study the practices and consequences of collaborations that develop common ground to better understand the digital humanities as a collaborative practice both in itself and within the humanities at large.

A common approach to this question, on a *micro* scale, is to interview or observe practices of collaboration as they are performed and experienced by individuals or small groups. Yet whether these individual cases are typical or atypical of the digital humanities more generally requires contextualisation on the *meso* scale, by quantitatively collecting dimensions of collaborations in a multitude of groups or institutions (for a discussion of the micro and meso scales, see Edwards, 2002). Focusing on the meso scale, this paper is thus concerned with a quantitative exploration of the composition of collaborations and the question of how participants interact with cross-disciplinary collaborators and disciplinary peers. This exploration is based on the findings of the online questionnaire described in Section 2.

This paper builds upon the theory of *communities of practice*, defined as the binding together of individuals through a sharing of practices, as experienced in mutual engagement, a joint enterprise and a shared repertoire of resources (Wenger, 1998, p. 73). In this paper I focus on mutual engagement, the meeting between collaborators, as configured through two underlying dimensions that I will elaborate below: the shared history of learning and the geography of practice (Wenger, 1998). Using these two dimensions I explore how they lead to different boundary practices between communities of practice, i.e. the interactions between members of different communities. For the purposes of this paper, the relevant communities are the humanities, the computational domains, and collaborations as communities consisting of participants

from both the humanistic and computational communities.

The next section elaborates on the two above-mentioned dimensions, followed by a presentation of the questionnaire and a discussion of the results. The paper concludes with lessons learned from the questionnaire and an exploration of research questions that will further our understanding of how digital humanities collaborations work in practice.

1.1 Dimensions of communities of practice

The establishment of communities of practice can be described as contingent on two underlying dimensions: the shared history of learning and the geography of practice.

The first dimension, *shared history of learning*, refers to the joint adoption of practices and vocabularies through participation and reification of meanings. As a shared history of learning how to conduct humanities scholarship, and reification through educating students to be future scholars, the humanities can be thought of as a community of practice. The same can be said about the computational domains. These communities of practice demarcate what type of problems are of interest, what types of approaches are suitable and how research should be communicated, thereby defining the boundaries of disciplinary communities (Becher and Trowler, 2001, Gieryn, 1983). The collaboration between the computational domains and the humanities can therefore be seen as a meeting of different histories of learning. The meeting of shared histories of learning is therefore considered to be the *disciplinary diversity* of a collaboration and is measured by the extent to which collaborations consist of both humanities scholars and computational experts.

The development of common ground can be described as the creation of a new shared history of learning. Over time, a common ground might develop into a shared history of learning of a new community of practice that is the union of the digital and the humanities. In this context, several authors have suggested that the digital humanities can indeed be thought of as a community of practice (Siemens and Burr, 2013, Siemens, 2016).

The second dimension, *geography of practice*, refers to the physical locations of collaborators and how that configures interactions. The geography of practice stands in a bidirectional relationship with the first dimension, as it influences the likelihood of shaping a shared history of learning. The most significant aspect is the *physical distance* between collaborators. First, distance affects communication. When collaborators are closer together, communication has higher quality, is more frequent and more often face-to-face (Kiesler and Cummings, 2002, Kraut and Egido, 1988). Second, distance affects the mutual awareness of collaborators, following the 'out of sight, out of mind' adage (Olson et al., 2002). Finally, distance affects the formation of group identity, leading to collaborators speaking in terms of 'us' and 'them' (Armstrong and Cole, 2002). While disciplinary diversity by itself necessitates coordination to align collaborators, these disciplinary differences, unlike physical distance, have not been found to increase *problems* of coordination (Cummings and Kiesler, 2005, Walsh and Maloney, 2007). Problems of coordination have been found with respect to differences in language and cultural habits, access to technology and conflicting requirements from funders (Siemens and Burr, 2013).

This is not to say that physical distance is only a negative aspect, nor does physical proximity guarantee a better collaboration. Extending physical distance in a collaboration means that one can work with the most fitting collaborators rather than being dependent on who is available nearby (Siemens and Burr, 2013). Previous research

found that for collaborations within a university, an increase in the number of collaborators correlated with an increase in negative collaborative experiences. Yet this correlation was not found for collaborations between universities (Tsai et al., 2016). Moreover, physical distance in collaborations can be a strategy for the dissemination of knowledge beyond one's own local network (Poole, 2013). Furthermore, 'virtual teams' that collaborate mainly through communication technologies such as email or teleconferencing have proven successful, although the formation of mutual trust remains an issue (Purvanova, 2014). Face-to-face communication was found to be more strongly related to team performance than virtual communication (Marlow et al., 2018). Yet Marlow et al. point to the advantage of what they call 'hybrid teams', where complex problems are coordinated face-to-face, while clearer tasks may be coordinated via communication technologies such as email. Establishing trust and addressing ill-defined problems, which are common in the digital humanities, therefore benefit from face-to-face meetings throughout a collaboration (Siemens and Burr, 2013).

Physical distance is thus strongly interrelated with communication, a necessary aspect of negotiating common ground. This brings me to the next aspect of my study.

1.2 Boundary practices

As a meeting place of different disciplinary communities, digital humanities collaborations can be characterised as *boundary practices*. Within a collaboration, the development of common ground requires participants to look beyond their own disciplinary identity and engage with collaborators from different backgrounds (Siemens et al., 2011b). Participants must be willing to learn about the practices and vocabularies employed by collaborators and integrate them into their own practices for mutual coordination. As such, interdisciplinary collaborations can be described as practices of crossing one's own disciplinary boundaries. Collaborations therefore potentially constitute what I term *interdisciplinary boundary crossing*.

The question remains how this (re-)configures the relationship with a participant's disciplinary community. It has been argued that participants drift away from their disciplinary culture and into a new shared history of learning following the adoption of new vocabularies and practices (Wenger, 1998, p. 103). If scholars wish to discuss their research with disciplinary peers who are not part of the collaboration, they now find themselves confronted with a boundary of different practices and vocabularies that they did not experience before. As such, collaborations potentially constitute what I term *intradisciplinary boundary construction*. For a simplified overview of the boundary practices between the communities of practice, see Figure 1.

The interactions between the communities of practice that form part of a digital humanities collaboration can therefore be characterised as a duality of interdisciplinary boundary crossing and intradisciplinary boundary construction. In the rest of the paper, these practices are referred to simply as boundary crossing and boundary construction. This paper explores the boundary practices, disciplinary diversity and physical distance of digital humanities collaborations. Specifically, the research question is as follows: *How do disciplinary diversity and physical distance affect boundary practices of digital humanities collaborations?*

As increased disciplinary diversity is expected to lead to more opportunities for cross-disciplinary interactions within a collaboration, the hypothesis underlying disciplinary diversity is that little disciplinary diversity, e.g. a collaboration consisting only of historians, will result in less boundary crossing and less boundary construction. In contrast, large disciplinary diversity, i.e. a collaboration consisting of an equal number
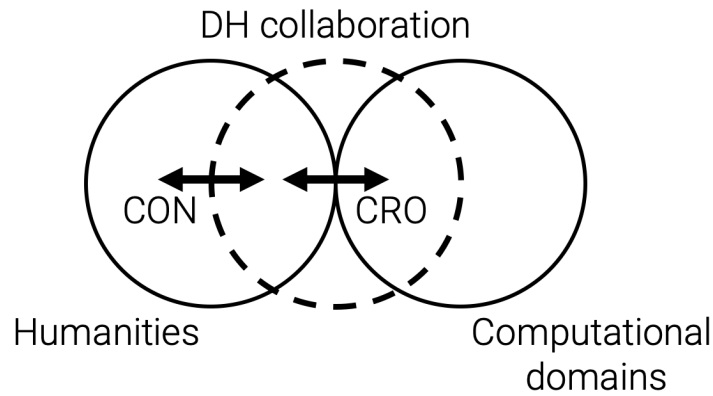
Figure 1: Model of a digital humanities collaboration, including intradisciplinary boundary construction (CON) and interdisciplinary boundary crossing (CRO).

of humanities scholars and computational experts, will result in increased boundary crossing as well as increased boundary construction. Furthermore, increased physical distance is expected to make interactions and coordination between cross-disciplinary collaborators more difficult. In cases of a large physical distance between cross-disciplinary collaborators, it is moreover to be expected that participants will have a small physical distance to their disciplinary peers, since in these cases participants are likely to be situated in their disciplinary departments or institutes. Similarly, a small physical distance to collaborators might mean a large physical distance to disciplinary peers. The hypothesis underlying physical distance is therefore that a small physical distance, e.g. humanities scholars sharing an office with computational experts, facilitates boundary crossing and boundary construction. In contrast, a large physical distance is expected to reduce both boundary crossing and boundary construction.

In order to test these hypotheses, it is necessary to acquire systematic and comparable figures related to these dimensions of digital humanities collaborations. In the next section I therefore introduce an online questionnaire on collaborative practices in the digital humanities.

2 Method

2.1 Online questionnaire

The questionnaire was distributed between November 2017 and April 2018 via social media and email. The distribution on social media included tweets with hashtags of conferences that took place during the period that the questionnaire was open for input. The questionnaire was furthermore distributed through blog posts and mailing lists. Finally, it was emailed to 128 collaborations based on their affiliation to CenterNet[1] or my awareness of them. Invitations for participation were written in English, Dutch, French, German, Spanish, Portuguese and Italian; the questionnaire itself was in English.

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[1] CenterNet is an international network of digital humanities centres (Walter, 2012). I scraped the CenterNet list on 20 November 2017. For a version of the list archived in November 2017 see `https://web.archive.org/web/20171029201211/http://dhcenternet.org/centers`

The questionnaire was hosted on a Qualtrics account of the University of Luxembourg. Respondents were not asked for personally identifiable information in order to preserve anonymity, although the questionnaire did include a question about the name or title of the collaboration for which the participant was filling out the questionnaire. The main reason this question was included is that many scholars active in digital humanities do not participate in just one collaboration. In trial runs I noticed that participants became confused about which collaboration they were describing in the questionnaire. For example, one participant that worked at a digital humanities centre on a project switched back and forth between answers related to the centre and answers related to the project. By asking participants to give the name of the collaboration, be it the centre or the project, this name was included in questions so that they were reminded throughout the questionnaire on which collaboration they were providing information. The name of the collaboration was not used for further analysis.

It is therefore possible that several respondents described the same collaboration. Some statistics that are related to collaborations specifically, such a physical distance and disciplinary diversity, may therefore contain duplicates. However, the inclusion of duplicates need not imply that results are skewed. Furthermore, the boundary practices reported by respondents are individual. It is possible that within the same collaborations, different participants experienced different boundary practices. Insofar as this paper aims to investigate whether specific organisations of collaborations lead to specific boundary practices, the inclusion of duplicates therefore does not cause problems for analysis.

The questionnaire did not provide a definition of digital humanities or digital history, since both terms are contested in the literature (see e.g. Antonijević, 2015, Robertson, 2016, Terras et al., 2013). Likewise, it is not easy to define what constitutes a collaboration or who is part of a collaboration (Katz and Martin, 1997). Whether a certain interaction is considered a collaboration varies between disciplines and institutes (Burroughs, 2017). For example, CenterNet lists all affiliates as 'centres', yet contains a variety of terms such as 'lab', 'centre', 'initiative', 'team', 'department', 'institute' and 'group', without a clear delineation between any of these concepts. Rather than defining types of collaborations, collaborations are defined to exist in mutual recognition as collaborators (Wenger, 1998, p. 56). The questionnaire therefore did not provide a definition of the types of collaboration, nor who should be thought of as collaborators. The questionnaire was thereby designed as a bottom-up approach to investigate the boundary practices of collaborations, rather than a top-down approach of defining types of collaborations and describing the boundary practices for each.

2.2 Main units of analysis

The questionnaire can be consulted in Appendix A. For a structured overview of variables central to the discussion of the research question, see Table 1. For all variables, respondents could choose a single answer. The range of options and outcomes are described in the next section. In this section I describe how these variables relate to the model of digital humanities collaborations as shown in Figure 1.

As described above, *physical distance* concerns the distance between collaborators within the collaboration. In Figure 1, this refers to anyone falling within the 'DH collaboration' circle. *Disciplinary diversity* refers to the number of participants from the 'Humanities" circle and participants from the 'Computational domains' circle that fall within the 'DH collaboration' circle.

Table 1: Main variables for discussing the research question. The numbers in the column 'Question' refer to the numbered questions in Appendix A.

Variable	Question	Type	Response rate (# / %)
Physical distance	9	Ordinal	168 / 97
Disciplinary diversity	5	Ordinal (Likert)	173 / 100
Intradisciplinary interactions	13	Ordinal	170 / 98
Cross-disciplinary interactions	12	Ordinal	168 / 97
Main means of communication	11	Categorical	170 / 98

With respect to boundary practices, *intradisciplinary interactions* is represented by the arrow marked 'CON' in Figure 1, to measure the interactions between participants of the collaboration and their disciplinary peers outside the collaboration. *Cross-disciplinary interactions* is represented by the arrow marked 'CRO' to measure the interactions within the collaboration circle between participants of different disciplinary circles. Finally, *main means of communication* refers to the means of communication between collaborators within the 'DH collaboration' circle.

None of the variables were interval, as shown in Table 1, or normally distributed, see Appendix B. Therefore, for all statistical tests non-parametric tests will be used.

3 Results

The questionnaire received 173 responses.[2] The replies were analysed using SPSS. Since none of the questions were mandatory, some questions received fewer than 173 replies. As this constitutes a relatively small sample size, the analysis below reports both the frequencies of answers as well as percentages. Statistical tests are considered significant when $p<0.05$, following common practices of statistical analysis, and are reported in footnotes accompanying interpretations of results.

The questionnaire collected responses from all continents except Africa. Whether this reflects a lack of African digital humanities collaborations or simply a lack of responses is unclear. To geographically contextualise responses, the questionnaire inquired where collaborators were located, allowing multiple answers. 121 collaborations (70%) included European partners. European countries with over ten responses were France (22), Germany (24), Italy (19), Luxembourg (15), the Netherlands (28), Switzerland (10) and the UK (27). 47 collaborations included North American partners (27%), including Canada (14) and the USA (40). Finally, 32 collaborations included partners from the rest of the world (18%), with no country reporting more than eight responses.

To further contextualise the type of collaborations, the questionnaire included questions about the time-frame (single choice) and the source of funding (multiple choices). With respect to the time-frame, respondents could choose between short-term (deadline within four years), semi-long term (longer than four years or without a concrete deadline) or long-term (no deadline). Although four years is already relatively long, especially for computational projects, this captures projects tied to PhD positions and most fixed-term contracts. The majority of collaborations were short-term, see Table 2. With respect to funding, there was a fairly equal split between university funding and

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Table 2: Descriptive aspects of collaborations, reporting both raw frequencies of answers (#) and the percentage related to all 173 responses (%).

Time-frame	#	%	Funding	#	%	Reason	#	%	Success	#	%
Short-term	95	55	University	77	45	Topic	45	26	Yes	89	52
Semi-long	33	19	National	84	49	PI	33	19	No	5	3
Long-term	44	25	European	23	13	Professional	19	11	Too early	31	18
			Government	22	13	Collaboration	14	8	Partially	12	7
			Infrastructure	9	5	Methods	13	8	Can't say	4	2
			Other	43	25	Novelty	6	3			
						Other	10	6			

funding from a national funding agency.

The questionnaire furthermore inquired about the contractual responsibilities of collaborators, where respondents could choose multiple answers. For the majority of collaborations, participants worked on multiple research projects (129; 75%). Only 17 respondents (10%) indicated that participants were contractually tied to one collaboration only.

Finally, the questionnaire included open-ended questions about the respondents' individual reason(s) to join the collaboration, and whether they considered the collaboration a success. Both questions were manually coded for analysis by grouping similar answers under a single category. The most frequently cited reason for joining a collaboration was interest in its topic, see Table 2. Two other types of responses are particularly interesting. The second most common response was that the respondent was the PI or founder of a collaboration. This is hardly an explanation for why a respondent chose to participate in a collaboration but suggests that there is a different incentive between PIs and others who join the collaboration later on. It appears that PIs do not join a collaboration but establish it, and consequently have no other reasons for joining. Another interesting response is that several respondents indicated that they joined as part of their professional responsibilities, either because the collaboration was tied to a position they had applied for, demands of available funding, or was part of their job duties. This suggests that participation in digital humanities collaborations may in some cases follow top-down decisions rather than intrinsic interests.

With respect to the success of a collaboration, the majority of respondents considered their collaboration a success, see Table 2. Only five respondents answered negatively. I cannot assume or conclude that this is representative of the success of digital humanities collaborations in general. It could be a result of self-selection bias for the question, as several respondents did not answer the question. Furthermore, this finding could show self-selection bias for the questionnaire, with scholars in successful collaborations more likely to respond to a questionnaire about their collaboration. The questionnaire did request no further explanation why a collaboration was deemed successful or not.

Having contextualised the responses as such, the following sections focus on the boundary practices central to this paper, and how they are configured by disciplinary diversity and physical distance.

Table 3: Disciplinary diversity. Frequencies (#) and percentages of all 173 responses (%).

	Leadership		Participants	
	#	%	#	%
History	88	51	102	59
Other humanities	82	47	109	63
Cultural heritage	22	13	50	29
Humanities total	**157**	**91**	**150**	**87**
Computer science	23	13	83	48
Computational linguistics	18	10	43	25
Software development	13	8	75	43
Computational total	**40**	**23**	**127**	**73**
Library	21	12	51	31
Other	35	20	54	31

3.1 Disciplinary diversity

With respect to the first dimension, disciplinary diversity, I consider three types of disciplinary backgrounds. First, *humanities backgrounds*, consisting of options 'history', 'other humanities', or 'cultural heritage'.[3] Second, *computational backgrounds*, consisting of the options 'computer science', 'computational linguistics' and 'software development'. Finally, other options were 'library' and 'other'. Three questions inquired about disciplinary diversity.

The first two questions concerned the disciplinary background of the leadership of the collaboration and of other participants. Respondents could choose multiple answers for both questions. For an overview of responses, see Table 3. With respect to the disciplinary diversity of leadership, *collaborations were mostly led by humanities scholars*: 91% included humanities scholars as leaders, compared to 23% that included computational experts. Furthermore, the majority of collaborations were led exclusively by scholars with a humanities background (126; 73%). A much smaller number of collaborations were led exclusively by people with a computational background (9; 5%). For 31 collaborations (18%), leadership involved scholars from both the humanities and a computational background.

With respect to the other participants of collaborations, disciplinary diversity appears more balanced. *Most collaborations included both participants with a humanities background and participants with a computational background*: 87% of collaborations included humanities scholars, and 73% included computational experts.

The third question concerned the ratio of humanities scholars to computational experts on a 5-point Likert scale. *For the vast majority of collaborations, humanities scholars outnumbered computational experts* (for an overview see Figure 2). Collaborations with only humanities scholars or mostly humanities scholars together comprise three-quarters of all responses. No collaboration included computational experts only.

In sum, *there was little disciplinary diversity in digital humanities collaborations*: leadership consisted mostly of humanities scholars, and humanities scholars also outnumbered collaborators with a computational background as participants.

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[3] The division between history and other humanities is a result of the questionnaire being conducted as part of my PhD research on digital history specifically (Kemman, 2019).
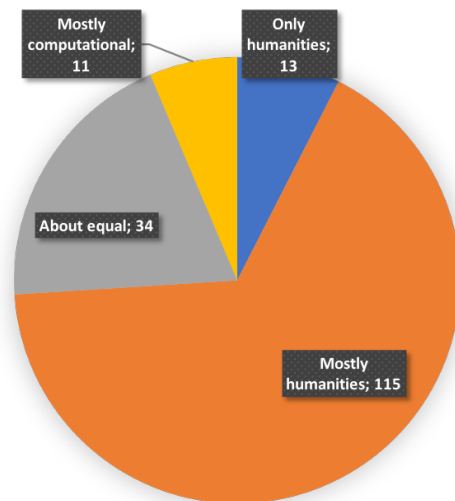
Figure 2: Ratio of disciplinary backgrounds.

3.2 Physical distance

With respect to the second dimension, physical distance, three questions inquired about where collaborators conducted their work and how they communicated with one another.

First, respondents were asked where the main participants of the collaboration worked, allowing a single answer. From my own observations, collaborations are often officially led by professors who have their own offices, but mainly conducted by researchers in PhD or postdoc positions who might or might not be sharing an office together. It is the interactions of these main participants that are of particular interest for the development of common ground. The frequencies of responses to this question can be seen in Figure 3. A total of 34 collaborations (20%) were conducted at a very short distance in a single space, either a lab or an office. 42 collaborations (24%) were conducted across a wider distance, but still within the same institute. Finally, 92 collaborations (53%) were conducted between multiple institutes in national or international contexts. Thus, *the majority of collaborations were conducted at a great physical distance*.

A second question concerned the institutional buildings where these spaces were located, allowing multiple answers. The majority of collaborations were located in the humanities building of an institute (112; 65%). Far fewer collaborations had spaces in the computer science building (29; 17%) or the library building (32; 18%). This corresponds to the earlier finding that the majority of collaborations consisted mainly of scholars from the humanities.

The final question inquired about the main means of communication within the collaboration, allowing a single response. In Figure 4 it can be seen that physical distance affected communication within a collaboration:[4] *as physical distance increased,*

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[4]   The category 'offices on multiple floors in a single building' received only six responses, and all six respondents communicated face-to-face. This distribution of answers is different from the other categories, which I assume is a result of the small sample size rather than a meaningful consequence of this category of physical distance. This category is therefore excluded from subsequent analyses.
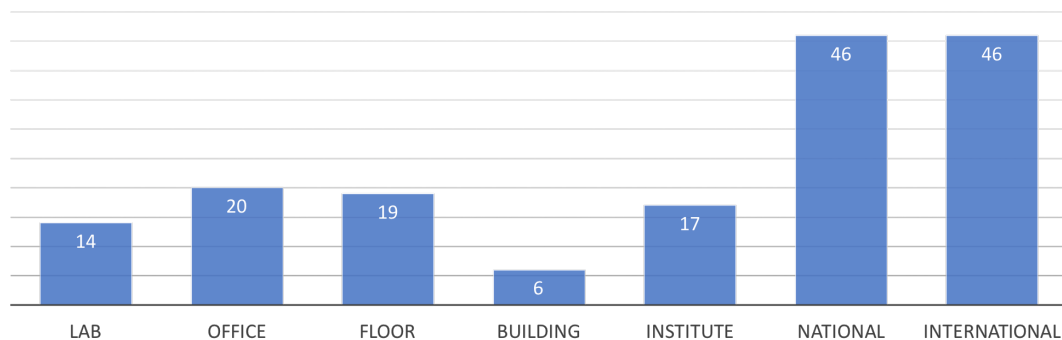
Figure 3: Physical distance between main collaborators, showing the frequencies of responses.

the use of face-to-face communication decreased, and the use of email increased,[5] which is in agreement with the literature. While both are within a single space, communication within a lab appears differently from that within a single office, indicating different styles of collaboration in different spaces. Moreover, when the collaboration was spread out over multiple buildings in a single institute, the use of email increased to a level similar to that for multiple institutes or international collaborations. This seems to indicate that inter-departmental collaborations experience similar obstacles to face-to-face communication as inter-institutional collaborations.

In sum, *the physical distance between participants in digital humanities collaborations is often great*: the majority of collaborations were conducted between different institutes and increasingly depended on email rather than face-to-face communication.

3.3 Boundary practices

As described above, two forms of boundary practices are central to the current study: interdisciplinary boundary crossing and intradisciplinary boundary construction. As a proxy for these boundary practices, the questionnaire inquired about the frequency of research-related communication with both cross-disciplinary collaborators and disciplinary peers. Figure 5 shows the frequency of responses to both questions in comparison. From this figure it can be seen that both disciplinary and interdisciplinary communication were quite frequent. Two-thirds of respondents spoke at least weekly with interdisciplinary collaborators. Three-quarters of respondents spoke at least weekly with disciplinary peers. Interaction with disciplinary peers outside the collaboration was significantly more frequent than interdisciplinary communication within

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[5] I tested the relation between physical distance and communication via email or face-to-face with Kendall's tau correlation, a non-parametric test for ordinal data with small sample sizes (Field, 2009, pp. 181-182). Considering both variables are ordinal, tau-c was used to control for so-called 'tied ranks' where multiple respondents chose the same answers. Only cases that mainly communicated via email or face-to-face were selected, and the six responses in the category 'offices on multiple floors in a single building' were left out (see footnote 4). For the remaining 129 cases larger physical distance was found to be significantly correlated to more email instead of face-to-face communication τ-c=0.445, p(two-tailed)<0.001, N=129.
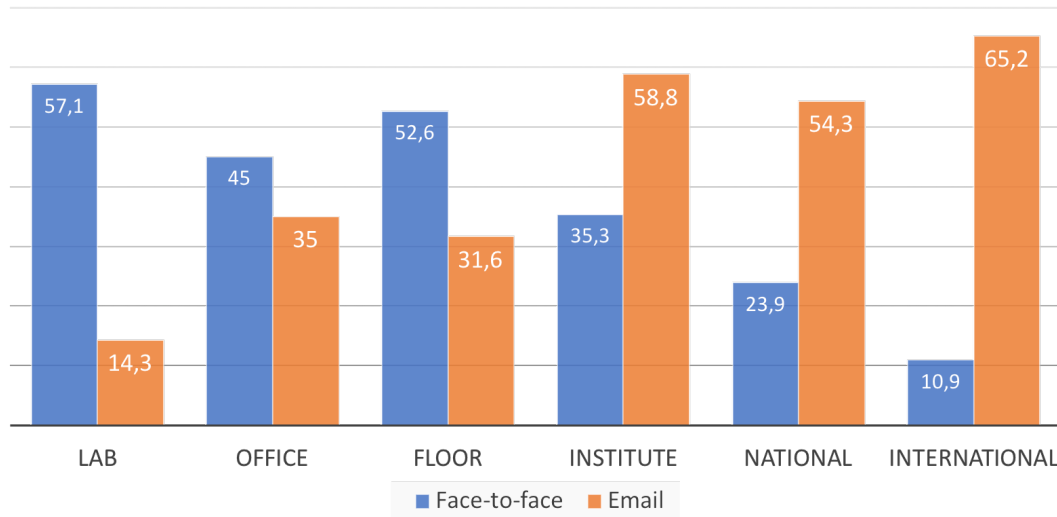
Figure 4: Main means of communication within the collaboration per distance, showing the percentage of responses.

the collaboration.[6]

Tests on the relation between disciplinary diversity or physical distance and boundary practices all returned non-significant results.[7] In other words, *I have found no signs that disciplinary diversity or physical distance affected the frequency of intradisciplinary or interdisciplinary boundary interactions*.

4 Discussion

In sum, I have found, with the aid of the questionnaire, that there was often little disciplinary diversity in digital humanities collaborations: most participants came from the humanities and most collaborations were led by humanities scholars. The majority of collaborations were conducted across a great physical distance, which correlated with an increased dependence on distant communication via email rather than face-to-face.

I hypothesised that small disciplinary diversity and great physical distance would lead to both a decreased opportunity for interdisciplinary boundary crossing and decreased intradisciplinary boundary construction. However, the analyses did not confirm that disciplinary diversity or physical distance affected the frequency of boundary interactions. The hypothesis therefore cannot be confirmed. Yet a number of findings give further insights into the boundary practices that may affect the development of

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[6] I tested the difference with a Wilcoxon signed-rank test, a non-parametric test of differences between two sets of answers originating from the same respondents (Field, 2009, pp. 552-558). Respondents communicated significantly less with cross-disciplinary collaborators with $z=-2.301$, p(two-tailed)<0.05, N=168, $r=-0.13$.

[7] I tested these relations with Fisher's exact test, a test to compare the relationship between non-interval variables with small sample sizes (Field, 2009, p. 690). This concerns four independent statistical tests, none of which showed a statistically significant relation: 1) disciplinary diversity related to interdisciplinary communication, p(two-tailed)$=0.08$, 2) disciplinary diversity related to disciplinary communication, p(two-tailed)$=0.52$ 3) physical distance related to interdisciplinary communication, p(two-tailed)$=0.12$ and 4) physical distance related to disciplinary communication, p(two-tailed)$=0.25$.
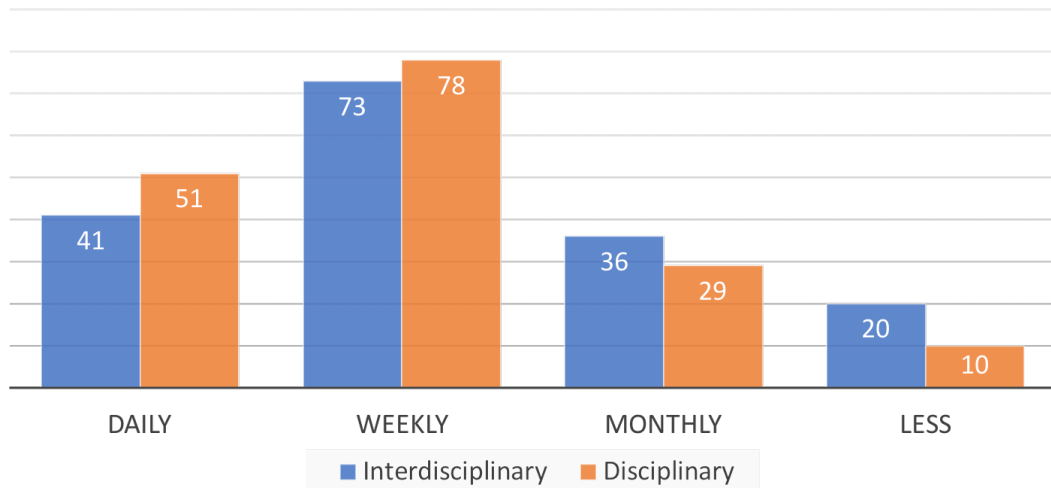
Figure 5: Frequencies of interactions with cross-disciplinary collaborators or disciplinary peers, showing the frequency of responses.

common ground in digital humanities collaborations.

First, while physical distance did not affect the *frequency* of interactions, it did affect the *nature* of communication in the collaborations, as increased physical distance was related to an increased reliance on email. However, previous research found digital communication insufficient for the development of common ground (Siemens, 2009). Especially insofar as collaborations need to establish mutual trust and coordinate ill-defined goals, it has been questioned whether this can be facilitated through distant communication (Sonderegger, 2009). In collaborations, goals emerge through continuous negotiations instead of being established prior to the collaboration (Haythornthwaite et al., 2006). Therefore, collocation, such as sharing an office, has been found to facilitate the development of common ground most effectively (Olson et al., 2002).

Second, for the majority of collaborations participants worked on multiple projects. This suggests that even if a common ground is established in a collaboration, these shared practices and vocabularies are limited to the collaboration. For other collaborations, it is to be expected that participants need to negotiate other common grounds. The opportunity for a common ground to develop into a shared history of learning thus appears limited.

Third, the majority of collaborations were embedded in the humanities buildings of institutes. This suggests smaller physical distance to disciplinary peers for participants from the humanities.

Finally, respondents communicated significantly more with disciplinary peers outside the collaboration than with cross-disciplinary collaborators. These last two findings suggest that humanities scholars remained aligned with their humanities background rather than forming a new alignment with computational collaborators. It thus appears unlikely that the humanities scholars involved in the digital humanities drift apart from their disciplinary community. Considering the finding that collaborations were furthermore predominantly conducted and led by humanities scholars, my findings agree with Svensson (2011) who characterisesd 'the digital humanities as

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a humanities project'. Digital humanities thus appears less diverse than is generally assumed (cf. Edmond, 2016).

5 Conclusions and future outlook

In conclusion, let me return to the research question underlying this paper: *how do disciplinary diversity and physical distance affect boundary practices of digital humanities collaborations?* Answering this question is not a straightforward matter. Disciplinary diversity and physical distance do not affect the frequency of boundary interactions. I therefore have not found effects of these dimensions on boundary crossing or boundary construction. Yet physical distance does affect the nature of communication, with increased physical distance related to increased reliance on email. The questionnaire moreover found that the majority of collaborations were conducted at a great distance with predominant participation from humanities scholars. I therefore conclude that digital humanities collaborations are biased towards the humanities rather than balancing the digital and the humanities. The main contribution of this paper then is to provide an empirical grounding for discussions of digital humanities as a meeting place between the computational domains and the humanities. The results of this paper furthermore facilitate the contextualisation of future case studies of digital humanities collaborations, making it possible to position their organisation as typical or atypical compared to the results of the questionnaire.

The approach described in this paper thereby provides a quantitative meso perspective on collaborations, yet has a number of limitations that affect interpretability. A first limitation is that, as a result of my distribution methods, most respondents came from the humanities. This could have skewed findings insofar as humanities scholars outnumbered other disciplinary backgrounds. For example, collaborations between computational experts and cultural heritage, which may well be considered digital humanities practices, are probably underrepresented. Second, by focusing on disciplinary diversity, physical distance and boundary practices, the questionnaire sought to investigate collaborations through a quantitative approach. However, this does not provide in-depth insights into the development of common ground, the establishment of boundary practices or the nature of practices in the digital humanities. For example, since the majority of respondents indicated that participants worked in multiple collaborations, a much more detailed look at how individuals move between collaborations and perform boundary practices is necessary. Therefore, following the results of this questionnaire, a number of questions for future research require further exploration.

First, considering the apparent dominance of humanities scholars in digital humanities collaborations, both among participants and leaders, a question is how this affects possible power relations in interdisciplinary collaborations. Whereas McCarty (2012) has argued for a level ground where computational experts work with rather than in the service of humanities scholars, it is possible that humanities scholars effectively set the agenda for digital humanities collaborations. The question of how such power relations affect the development of common ground and the coordination of practices requires deeper observations of the interactions between humanities scholars and computational experts. For example, one question might be whether commonly negotiated vocabularies are closer to the disciplinary discourses of the humanities or to that of computational domains.

Second, considering the dependence on communication technology such as email,

one question is how this affects the development of common ground. Since communication technology has been found lacking in previous research, long-distance collaborations may need to plan for face-to-face meetings at partners' locations in order to develop common ground (Siemens and Burr, 2013, Sonderegger, 2009). Yet whether such meetings at intervals are sufficient is underexplored. In the case of communication technology, email, rather than synchronous distant communication, has been found to be the best alternative to face-to-face. The reason is that email allows collaborators to contemplate and elaborate on what they intend to communicate, and it also provides a stable backlog that can facilitate common ground (Sonderegger, 2009). More research is therefore needed on how communication technologies are used to develop common ground in the digital humanities.

Finally, the relationship between the digital humanities and the humanities at large deserves more attention. One question is whether scholars ultimately remain part of their disciplinary culture or whether the digital humanities indeed constitute a distinct community of practice (Siemens and Burr, 2013, Siemens, 2016). It has been suggested that digital humanities constitute a "dual citizenship" (Svensson, 2012) or a third culture (Hunter, 2014) between the digital and the humanities. Yet the results from the questionnaire suggest otherwise. Scholars remained in close contact with disciplinary peers. Most scholars were part of multiple collaborations, making it likely that scholars developed and negotiated different practices in different settings. This raises the question of whether vocabularies and practices shared within a single collaboration are able to extend beyond that collaboration into a wider community of practice of digital humanities.

On the meso scale adopted in this paper, the digital humanities therefore appear to maintain the duality of the humanities and the computational domains. Yet the results suggest that the digital humanities may be more heavily oriented towards the humanities than a balancing of the digital and the humanities. While on a micro scale scholars may act in-between the two domains, possessing both humanistic and computational skills, these cases seem atypical in the wider context of digital humanities collaborations. This is not to deny the possibility of the digital humanities emerging as a third space, but it poses questions about how scholars can develop into members of such a third space, how exactly this third space relates to the humanities and the computational domains and what kind of boundary practices are consequently introduced.

Acknowledgements

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Appendix A - Questionnaire

1. What is the name or title of your collaboration? (text input)

2. Where are people participating in `Q1-answer` located? (multiple choices)

3. From what backgrounds does leadership (director, PI, supervisor, or otherwise) come? (multiple options)
   - History
   - Other humanities disciplines
   - Computational linguistics
   - Computer science
   - Cultural heritage
   - Library
   - Software development
   - Other (text input)

4. From what backgrounds do participants other than leadership come? (multiple choices)
   - History
   - Other humanities disciplines
   - Computational linguistics
   - Computer science
   - Cultural heritage
   - Library
   - Software development
   - Other (text input)

5. Are participants mostly from a humanities background or mostly from a computational background? (single choice)
   - Only from a humanities background
   - Mostly from a humanities background
   - About equal
   - Mostly from a computational background
   - Only from a computational background

6. Which of the following statements is true about `Q1-answer`? (multiple choices)
   - Participants are all contractually tied solely to `Q1-answer`
   - Participants are all contractually tied to the same organisational unit (not necessarily `Q1-answer`)
   - Participants are contractually tied to other organisational units than `Q1-answer`
   - Participants have a dual position in their contract, `Q1-answer` and another organisational unit

- Participants are contractually tied to different institutions
- Participants work only on the `Q1-answer`
- Participants work on multiple research projects
- Participants perform user research engaging humanities scholars not part of `Q1-answer`

7. What is the time frame of `Q1-answer`? (single choice)
   - Short term (working towards deadline within 4 years)
   - Semi-long term (no concrete deadline or more than 4 years)
   - Long term (no deadline)

8. What is the source of funding? (multiple choices)
   - University
   - National funding agency
   - European funding agency
   - Government (other than national funding agency)
   - Another infrastructure project (e.g. DARIAH, CLARIN)
   - Other (text input)

9. What is the physical space where the main participants of `Q1-answer` work? (single choice)
   - Lab space
   - Single office
   - Multiple offices on a single floor
   - Multiple offices on multiple floors in a single building
   - Offices in multiple buildings of a single institution
   - Offices in multiple institutions in a single country
   - Offices in multiple institutions in multiple countries

10. Where is the space or are spaces located (multiple choices)
    - In the library building
    - In the humanities building
    - In the computer science building
    - Other (text input)

11. How do you mainly communicate with other participants? (single choice)
    - Face to face
    - Video conferencing
    - Telephone conferencing
    - Email
    - Slack
    - Other communication platform(s) (text input)

12. How often do you communicate about research-related matters with participants from a different disciplinary background than your own? (single choice)
   - Daily
   - Weekly
   - Monthly
   - Every 2-6 months
   - Annually
   - Never

13. How often do you communicate about research-related matters with people from your own disciplinary background, that are not part of `Q1-answer`?
   - Daily
   - Weekly
   - Monthly
   - Every 2-6 months
   - Annually
   - Never

14. Of what organisational unit(s) is the lab a part? (multiple choices)
   - Entirely independent
   - The digital history/digital humanities group
   - The humanities faculty
   - The computer department
   - The library
   - Other (text input)

15. Which of the following does the lab provide? (multiple choices)
   - Computers
   - Scanners
   - Printers
   - Personnel (such as software developers)
   - Other (text input)

16. Which of the following statements is true about the lab? (single choice)
   - The lab is meant for people contractually tied to the same organisational unit as the lab
   - The lab is open to anyone from the humanities in the university
   - The lab is open to anyone from history in the university
   - The lab is open to anyone in the university
   - Other (text input)

17. Please describe in short the goal of `Q1-answer`? (text input)

18. What is your individual reason for joining `Q1-answer`? (text input)

19. Would you say `Q1-answer` is successful? (text input)

Appendix B - Kolmogorov-Smirnov tests

None of the variables used in this paper were normally distributed, as found through Kolmogorov-Smirnov tests, a test for normal distribution (Field, 2009, pp. 144-148):

- Disciplinary diversity $D(166)=0.38$, $p<0.01$

- Physical distance $D(166)=0.25$, $p<0.01$

- Intradisciplinary interactions $D(166)=0.28$, $p<0.01$

- Cross-disciplinary interactions $D(166)=0.27$, $p<0.01$

- Main means of communication $D(166)=0.31$, $p<0.01$