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Reflexive inertia : reinventing scholarship through digital practices

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Chapter 3

Decomposition as practice and process: creating boundary objects in computational humanities⁴⁶

Parenthesis – relation to conceptual framework

The single most commonly heard expectation towards the epistemic advantages offered by digital approaches in the humanities arguably is that of enabling data-intensive research in previously data-sparse intellectual traditions. Some highly publicized initiatives – such as the Harvard-based culturomics project (Aiden & Michel, 2013), or the cultural analytics lab founded by media theorist Lev Manovich - have proposed to apply data-mining and algorithmic analysis to trace developments in language, the arts, and popular culture. Many European and US policy views of digital infrastructure are similarly based on the idea that the provision of datasets and analytical tools will enable the humanities to pose wholly new types of research questions, thus allowing to move beyond the limitations of empirical material and secondary literature 'lone' scholars can cover in the process of writing a monograph. The joint international funding initiative Digging into Data for instance pictures data as a sort of basic empirical layer around which academics from different backgrounds can gather and organize their work (Williford & Henry, 2012). These imaginings are complemented by attempts to retell the very history of the humanities as a chronology of primarily empirical, data-driven research, thus implying that the turn to hermeneutics in the late 19th century is best understood as an accident (Bod, 2014).

Against the background of my conceptual framework of a scholarly infrastructure, in which particular disciplinary cultures of knowledge making are loosely related in a larger work ecology, such accounts warrant critical scrutiny. For one, the commonly heard language of 'enhancing' the humanities by overcoming 'limitations' of 'data scarcity' suggests a problematic hierarchy of empirical exactitude and development, where the humanities have yet to attain the epistemic robustness of the sciences.

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Secondly, the notion that incorporating data-intensive approaches into the humanities is a simple matter of 'applying' new tools and methods to scholarly problems is based on a reductive epistemological vision, in which data are seen as agnostic with respect to disciplinary cultures. In the preceding chapters I have already analyzed a variety of data-related issues that arise in the attempt to reengineer the scholarly knowledge machine, most prominently that of data work and the role of its valuation for the type of knowledge produced in a field. In the following chapter, I will address data as a problem for interdisciplinary collaboration between computer science and the humanities. Combining infrastructure studies and STS theorizing on scientific method, the characteristic features of modern disciplines – and thus the way they use data to produce knowledge – can be seen as the emergent result of a historical process. Due to repetition of particular research practices over time, elements of research work have become packaged into standardized sequences, for example commonly used data formats, methods, and ways of communicating with peers (Latour, 1987; Fujimura, 1987, 1992). It is by conforming to these specific disciplinary traditions that individual researchers are able to draw on the work done by their predecessors, albeit on the condition that they also adopt the underlying normative assumptions. STS scholar John Law (2004) therefore argues that methods, be they data-intensive or qualitative, are not objective devices for extracting truth out of messy social and cultural contexts, but instead enact a reality according to specific disciplinary conventions. Academic disciplines can in fact be seen to produce implicit and explicit criteria for what individual contributions to the shared body of knowledge must look like (in terms of format, style, methods used) so as to be acceptable within the community of peers. Simultaneously, they provide institutionally embedded facilities (methodological training for undergraduates, available lab equipment, commonly used databases and software) that make it easier to produce exactly such contributions, but not others. Together, established traditions and facilities constitute what Law calls the hinterland of a discipline.

Applied to interdisciplinary work in digital scholarship, this perspective raises both normative and practical questions. If methods enact reality, rather than merely extracting it, normative choices need to be made about what forms of reality to make possible and which to exclude. Practically, it suggests that research at the intersection of humanities and computer science will not be a simple process of 'applying' large datasets to scholarly research questions. Instead, we can expect what Edwards et al.

(2011) call 'science friction', i.e. difficulties in collaboration that arise due to diverging traditions of conceptualizing, analyzing, and practically handling data. Some sort of reflexive work will therefore be necessary to capture differences between disciplinary hinterlands and so be able to create compatibility.

Introduction

Computational humanities, although practised by an international community of scholars since the late 1940s (Busa, 1980, Hockey, 2004), has recently caught the attention of policy makers in both Europe and the USA. Substantial amounts of funding are currently being invested in individual projects as well as in the coordinated creation of cyberinfrastructure, in order to promote computational approaches to the study of literature, art, and history (e.g., Anderson, Blanke & Dunn, 2010; Williford & Henry, 2012). The research published in journals such as *Literary & Linguistic Computing* over the last decades is a testament to the possible interdisciplinary fusion of computer science and humanities scholarship. However, the current policy investments in new computational humanities projects constitute a somewhat different situation. While research published in the above mentioned journal in fact has acquired typical features of disciplinarity over the years — for example, established types of research questions and methodological standards — current policy efforts encourage computational approaches also in other areas of humanistic inquiry with no such history. Moreover, although scholars in the older tradition of computational humanities typically dispose of a hybrid skill set that includes both programming and scholarly domain expertise, the recent wave of collaborative projects tend to operate with a division of labor between computer scientists and humanities scholars (cf. Kaltenbrunner, 2014). Here, the collaborating researchers find themselves in a situation that requires them to work out a viable interdisciplinary arrangement from scratch and in relatively little time.

Policy views on the practice of computational humanities, however, are frequently informed by an insufficiently complex understanding of the dynamics of disciplinarity, research practice, and technology. In keeping with the bold expectations associated with ‘big data’ and the ‘Fourth Paradigm’ (Hey et al., 2009), many policy reports on the potential of computational humanities express the expectation that the shared use of large datasets will bring about a unified culture of computationally intensive research (Williford & Henry, 2012; Willikens et al., 2010). Once the required cyberinfrastructure is in place, the assumption is that scholars from all areas of study will naturally find themselves engaging in increasingly intensive teamwork across their respective specialization.

In this study, I subject the process of establishing interdisciplinary collaboration in a computational humanities project to a detailed empirical analysis. My account contrasts with the picture of a smooth, data-driven

synthesis of different fields by making visible the tensions and hard work involved in that process. The analysis is based on my fieldwork in a Dutch computational humanities project, where computer scientists work together with researchers from Indonesian Studies and Network Analysis to study the changing relations between politically influential actors in Indonesia. I make use of two theoretical concepts from Science and Technology Studies (STS) to analyze the collaboration. Firstly, Law's (2004) concept of hinterlands, which describes sedimented socio-material practices that constrain how researchers can structure their research processes in given fields. Combining this perspective with Star & Griesemer's (1989) concept of the boundary object, I theorize the unfolding collaboration as the reflexive search for a viable organizational arrangement that allows the participants to work together without giving up existing disciplinary commitments.

I firstly offer a theoretical discussion in which I introduce in more detail the above mentioned conceptual resources. Turning to my case study, I then describe an initial attempt of the project participants to organize their shared research process around the dataset as an organizational pivot. This, however, created tensions owing to diverging perspectives on the 'nature' of data and their function in different disciplines, which in turn prompted the participants to envision more context-sensitive ways of embedding computational approaches with scholarly practice. In the last section, I critically assess a European cyberinfrastructure initiative that similarly tries to respect the specificities of scholarly practice in the humanities. Here I reflect in particular on the inherent tension between 'mutual shaping' of digital tools and their users on the one hand, and the policy interest in efficient, functionalist design principles on the other.

Case and methods

The Elite Network Shifts (ENS) project was a successful applicant to the Royal Netherlands Academy of Arts and Sciences' newly developed program Computational Humanities. Launching in February 2013, ENS is a collaboration between Indonesianists, network researchers and computer scientists (subdiscipline information retrieval, IR). Its aim is to gain new insights about sociological developments in groups of elite actors in Indonesia, with an empirical focus on two periods of political upheaval. Firstly, the period of decolonization and the rise to power of the military dictator General Suharto (1945–1955). Secondly, the period around the downfall of Suharto and the subsequent democratic reforms (1991–2010).

The empirical basis for this research is constituted by large amounts of digitized newspaper content (in Indonesian, Dutch, and English), which is processed through a combination of natural language processing (NLP) and statistical analysis, so as to filter out names of elite actors and visualize them in networks. ENS thus is based on a specific division of labor: the dataset is a product of the work of the computer scientists (Ridho and Maarten), while it constitutes the empirical basis for the research of the Indonesianists (Jacky, Gerry, Fridus) and network researchers (Vincent and Andrea, who hold doctoral degrees in applied mathematics and physics). The anticipated benefits of collaboration are mutual. Indonesianists and network researchers get access to large amounts of tailor-made empirical material. The IR researchers in turn get the chance to study the search behavior of humanities scholars, which is an important precondition for designing better data extraction algorithms, search engines, metadata etc.

The empirical materials on which I base my analysis of interdisciplinary collaboration in ENS were collected in a variety of ways. Firstly, through participant observation in project meetings, spread over a period of ten months (~25h). Secondly, I conducted a first round of semistructured interviews with all project participants about three months into the project, and then a second round of interviews with one project leader and the three main research participants (Ridho, Vincent, Jacky) eight months after launch. I also collected data from electronic communication within ENS, both by following email conversations and by joining a Zotero group library, which the participants used heavily to exchange project-internal documents, ideas, and papers. My role as an 'embedded' ethnographer was explicitly part of the original research proposal. Although I did not have an employment contract in ENS, I was invited to participate by attending internal meetings. Moreover, I was asked to recurrently present my findings and ideas to the group, thus helping the participants to reflect on the unfolding collaborative process.⁴⁷

Hinterlands and boundary objects

In his provocative book *After Method*, John Law (2004) introduces the notion of the hinterlands of the social sciences. Such hinterlands are

⁴⁷ I wish to thank the participants of ENS for allowing me to conduct fieldwork in their project. I am also particularly grateful to Stef Scagliola at the Erasmus Studio Rotterdam, with whom I have had fruitful discussions about the project.

constituted by the often unquestioned methodological apparatus that underlie scholarly knowledge. Examples include both qualitative and quantitative approaches, such as the statistics of the t-test, or the methodological precepts that inform grounded theory. Hinterlands make possible certain forms of knowledge — they both constrain and enable what the researcher can see/say. A research argument that draws attention to one aspect of a phenomenon inevitably pushes into invisibility other aspects. Law argues that there is often a problematic normativity attached to method in the social sciences, in the sense that it is often seen as a secure way to uncovering the actual structures of reality. Law's own assumption about the reality social scientists study is that it produces a surfeit of generative potentials. Method can be used to selectively amplify some of these potentials, thus creating snapshots of a certain reality, without, however, ever exhausting other possibilities. Law's main argument is that social scientists should make an effort to dig into their hinterlands, in order to realize their inevitable blind spots, and to think about what other kinds of knowledge it might be desirable to generate. A number of factors militate against such reflexivity, however. Hinterlands in fact can be seen as sedimented research practices, which have acquired a structure-like quality through repetition over time. These practices become part and parcel of what it means to be a researcher in a given field. Similar to what Bowker & Star (2000) have observed for socio-material infrastructures, hinterlands therefore tend to become invisible to the researchers that inhabit them, precisely because they are so thoroughly embedded with everyday disciplinary routines. But even if a researcher is committed to reflexivity, going against the grain of a given hinterlands can pose a risk for disciplinary career development. Questioning the very foundations of a hegemonic methodological approach often involves the mobilization of significant amount of resources (cf. Latour, 1987), not to mention possible difficulties to get unconventional research published in 'flagship' journals.

Interdisciplinary collaboration constitutes an occasion where different hinterlands are intersected. Each of these comes with established disciplinary ways of structuring the research process, for example in terms of how empirical materials are used, what type of research questions are posed, and the way theoretical frameworks are expressed in specific methods. Interdisciplinary researchers typically expect such collaboration to complement, rather than replace, their disciplinary career development. Their participation thus should contribute to the shared process, but without forcing them to abandon their methodological, theoretical, and praxeological

investment in a given discipline. In ENS for example, participation in the project should not only advance our knowledge of elite shifts in Indonesia, but also result in a PhD thesis for computer scientist Ridho, and in journal publications for the postdocs Jacky and Vincent.

Here it is useful to draw on Star & Griesemer's (1989) concept of the boundary object. A boundary object is an organizational element that connects the activities of actors from different social worlds. Those shared objects are interpretively flexible. They mean different things to different actors, thus satisfying the requirements of their respective social world, but they are robust enough to maintain a certain integrity across those contexts. The concept of the boundary object was originally developed in reaction to Latour and Woolgar's (1979) notion of translation. Translation in this latter sense is a move by which entrepreneurial scientists transform interests of individual actors into goals that are conducive to their own ambitions — translation thus can be seen as the attempt to enroll allies into a socio-material network, which in turn can be used to stabilize a particular scientific fact (Callon, 1986). This is often a competitive process: multiple entrepreneurs try to enroll the same actors for different purposes. However, by virtue of their interpretive flexibility, boundary objects allow different actors to cooperate while maintaining ties to their original social worlds. The translations involved in creating a boundary object thus do not occur along a single axis (actor A tries to enroll actor B by translating her interests, thereby disciplining her), but are multidirectional (various actors try to mutually interest each other in their respective objectives). This multidirectional translation will entail significant amounts of negotiation, given the need to balance diverging actor interests. By definition, the creation of boundary objects is an emergent process that will tend to resist attempts to specify outcomes in too much detail in advance.

Here I am studying the process of establishing a viable collaborative organization in the context of computational humanities. If boundary objects are to emerge, collaborative modalities have to respect strong extant commitments of researchers to their respective hinterlands, rather than simply override them. Romm (1998) has argued that interdisciplinarity always involves a significant amount of reflexivity, insofar as it tends to throw into relief the differences between fields. Developing this point further, I propose to think of the process of creating boundary objects in computational humanities in terms of the metaphor of decomposition: it requires a reflexive effort in which the collaborating actors iteratively discover various aspects of their hinterlands that constrain the possible

modalities of interdisciplinary organization. Ideally, this decomposition leads to a viable arrangement that allows for meaningful collaboration in the project, yet without forcing researchers to simply abandon their original disciplinary affiliation.

My argument thus is in keeping with a key finding of the existing literature on interdisciplinarity, namely that the very establishment of a shared process should be considered a significant product of interdisciplinary research in its own right (Jeffrey, 2003; Lyall et al., 2011). This insight, however, is downplayed by the recent revival of a universalist expectation towards data. Currently, substantial amounts of funding are being invested in the creation of cyberinfrastructure for the sciences and the humanities, both in Europe and the USA (Bulger et al., 2011). The concept of cyberinfrastructure is heavily informed by the assumption that a new paradigm of scientific work is upon us, one in which research is driven by the detection of patterns in large quantities of data. Buzz words that express variants or aspects of this assumption include the 'data deluge' (Hey & Trefethen, 2005), 'big data' or the 'Fourth Paradigm' (Hey, 2009; Williford & Henry, 2012). A key promise of this discourse is that data will speak for themselves if available in sufficient amounts, thus liberating researchers from the constraints of disciplinary methods and theory-building (Anderson, 2008). Such an assumption certainly has managerial advantages, at least on paper. The UK e-science program for example conceptualizes data as a basic, self-identical unit, similar to an atom (Hey & Trefethen, 2002). Importantly, if data are seen as atoms, they can be expected to travel across disciplinary boundaries without losing their integrity. This in turn allows instrumental relations to be specified between producers and (re)users of data on a very large scale. Cyberinfrastructure can then be conveniently conceived as a large data repository, which merely needs to be overlaid with a layer of middleware and interfaces that cater to the more specific disciplinary needs of its users (Wouters & Beaulieu, 2006). The 2010 report on computational humanities by the Royal Netherlands Academy of Arts and Sciences squarely fits this perspective. Research in computational humanities, thus the report, should essentially be organized on top of a shared layer of digital data. The Academy anticipates that the most interesting areas for research is in the formalization of knowledge and perception, for example by the parametric modelling of the interpretive horizon against which pieces of arts are received by their audiences. Such formalization finally allows the humanities to produce knowledge that is 'not hindered by frame problems [resulting] from narrow disciplinary

perspectives' (Willekens et al., 2010, 10). Although conceding that this requires scholars to adapt their current practices, the report suggests that such adaptation constitutes merely an 'enhancement' of the epistemic goals that the humanities have always pursued, namely 'the search for high-level concepts, patterns and motifs in humanities data (Willekens et al., 2010, 11)'. From this perspective, interdisciplinary collaboration between scholars and computer scientists is primarily a matter of undoing the fragmentation of knowledge production into disciplines, which will 'naturally' follow from acknowledging the universality of data.

In this study, I argue that a more complex understanding of interdisciplinary collaboration in computational humanities is required, both to avoid stereotyping the latter as neo-positivist, and for the practical purpose of overcoming fundamental conflicts between disciplines that would otherwise threaten the success of costly initiatives. The analytical framework I have outlined in the above is of course revealing of my own academic socialization in the hinterland of STS, which has a long tradition of providing detailed, ethnographic studies of situated knowledge practices (Latour & Woolgar, 1979; Knorr Cetina, 1981). In this sense, my analytical categories co-produce the very tensions that I argue are characteristic of interdisciplinary collaboration. I would argue, however, that this perspective is selective in a useful way, because it encourages us to take seriously the challenges and concerns researchers are faced with when entering interdisciplinary projects, rather than alienating them by assuming a historically elusive universalism of scientific practice.

Different hinterlands in ENS

As is typical for the early phase of interdisciplinary collaboration (Lyll et al., 2011), the first few months of ENS were characterized by intense exchanges among the participants, during which they familiarized themselves with the specific disciplinary expectations and habits of each other. Through the theoretical lens of Law's approach, these can be seen as revealing of distinctive features of different hinterlands.

A first difference consists in the rhythm and material formats in which traces of the research processes become visible and circulate within the project. For example, the Indonesianists were astonished by the speed and regularity by which PhD candidate Ridho produces NLP algorithm prototypes, thus creating the impression that the work of extracting a dataset from the digitized newspapers was close to being done. This is

evidence of a more experimentally oriented research culture in IR that produces rapid preliminary output, and it contrasts with the one in Indonesian studies, where a scholarly narrative sometimes is crafted over years. In an interview I conducted only shortly after the launch of the project, Indonesianists Gerry and Fridus reflect on Ridho's already significant progress in writing his first academic paper.

Gerry: In our tradition, a PhD student would not dream of doing a paper in the first five months. They are still thrashing around, reading everything, and deciding what they really want to do. They might write a paper in their third year. Where they begin to synthesize what they have learned, and they would adopt a position on something that we would think is worth adopting a position on.

Fridus: Part of the papers in computational [science] is... is describing what you're doing. While in our discipline we have to do something and then we can find something and then we have to start analyzing. (...)

Author: So the research is less prespecified? So what you will do is part of what you have to find out?

Fridus: Yes.⁴⁸

Furthermore, the hinterlands of IR, network research, and Indonesian studies are characterized by different assumptions about where aspects of knowledge reside. Interestingly, the bibliographical references Jacky posted in the ENS Zotero group library frequently stress the complexity of the political developments under study in contemporary Indonesian history, and that investigating such complexity requires intimate personal familiarity of the analyst with these. The blurb of a standard work in contemporary Indonesian history reads as follows:

Periods of major political transition are generally so complex as to present the political analyst with one of his most difficult challenges. Indonesia between 1957 and 1959 was no exception. (...) Dr Daniel S. Lev is particularly well qualified to examine the course of Indonesian political developments between 1957 and 1959. Arriving in Indonesia towards the end of this period, he remained there for three years engaged in an intensive study of its political life. His

48 Personal interview with Gerry van Klinken and Fridus Steijlen, March 2013, Leiden.

monograph constitutes by far the most searching analysis yet to appear of this critically important period (Lev, 1966).

'Data' here are treated as inseparable from the individual, embodied knowledge of the prominent Indonesianist Daniel S. Lev, who in fact used his body as a research instrument (which was physically transported to Indonesia and spent several years there). This is a very different approach from the one envisaged in the project, where data are extracted from newspapers. The assumption underlying the latter approach is that the process of generating data can be partially separated from the process of analysis, which is a practical requirement for the division of labor between IR researchers and Indonesianists.

Furthermore, there are disciplinary differences in the ways researchers reduce the complexity of the studied phenomena. For example, in some social sciences it is common practice to remove outliers from a sample when testing it for statistical significance. In other disciplines this would be frowned upon, since disciplinary interest may exactly lie in what those outliers have to teach us. To give another example, studies on NLP and automated event-coding applied to newspaper content often stress the increased efficiency of automated approaches in comparison to manual coding. One such study (Shellman, 2008), also posted in the ENS group library, suggests that in time, improved coding algorithms will be able 'to capture the event itself'. This claim is based on an underlying theoretical choice about how to define an event, as well as an implicit source-critical assumption ('newspapers record events more or less accurately, therefore large amounts of news data allow most relevant events to be covered'). Some of these choices seem problematic from a social sciences perspective. For example, Jacky recurrently emphasized the importance of thick description, which implies that the significance of an event can only be gauged after the analyst has gained significant familiarity with the specific culture she studies. This is at odds with the *a priori* definition of an event as in Shellman's paper. Another potential tension could arise from the choice of treating all newspapers as being on equal footing. Traditional source criticism would point to the political bias of individual newspapers, which is also going to influence which actors and events they cover in the first place. This poses a certain challenge to the practice of taking newspaper content out of its original context through algorithmic processing, with the context being represented only by a limited amount of metadata.

Data as a link between hinterlands?

The original research proposal envisaged that the collaboration should be ordered around the dataset as an organizational pivot. Specifically, the document anticipates that about two years into the project, the participating computer scientists will have extracted a dataset from the digitized newspapers (subproject 1), which will then form the basis for the research of the Indonesianists and network researchers (subprojects 2 and 3).

In subproject 1, we will automatically extract entities and relations between entities from large historical news corpora (...). Subproject 2 will adopt a sociological and historical perspective and use techniques from social network analysis to trace central actors (identified in subproject 1) in their different social relations over time. In subproject 3, we focus on structural properties of social networks and their evolution over time from a statistical physics, complexity point of view.

Based on the extracted relational information, two subprojects are devoted to network analysis. Network analysis faces a trade-off between shallow, quick and effective analysis using minimal language processing tools, or deep but more laborious and risky analysis making extensive use of linguistic analysis. The challenge lies in the sociologically meaningful interpretation of network-analytical results and the emergence of new research questions for mathematical network analysis tools resulting from the empirical study of real-world historic networks. (Oostindie et al., 2011)

The project agenda implies a collaborative path-dependency, and it tends to present a somewhat dichotomous division of labor. First, it foresees that an algorithm will be developed that allows a dataset to be extracted from the digitized newspaper content. This involves custom NLP techniques for the identification of relevant entities in the newspaper articles — in this case, names of actors who are potentially part of elite networks. Moreover, the work of applied mathematician and network researcher Vincent allows co-occurrence based networks to be constructed from these data, i.e. a statistical analysis to single out patterns of recurring links between two actors who are mentioned together in the same sentence of a newspaper article. There is initially no theoretical understanding of what those recurring links mean. Co-occurrence of two actors can be completely random, or it can indeed

point to particular relations that are of interest to students of elite networks, such as kinship or business contacts. To be sure, the plan is that the expert knowledge of the Indonesianists informs the NLP algorithm and the construction of co-occurrence based networks. However, the assumption is that after this step is concluded, the resulting dataset provides a stable empirical basis that allows Jacky to answer her research questions. The proposal assumes that a dataset is made meaningful to the Indonesianists by operationalizing concepts such as 'elite', 'elite circulation', and 'regime transition' as empirically quantifiable data categories, so as to create a bridge between the disciplines. Moreover, the proposal is quite specific as to what kinds of insight the extracted dataset should (must) yield: 'otherwise hidden network relations between key actors', 'correlations between events over time', 'the role of individuals who co-act in different networks at the same time' (Oostindie et al., 2011).

However, this approach proved to be a cause for concern for several of the participants. In fact, project leaders Fridus and Gerry indicated that one of their greatest worries is the possibility that the resulting dataset turns out not to make 'sociological sense' after all.⁴⁹ Similarly, at an early project meeting, Indonesianist Jacky voiced her opinion that a quantitative approach might easily brush over many empirical details that can only be appreciated in a hermeneutic case-by-case approach. This could make it difficult to integrate an algorithmically extracted dataset into her personal research.

In terms of methodologies, I am generally wary of the statistical and quantifiable. To my mind, it can lead to either addressing only those aspects of social phenomena which are easily measured (and so, often, the least interesting) or, if more complex phenomena are studied, there is a danger that the assumptions behind statistical or technical procedures are hidden or insufficiently examined. (...) I want to avoid a situation where I receive a lot of data from Ridho and Vincent and then try to situate it within the detailed contextual knowledge of the Indonesianists (ENS, internal document).

Not least, Jacky reported that upon presenting the original outline of the ENS research proposal to Indonesianist audiences at conferences, she was recurrently faced with the objection that those elite dealings that are of real

49 Personal interview with Gerry van Klinken and Fridus Steijlen, March 2013, Leiden.

interest to scholars are unlikely to be reported in newspapers. Highlighting shifts in, say, the changing frequency and composition of elite names as reported in the news here was generally perceived to be at odds with the conceptual fuzziness of notions such as 'elite' and 'power'.

The source of these tensions, I suggest, ultimately is the diverging function of data in the various hinterlands that are involved in ENS. As argued in the above, data in Indonesian studies is not a clearly differentiated organizational element, but bound up with highly individualized ways of doing research. Generally, and in contrast to the experimental nature of IR with its multiple preliminary research products, the monograph/paper format dominant in the humanities and qualitative social sciences implies a more weakly differentiated research process. When working on a monograph, scholars have considerable freedom in adapting their narrative to new, conceptually relevant insights. It is furthermore assumed that the receiving disciplinary community takes the time necessary to read the entire narrative of a monograph or paper, rather than merely 'extracting' any empirical information it might contain. In addition, while theorizing in IR is more ad hoc and need-driven (e.g. 'how to explain this particular aspect of the search behavior of a user group?'), theory in Indonesian studies normally refers to larger theoretical projects (e.g. 'how are social values reproduced in a society?'), thus indicating that individual research results are primarily meaningful in relation to an encompassing disciplinary discourse. These theoretical projects relate in complex ways to empirical materials and data categories, provided that the latter term is even used in a given hinterland. In many disciplines of the humanities and social sciences it is customary to pose research questions that are of a hermeneutic, open-ended nature, thus defying the possibility of an ultimate, empirically based answer. In other words, the tension arises from treating research problems concerning elite shifts as something that can be uniquely answered by the data that are being produced by computer scientists and network researchers, whereas research problems in Indonesian studies are normally seen as irreducibly open-ended, hermeneutic affairs. The dataset thus is treated as a mechanical 'joint' that connects the work of the computer scientists to the work of the Indonesianists. This, I suggest, creates the rather high expectation that the extracted dataset is (must be) 'sociologically meaningful' in itself.

In contrast, the hinterlands of IR and network research were much easier to intersect, owing to the strong consistency in the understanding of data across those fields. Vincent could integrate the tables of actor names

that resulted from the application of Ridho's NLP algorithms into his own statistical analyses (of network properties such as the amenability of the data to particular clustering methods, the relative density and size of these clusters, as well as their relative persistence over time etc.) without any problem. This allowed Vincent to immediately go about drawing comparisons between 'behavior' of the ENS data and that observed for other types of networks, thus providing him with a clear basis for papers that can be submitted to network research journals. The substantial praxeological continuity between IR and network research is perhaps best reflected in the fact that Ridho provided data in such a format that they could be directly uploaded to R and MatLab, the analysis software Vincent habitually uses — in contrast to Indonesian studies, the data could smoothly travel between the hinterlands of IR and network research.

Discussing a problem closely related the one described in this section, Ramsay (2011) argues that the reason why computational humanists have difficulty breaking into the mainstream of literary criticism is that they often fail to properly embed their computational methods in hermeneutic disciplinary discourse. For example, if one begins to approach the work of Virginia Woolf through algorithmic analysis, a conceptual slippage can easily occur in which statistical criteria of validity replace hermeneutic criteria of validity. Statistical methods that can provide solutions to punctual, often binary questions are then applied to hermeneutic, more open-ended questions. Those criteria are qualitatively different of course, because hermeneutic questions per definition cannot be solved. In ENS, the original assumption was that a dataset, once it is compiled, can help to 'solve' the hermeneutic problems Indonesianists work on. Validity criteria that can be usefully applied to the creation of a dataset (e.g., 'is this a valid formalization of the concept of elite'?) are tacitly extended to apply to research questions in Indonesian studies. As a solution to this kind of problem, Ramsay proposes to strip computational methods of the statistical criteria of validity they are usually associated with. Instead of being associated with a rhetoric of 'solving' problems of interpretation, computational methods could be used to refine or even multiply them. In principle, computational methods could be thoroughly in the service of hermeneutics, rather than their opposite.

Emerging boundary objects

The sometimes tense exchanges in the early phase of ENS thus had made

clear that the original project plan — if followed by the letter — would be rather counterproductive, and that more practical ways of creating interfaces, especially between Indonesian studies and IR, were necessary. Circulating an earlier version of this report in the group played a certain role in this process. Project leader Gerry defined reading an earlier version as ‘liberating’, in the sense that it made the anxiety that had plagued him during the early months of the project explicit. Again, it is worth pointing out that my choice of framing tensions in ENS through Law’s theoretical framework may have had a performative effect. Had I as an analyst had less exposure to STS ethnography with its emphasis on the specificity of disciplinary research practices, or had I had less autonomy in developing my argument, the particular way in which the participants thought about the challenge of collaboration might have been a different one.

A project meeting in June 2013 occasioned an extensive discussion about how to properly integrate Indonesianist research practice with the computational approach as outlined in the original proposal. A first idea suggested by Jacky was to extract a dataset, travel to Indonesia, show it to the actors represented in the dataset, and ask them to comment on it. This would constitute a way of fathoming the limitations of knowledge claims purely based on algorithmic analysis, thus potentially allowing the methodology of elite analysis in ENS to be both developed and questioned through a combination with qualitative interviews. Not least, this could lead to new ways of making academic research in Indonesian studies engage with ongoing societal developments in Indonesia.

A second possibility suggested jointly by Vincent and Jacky is to structure collaboration around ‘sentiment analysis’. The principle of this approach is to extract a dataset that not only visualizes networks of elite actors, but that also specifies the modality of their relations through a more fine-grained linguistic analysis of sentences (e.g. actor A attacks actor B). The Indonesianists then could continuously specify their wishes as to which sorts of relations they are interested in, thus potentially allowing for meaningful embedding of the data in their work. The goal here would be to avoid a situation where the Indonesianists are confronted with data extracted by IR and network researchers, together with an overly specific assumption concerning the research questions those data should be used to answer. Of course, this could also entail a restructuring of individual research processes, but this would then be the result of an iterative negotiation process.

Particularly noteworthy moreover is a possibility of integrating co-

occurrence based analysis of the dataset with hermeneutic questions that the participants began to envision about half a year into the collaboration. This approach emerged from a project-wide discussion of a draft report circulated by Jacky, in which she compares a number of theoretically informed ways of conceptualizing the notion of 'elite'. Jacky cites three definitions. Building on Max Weber's institutional sociology, a first definition equates elite essentially with those who are in a structural position to override other people's interest, i.e. actors who occupy top positions in politics, the military, bureaucracy etc. (Mills, 1956). A second definition, adopted from a body of literature that criticizes the nominalistic Weberian approach (e.g., Dahl, 1958), suggests that only those individuals who actually shape political developments — overtly or behind the scenes — should be legitimately considered elites. The resulting list of actors would not necessarily be the same as those who happen to occupy formally high-ranking positions. Thirdly, Jacky outlines a method for identifying elites based on co-occurrence, thereby drawing on Vincent's early experimentation with a subset of the ENS newspaper data. By using a variety of clustering techniques, Vincent was able to identify relatively coherent groups of actors recurrently mentioned in Indonesian newspapers. However, rather than choosing a single 'best' definition of elite, Jacky proposes to build her argument on the comparison of the different approaches. Following the agreement of all members to develop this idea, Jacky then operationalized the first definition of elite by drawing on a number of empirical sources, e.g. a list of the 150 richest businesspeople in Indonesia, as published by the business magazine *Globe Asia*, or by manually compiling a list of all Indonesian ministers and members of parliament. In the next version of the paper, Jacky compared Vincent's networks with the lists she herself had generated using the Weberian approach (Hicks, unpublished). The paper offers observations about the relative degree to which Vincent's networks overlap with her own lists, but also uses the comparison to mutually problematize and question the various definitions of elite. Rather than settling the question 'what is an elite?' through applying a single approach, the comparison thus re-introduces a strong hermeneutic dimension in the discussion.

In all of the proposed scenarios, the dataset functions as a boundary object between the subprojects. That is, although allowing all researchers to make use of the dataset, its exact meaning and function differs for each of the participants. The first and the last strategy are structurally similar. In both cases, Ridho first extracts the data through the application of custom

NLP methods, thus allowing him to combine his own doctoral research with his 'instrumental' task of generating empirical material for Vincent and Jacky. The latter two, charged with analyzing the data, can indeed draw on Ridho's work, yet without violating extant commitments to their respective hinterlands. On the one hand, the data extracted by Ridho can be used by Vincent to write papers that interrogate the network characteristics. Simultaneously, this data processing can be used to formulate quantitative statements about the composition and coherence of elites, based on specific operationalizations. On the other hand, Jacky can draw on Vincent's work in her own argument in such a way as to contribute to theorizing in elite studies, namely by using the comparison of different operationalizations to mutually problematize these operationalizations, or by comparing it with the conceptualizations of elite as developed through interviews with the represented actors. The structure of this argument puts to use the computationally extracted data while still accommodating Jacky's hermeneutic agency. The second approach, the one relying on sentiment analysis, has yet to prove its feasibility. Technology here is instrumental in conferring the interpretive flexibility that defines a boundary object. The hope is that fine grained NLP allows for Vincent to conduct his statistical analyses while accommodating the type of hermeneutic questions Jacky is interested in.

Key features of the unfolding collaborative process in the early phase of ENS thus have been reflexivity and emergence. The process is reflexive insofar as it entailed uncovering a problematic assumption in the original research proposal (namely that data can be straightforwardly used as a link between disciplines), as well as highlighting an important constraint (namely that data analysis for Jacky must be combined with a hermeneutically oriented approach that is viable for Indonesianist disciplinary audiences). The process is emergent insofar as a viable collaborative modality has been developed through iteration: from an early attempt to structure organization on the basis of a universalist notion of data towards a more differentiated view and specific solutions for how to make the dataset function as a boundary object. An interesting side effect of this development is that, rather than stabilizing a singular fact about elite shifts in Indonesia, the project is simultaneously producing different knowledge claims, which mutually highlight the limitations of each other: statistically derived claims about elite shifts co-exist with and complement the

hermeneutic reflection on the very meaning of 'elite'.⁵⁰ Creating boundary objects in ENS thus entailed a reflection on the epistemological constraints of individual hinterlands, much like the reflexivity Law (2004) calls for. The very diversity of the involved hinterlands in fact functioned as a driver of reflexivity. A collaboration only between IR and network researchers would not have required the same effort at decomposition to arrive at a viable division of labor, given the praxeological continuity between those fields.

Decomposition and cyberinfrastructure design

In the above case study, I have tried to illustrate how the decomposing of disciplinary research processes potentially can yield viable interdisciplinary arrangements in computational humanities. By emphasizing the role of reflexivity and emergence, I have meant to promote an approach that leverages disciplinary specificities in the creation of boundary objects, rather than framing them as a problem that needs to be countered by treating data as atoms. The research policy discourse on cyberinfrastructure initiatives is indeed still very much informed by such a neo-positivist approach, as discussed in the previous theoretical section. At the same time, there are a number of projects that indicate greater awareness of the type of conflicts that this tends to produce. These recent, more context-sensitive initiatives are based on a reflexive approach that bears some similarities to my notion of decomposition. Although this is certainly an interesting development, in this section I critically interrogate to what extent it is actually possible to combine reflexivity and emergence with the creation of large-scale cyberinfrastructure.

A case in point is the agenda-setting paper by Anderson et al. (2010), which illustrates the design principles underlying the European cyberinfrastructure project DARIAH. Anderson et al. (2010: 3782) explicitly acknowledge earlier critique on data-driven approaches to creating digital research facilities for humanities scholarship (Beaulieu & Wouters, 2009). Cyberinfrastructure initiatives, they argue, can only be successful if they acknowledge the specificities of humanities scholarship in comparison to the sciences, as well as the need to involve prospective users in the planning

⁵⁰ Fujimura (1992) argues that such a co-existence of competing knowledge claims is characteristic of organizing shared research activities around boundary objects. Far from being an obstacle, I suggest, such 'incommensurability' can be seen as a productive irritant for further research.

process. The design of DARIAH itself is based on the interrelated concepts 'methodological commons' and 'scholarly primitives'. The assumption here is that disciplinary research processes can be decomposed in such a way as to filter out processual elements that are shared across all the humanities. Once such elements are identified, they can provide the basis for designing universally applicable digital research tools, dubbed 'methodological commons' (McCarty & Short, 2002). Anderson et al. take their clues from the work of digital humanities pioneer John Unsworth (2000), who first proposed building infrastructural facilities for digital scholarship around 'scholarly primitives'. These include basic functions such as annotating, comparing, referring etc. However, in the understanding of Anderson et al., the primitives identified by Unsworth are still too idiosyncratic for the goal of a really pervasive cyberinfrastructure. They propose to break them down into even more basic processual elements:

(...) rather than Unsworth's focus on building tools to support discrete practices embodied by the primitives, [this approach] allows us to see scholarly primitives as part of a wider set of activities that could be translated into a set of functions for building a coherent research infrastructure that supports a chain of related activities. For example, we can start to visualize how the scholarly activity of searching, which includes at a lower level of granularity chaining and browsing, and the scholarly activity of collecting, which includes gathering and organizing, could combine to form a linked data infrastructure that allowed researchers to create their own dynamic representations of knowledge from the data deluge that is the Web (Anderson et al., 2010: 3875).

Although not operating with a universalist notion of data, Anderson et al.'s approach thus is still a functionalist one. It presupposes that the totality of scholarly research processes is reducible to a finite set of shared tasks, which can then be partially automated. It is tempting to think of this approach not so much as uncovering pre-existing, universal elements of the scholarly process, but as being instrumental in establishing the universality of these tasks in the first place.

Collins and Kusch (1998) in fact propose thinking about the promulgation of scientific discoveries as an unfolding 'sociology of sameness'. In order to become acknowledged as discoveries, scientific results have to be accompanied by descriptions of repeatable experimental

setups. These indicate how scientific instruments must be configured and used so as to reproduce the 'same' reported findings (Collins, 1985; Shapin & Schaffer, 1985). If deemed convincing, such descriptions help to create collective indifference by the receiving community of scientists to some specific variations in that setup, while at the same time enacting the singularity of the demonstrated phenomenon. This, one could argue, is precisely the effect of designing cyberinfrastructure around scholarly primitives. For example, by assuming that all research processes in the humanities contain the organizational blocks chaining and browsing, Anderson et al. aim to establish a standardized practice of searching. This could create indifference to subtle variations in the practice of searching, but it would also be related to establishing a standard conceptualization of the object that is being searched. The only difference between the promulgation of scientific discovery and the design principle underlying methodological commons is that in the former case, the establishment of sameness is brought about by peer-review and disciplinary acknowledgment, while in the latter case, it is driven by a managerial interest in efficient design of instrumentation. The above case study, however, cautions us to expect substantial friction occurring in the process. Individual disciplinary understandings of 'searching' might be very different from one hinterland to another, provided that they are even explicitly differentiated as an organizational block in the first place. This could create precisely the sort of tension between the need to maintain functioning connections between the newly differentiated process and disciplinary expectations that was initially experienced in ENS, yet with much more limited possibilities to engage in iterative refinement of the decomposition.

To be sure, Anderson et al. (2010) are explicitly concerned with notions of emergence and 'mutual shaping' of technology and its users. Referencing the widely cited literature review by Williams and Edge (1996), they assume that the uptake and actual use of new technology is informed by a complex interaction with the epistemology and social context in a given discipline. Anderson et al. present primitives as a way to organize 'trading zones' around specific digital services and objects (Galison, 1997). Conceptually similar to boundary objects, these trading zones concede potential users some leeway in integrating these shared services and objects into their practices, which the authors assume reduces the friction between extant disciplinary customs and the prespecified purposes. At the same time, Anderson et al. claim that the proposed primitives describe actual basic elements in all humanities research processes. This allows redundant

investments to be avoided in linked-data tools that support the 'same' function.

Trying to reconcile a commitment to mutual shaping with the approach of designing infrastructure around primitives inevitably creates a certain tension. Mutual shaping stresses the emergent character of technology-in-use, whereas primitives are supposedly pre-existing elements of research processes across all fields. Anderson et al. can only deal with this tension by disproportionately emphasizing one specific aspect of the concept mutual shaping. Originally developed to replace techno-deterministic views in which technology is primarily seen to shape the users, the concept stresses that shaping indeed works both ways: technologies shape users in the sense of offering new possibilities; but at the same time, users always adapt technologies to local contexts and needs, rather than following prespecified uses intended by the designers (Bijker et al., 1987). In the use of Anderson et al., mutual shaping primarily seems to mean that scholars are not determined by current disciplinary customs, and that they are in principle free to realize the promise of methodological commons, if only they are willing. Although this is not a straightforward contradiction to mutual shaping, it does confer it a certain normative undertone. Mutual shaping comes to denote something of an encouragement to the users to conform to the holistic managerial values that inform the notion of methodological commons. Ironically, rather than to unpack the tensions that emerge from the attempt to design cyberinfrastructure around discipline-agnostic organizational objects, a theoretical key concept from STS here is applied in a way that tends to black-box those tensions.

Postscript to chapter 3

A core argument of this thesis is that the adoption of digital approaches in the humanities should not be thought of in terms of a 'diffusion' of novel analytical techniques from data-intensive into data-sparse fields. Rather, I have argued that it is best understood as a process of mutual adaptation of technology and infrastructurally embedded, disciplinary cultures. Digital practices will only become properly incorporated if they allow scholars to maintain functioning connections to inert disciplinary conventions. Drawing on a metaphor from infrastructure studies (Edwards, 2010; Edwards et al., 2011), I have suggested to think of the inevitable tension that arises in such reengineering attempts as friction. On the one hand, friction can reach unmanageable levels and so lead practitioners to abandon either their 'home discipline' or the experimentation with digital methods. It can also function as input for a reflexive learning process, however, thus ultimately paving the way for a workable compromise between the infrastructural status quo and novel technological affordances.

My field work in the Elite Network Shifts project has allowed me to study in detail the work that is necessary to accommodate different epistemic traditions in an interdisciplinary collaboration. The process can be summarized in two phases. In a first phase, participants recognized that the division of labor foreseen in the foundational research proposal was based on problematic assumptions, namely on the notion that data can act as a sort of a mechanical link between the task areas of the computer scientists and scholars of Indonesian studies. The proposal foresaw that the hermeneutic question of the humanists can essentially be reframed as an empirical problem, to be solved by sufficient amounts of data. When reporting early findings to their peers, however, the participating indonesiansts had to acknowledge that this approach was not compatible with dominant disciplinary conventions - for other scholars of Asian studies, a paper reporting only the results of a quantitative analysis of patterns in co-occurring names of elite actors did not in itself appear as a viable research contribution, since it failed to engage with ongoing discussions about the proper theoretical conceptualization of political power. In a second phase, the participants therefore began to reflect on differences in the actual role empirical material plays in their specific disciplinary traditions. Increasingly, their aim shifted from generating singular research findings according to the conventions of computer science and network research to juxtaposing and comparing quantitative and hermeneutic ways of framing the underlying notion of power. This has allowed the participants to collaborate in the

project while also respecting disciplinary expectations regarding the format and style of publications, which in turn is a precondition for advancing in the academic career system.

My argument that digital modes of scholarship are most productive when they do not imply a radical departure from the infrastructural status quo may seem counter-intuitive to those who think that the value of novel technology lies exactly in enabling 'breakthrough' type of research. To be sure, new tools may indeed help to generate radically innovative insight. I would argue, however, that such novelty will rarely arise from a paradigm shift that was planned on paper. A more promising policy for innovation in scholarly method is to conceptualize the incorporation of computational techniques in the humanities as a situated activity, with enough room for experimentation and perhaps failed attempts. In such a view, significant changes in the approach or goals of a given project – for example, radically downsizing its empirical scope when the necessary amount of data work cannot be provided, or admitting mutually contradictory knowledge claims within a single collaborative undertaking - would not be considered as a sign of inefficiency or imperfect preparation, but rather as a necessary part of the mutual adaptation of digital tools and different disciplinary practices. Such a policy might also have consequences for the way researchers themselves perceive friction in interdisciplinary work. In fact, whether friction prompts practitioners to quit experimenting with novel methods, or is rather seen as a necessary element of the process, will be strongly influenced by the organizational and administrative culture underlying the collaboration. If significant changes in a project are admissible, chances are higher that practitioners may still work towards interesting results, rather than (perhaps prematurely) abandon costly projects and write them off as failures.

