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Affordances and limitations of algorithmic criticism

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Chapter 10

Conclusion

10.1. Introduction

This thesis has established a number of salient characteristics of algorithmic criticism, and has explored some of the ways in which algorithmic processing of textual data may expand or curtail interpretative possibilities. It has been explained that machine reading entails a consistent and context-independent form of processing which can result in abstracted renditions of individual texts and of text collections in their entirety. As was demonstrated in the discussion of the central case study, the statistical resources and the visualisations that can be created through algorithmic analyses can often lead to fresh perspectives and to new ideas about literary works. The properties of algorithmic criticism that have been discussed in the previous chapters are likely to affect the broader field of literary studies in a variety of ways. Section 10.2 ruminates on some of the fundamental ways in which algorithmic criticism differs from conventional criticism. Four important differences can be identified: (1) it places a greater emphasis on practical work; (2) it lead to different forms of scholarly output; (3) it results in new ways of discovering texts with noteworthy characteristics; and (4) it can supply different types of arguments to support scholarly claims. It is important to stress, nonetheless, that there are also a number of important continuities: (1) the ways in which digital technologies are implemented are strongly marked by a subjectivity; (2) it uses both inductive and deductive methods; and (3) scholars continue to bear the responsibility to evaluate whether or not the methodology adequately supports the discipline's central scholarly objectives. The main similarities are discussed in section 10.3.

Through this focus on the various ways in which technology affects literary scholarship, this study aims to answer to David Berry's and Alan Liu's calls for a more critical mode of digital humanities research. Such a critical approach ought to be attentive to "the digital component of the digital humanities in the light of its medium specificity, as a way of thinking about how medial changes produce epis-temic changes".⁵⁹⁹ By studying the various ways in which computational methods may affect existing conceptualisations of knowledge, this thesis also aimed to make a contribution to the emerging scholarly field of software studies. Basset explains

⁵⁹⁹ David M. Berry, "Introduction", p. 4.

that software studies “turns what were once understood as the supporting dimensions of digital culture to the fore, and takes as the central problematic the cultural operations of software, and in particular the relationship between language and code”.⁶⁰⁰ More broadly, software studies seeks to identify the essential characteristics of software systems and critically examines their social and political effects. Since, as is stressed by David Berry, “certain social formations are actualized through crystallization in computer code”,⁶⁰¹ it appears reasonable to assume that the use of computational methods can have important implications for scholarly practices within literary research. In evaluating the merit of using technology, it is crucial to consider whether or not new technologies can veritably enable scholars to ask new questions and to produce new forms of knowledge.

10.2. Changes

10.2.1. Practical work

An important difference between conventional criticism and algorithmic criticism is that the latter form of scholarship invariably demands work of a practical nature. Such practical work may entail, more specifically, the construction of a text archive, the preparation of a corpus of encoded texts, or the development or further refinement of tools for the analysis of digital materials. Scholars who aim to study texts via digital methods often face the difficulty that the sources they are interested in are not yet available in an authoritative machine-readable form. Digital scholarship, furthermore, depends crucially on tools with which these sources can be analysed. Since the analytic tools that are publicly available often concentrate on generic functions, or on collections of a limited size, they may not be suitable for differently focused research questions. Digital humanists often need to invest substantial amounts of time and intellectual efforts into the development of resources and instruments themselves, often in close collaboration with computer scientists or librarians. Digital humanities research demands two distinct classes of activities, which Jerome McGann characterises as a bifurcation between “conceptual undertakings (gnosis)” and concrete “constructions (poeisis)”.⁶⁰²

Despite the fact that the creation of tools and resources is often very labour-intensive, the development of such digital artefacts is not always recognised fully as a legitimate form of humanistic scholarship. It is often difficult for scholars to make the results of digital work count in assessments of scholarly productivity, as these traditionally privilege textual publications. Practical work is often viewed as a mere preparatory activity, necessary as a support for the more critical analysis that

⁶⁰⁰ Caroline Basset, “Canonicalism and the Computational Turn”, p. 119.

⁶⁰¹ David Berry, *Critical Theory and the Digital* (London: Bloomsbury Publishing, 2014), p. 83.

⁶⁰² Jerome McGann, *Radiant Textuality: Literature after the World Wide Web*, p. 83.

take place at a later stage. Such a stance is misguided, however, as digital resources and tools generally demand critical analysis and intellectual exertions in themselves. Projects which aim to create scholarly digital resources frequently face a plethora of fundamental challenges which, in many cases, may only be addressed through a reference to more fundamental theoretical frameworks or concepts. Applying TEI, for instance, requires a deep understanding of the material that is encoded, and of the overall scholarly benefits that may be reaped from such editorial and critical interventions. Scholars who construct tools often need to take decisions about vocabulary, about the user interface or about the logic of algorithms, and such judgements are invariably based on theoretical assumptions.

While practical work often demands the construction of a prior theoretical framework, praxis can conversely lead to novel theoretical insights. McCarty stresses that the act of building also has epistemological value in itself. Modelling is “the continual process of coming to know by manipulating things”.⁶⁰³ Eventually, applications ought to function unobtrusively, but, before a tool can attain such a state of translucency, there is mostly a phase during which developers and adopters still question whether or not the tool can reliably and effectively be used to answer a question. When the algorithms that are implemented in a tool are applied to a corpus, this often exposes precisely those points on which the theoretical modelling misrepresents the actual situation. Such technical exigencies may necessitate a reconsideration of the logic that underlies a tool. The version that eventually emerges from the various alpha and beta versions may be seen as the conclusion that is drawn from these experiences. In this way, the development of an instrument contributes to a fundamental understanding of the nature of the task. Experimentation may reveal that particular aspects cannot be mapped directly to the strict information structure that is imposed by the computer, and creating a model is often “useful for isolating what gets lost when we try to specify the unspecifiable”.⁶⁰⁴ Julia Flanders views digital scholarship similarly as a form of translation. To be able to process artefacts digitally, parts of the existing discourse about cultural objects need to be converted to statements in a highly rigid and formalised language, and this often effectuates an estrangement. Paradoxically, the disunity between these different modes of expression can also be productive, as the assiduous work that is often needed to create the model invariably leads to an improved understanding of the activity that is modelled.⁶⁰⁵

In a more traditional form of research, the utility of computational methods would be investigated via an examination of the works of literary theorists, and by speculating subsequently about the obstacles that could arise if some of these critical activities are automated. An approach which fully evades practical work,

⁶⁰³ Willard McCarty, *Humanities Computing*, p. 28.

⁶⁰⁴ *Ibid.*, p. 25.

⁶⁰⁵ Julia Flanders, “The Productive Unease of 21st-Century Digital Scholarship”, pp. 13–14.

and which is exclusively theoretical in nature is inadequate in studies which focus on the impact of the digital medium. Johanna Drucker emphasises that “abstract theory and critiques of the foundation of textuality in the terms of older philosophies” are in themselves insufficient to explain the type of knowledge that can be produced by digital tools.⁶⁰⁶ To develop an understanding of the digital medium, an active involvement with the digital medium is indispensable. Such hands-on work is necessary because of the tacit nature of computing skills. In *Personal Knowledge*, Michael Polanyi argues that a proficiency in a practical skill entails a “tacit and passionate contribution of the person knowing what is being known”.⁶⁰⁷ Tacit knowledge cannot be transferred via writing, and needs to be acquired in a practical setting and via experience. An understanding of the possibilities and the limitations of computer-based scholarship crucially demands an active engagement with coding. Algorithm-based analyses of textual materials frequently produce results that could not easily have been predicted or envisaged on the basis of theory alone.

Practical work enables scholars to produce knowledge about the methodology of the field. Text analysis tools generally advance an argument, often implicitly, about the textual aspects that are of relevance, about the manner in which these aspects can be recognised, and about the manner in which these aspects, once quantified, can be further processed. The development of a software tool for the automated discovery of literary allusion, for instance, demands tasks which are very similar to the type of work that would be needed for authoring a discursive scholarly text about the general nature of literary allusions. The construction of tools demands a precise definition of terminology and a clear hypothesis about the manner in which the phenomenon can be identified.

Next to providing support for the actual analysis and interpretation of literary works, algorithmic criticism additionally aims to evaluate whether or not innovations in the field of language technology can usefully be applied to study questions of literary criticism. The nature of the practical work that is performed within literary informatics is often very dynamic, as algorithms for the exploration of texts evolve incessantly. Computer science continues to annex territories in areas which were previously considered impermeable. Literary scholars with an interest in computing continually need to remain abreast of technological advances, and need to adjust their understanding of the type of data that can be produced about texts. More pertinently, they must also evaluate, on a more fundamental level, whether or not such technical innovations can genuinely extend the possibilities for understanding the value and the meaning of literary texts.

⁶⁰⁶ Johanna Drucker, “Theory as Praxis: The Poetics of Electronic Textuality”, in: *Digital Poetics*, Tuscaloosa: University of Alabama Press 2002, p. 683.

⁶⁰⁷ Michael Polanyi, *Personal Knowledge Towards a Post-Critical Philosophy*. (Chicago: University of Chicago Press 1958), p. 329.

Unlike literary interpretations, the knowledge that is produced about methods and about tools can often be falsified. The correctness of algorithms for the recognition of literary devices can be assessed, for instance, by comparing the expected results to the actual results, and, more precisely, by considering the level of precision and the level of recall. If it is accepted that the utility of text analysis tools can be assessed unequivocally, the field of literary informatics differs in an epistemological sense from the field of literary criticism. In this thesis, it was accepted that literary criticism does not aim to address questions via a single conclusive answer. Its primary aim is to continue a discussion about literary works, and new interpretations do not necessarily aim to invalidate previous interpretations. Chapters 6 and 8 of this thesis contain detailed discussions of the methodology that was followed, and this information was included in an attempt to contribute progressively to a knowledge about the nature and the value of algorithmic criticism.

10.2.2. Different scholarly output

The observations that practical work is generally based on theoretical assumptions, and that praxis is necessary to produce new theoretical insights, do not necessarily lead to the conclusion, however, that the non-textual resources that result from practical work can also function independently as a resource which can disseminate these theoretical insights. The act of modelling a physical object or a heuristic activity can in itself produce knowledge about the object or the activity being represented, but it is unclear if granting access to the software tool in which the model is implemented, or to a visualisation in which data is presented, simultaneously grants access to this knowledge. The humanities, like any other discipline, have developed standards for the ways in which knowledge may be communicated. The outcomes of enquiries are traditionally expounded in the form of discursive writing, and numerous authors have stressed that this is also the most effective channel.

This dominance of textual resources is increasingly being undercut within the digital humanities. Schnapp et al. argue that the digital humanities consists of “an array of convergent practices that explore a universe in which print is no longer the exclusive or the normative medium in which knowledge is produced and/or disseminated”.⁶⁰⁸ Rockwell and Ramsay likewise draw attention to the fact that software tools can be viewed as resources which can independently proclaim a theory. In an attempt to establish “a materialist epistemology sufficient to the task of defending building as a distinct form of scholarly endeavour”,⁶⁰⁹ the authors

⁶⁰⁸ Jeffrey Schnapp, Peter Lunenfeld & Todd Pressner, *The Digital Humanities Manifesto 2.0*, p. 2.

⁶⁰⁹ Stephen Ramsay & Geoffrey Rockwell, “Developing Things: Notes Towards an Epistemology of Building in the Digital Humanities”, in: Matthew K. Gold (ed.), *Debates in the Digital Humanities*, Minneapolis: University of Minnesota Press 2012, p. 77.

argue that software tools are “hermeneutical instruments through which we can interpret other phenomena”. Like conceptual theories, digital tools enable scholars to deal with complexity by offering principles or guidelines to impose order on unorganised observations and to expose specific patterns or general qualities. Because of this quality, “text analysis and visualization tools are theories in the very highest tradition of what it is to theorize in the humanities”.⁶¹⁰ Rockwell and Ramsay also argue that software applications can convey scholarly knowledge, as they can communicate specific ideas about the validity or the utility of innovative ways of presenting content. The digital humanities are centrally concerned with the development of new possibilities for engaging with the human record. While such new vistas may be described in words, the statement clearly gains rhetorical force when the ideas are actually embodied by a working application. The authors conclude that tools can prove a concept and that they can posit a thesis independently.

If software applications are to be recognised as genuine acts of scholarship, this demands a possibility for peers to critically respond to the argument that is presented. Mark Sample explains that “a creative or intellectual act becomes scholarship when it is public and circulates in a community of peers that evaluates and builds upon it”.⁶¹¹ Galey and Ruecker argue along similar lines that a digital artefact can be conceptualised as a scholarly object if it advances an argument, and, additionally, if this argument can be interpreted independently from any textual resources in which the resource is described. The authors’ central proposition is that scholarly tools, like textual publications, can be subjected to peer review. Galey and Ruecker have developed a checklist which peers can use during the evaluation of digital tools. Amongst other criteria, it is stated that software tools ought to reify arguments which are “contestable, defensible, and substantive”, it ought to have “a recognizable position in the context of similar work” and it should address possible objections.⁶¹²

A theory that is expressed in code differs in a number of important ways, however, from a theory that is communicated in a discursive text. One crucial complication is that tools do not explicitly state their argument. The aims of the tools and the intentions of the developers mostly need to be decoded via a critical examination of the tool. The functionalities which are offered can often be gauged through actual usage, but to reconstruct the logic that is implemented, it is often necessary to have access to the source code. This code may be viewed as the modality in which the developer’s insights are expressed. This communication via code limits the reading audience to readers who have a degree of proficiency in the

⁶¹⁰ Stephen Ramsay & Geoffrey Rockwell, “Developing Things: Notes Towards an Epistemology of Building in the Digital Humanities”, p. 79.

⁶¹¹ Mark Sample, “When Does Service Become Scholarship?”, <http://www.samplereality.com/2013/02/08/when-does-service-become-scholarship/>., n.pag.

⁶¹² A. Galey & S. Ruecker, “How a Prototype Argues”, in: *Literary and Linguistic Computing*, 25:4 (27 October 2010), p. 414.

programming language that was used. A more serious difficulty, however, is that, even to those who can read the code, the tool can only ever reflect the intellectual efforts that were put into its development in an incomplete manner. Ramsey and Rockwell note that digital artefacts are often “insufficiently open about their theoretical underpinnings”.⁶¹³ In a discursive text, it is generally possible to admit to specific shortcomings or limitations of a theory, or to describe initial avenues of thinking which later proved to be unsuccessful. For a full and balanced evaluation of the reasoning that was followed, failures are usually as valuable as successes. Like scholarly arguments, algorithms have mostly evolved through cycles of trials and refutations, but, when initial bugs and flaws are removed, other scholars only have access to the version in which a functionality has been implemented successfully. When programmers make use of version management software, such trials and refutations can potentially be reconstructed by carefully comparing the different historical versions of the code. In most cases, however, such a contrastive comparison can highlight the changes, but not the motivation behind these changes. Tools generally contain a conclusion only, and no arguments in support of this conclusion. As a result, it is often difficult for peers to understand the reasoning that was followed during the creation of the code. Furthermore, the code in itself generally lacks information about the success rate of the algorithm. It may be the case, for instance, that the tool functions properly only in a limited number of cases.

As code cannot convey the full genesis nor the full rationale of an argument, such aspects need to be communicated via other channels. Fabretti suggests that software ought to be defined broadly as “the totality of all computer programs as well as all the written texts related to computer programs”. This definition covers not only the user interface and the underlying source code, but also the technical documentation and “the whole of technical literature related to computer programs, including methodological studies on how to design computer programs”.⁶¹⁴ The latter class of resources may be referred to as the epitext of software applications.⁶¹⁵ If such an expansive conceptualisation is accepted, the difficulties surrounding the legibility of software can be examined more effectively. Textual documentation about software is often necessary to outline particular misconceptions that may have existed prior to the full maturation of an algorithm. The applications in themselves usually lack a discussion of the assumptions that were held during the production process. They rarely convey a critical evaluation of their own performance.

⁶¹³ Stephen Ramsay & Geoffrey Rockwell, “Developing Things: Notes Towards an Epistemology of Building in the Digital Humanities”, p. 80.

⁶¹⁴ F. Fabretti, “Have the Humanities Always Been Digital?”, in: David Berry (ed.), *Understanding Digital Humanities*, Basingstoke: Palgrave Macmillan 2012, p. 165.

⁶¹⁵ Gerard Genette & Marie Maclean, “Introduction to the Paratext”.

Since the digital humanities, to a large degree, focus on the development of methodology,⁶¹⁶ publications which explain and motivate why particular decisions were taken, and why specific alternatives have not been pursued, can serve an important function. Texts about the accuracy of tools promote a degree of transparency which is necessary for the evaluation of their suitability. Within humanistic discourse, texts which discuss the nature of algorithms are commonly regarded as being of a lesser rank, nevertheless. Scholars whose focus is predominantly on the formation or the application of theoretical concepts may presume that detailed ruminations on technical details do not belong naturally within the humanities, and may assert that questions associated with the extraction of data ought to be addressed instead within fields such as computer science or information science. The development of a method is sometimes viewed as a purely banal activity, needed primarily as preparation for more evaluative work. While technical documentation is often viewed as a by-product of practical work, it seems clear that progress in the field of algorithmic criticism depends crucially on shared knowledge about the suitability of methods. De Roure notes that it is pivotal to share information on the methods by which results are generated. Such workflows used to produce a result “provides our route to repeatability, reproducibility and reuse”. When such workflows are shared, they can also be “discussed and reviewed, reused and repurposed”. De Roure also stresses that formal descriptions of workflows “are in many senses a new form of scholarly publication”.⁶¹⁷

Algorithms for the analysis of literary texts are currently still under development, and, to ensure that such work can be done effectively, it is crucial for scholars to share their insights about the accuracy of digital tools in scholarly texts. Scholars should contribute actively to the development of tools, so that they are not demoted to the role of mere observers. Through practical work, humanities researchers can ensure that technology is genuinely supportive of their research questions. Willard MacCarthy notes that experimentation places scholars “not merely in a position of witnesses or guessers but in the role of makers for whom the emergent potentialities of the medium constitute essential information”.⁶¹⁸

⁶¹⁶ Tom Scheinfeldt, “Where’s the Beef? Does Digital Humanities Have to Answer Questions?”, in: Matthew H. Gold (ed.), *Debates in the Digital Humanities*, Minneapolis: University of Minnesota Press 2012, p. 125.

⁶¹⁷ To support the sharing of workflows, Goble and De Roure have built the myExperiment website (www.myexperiment.org), which is “a social network of people sharing reusable methods for processing research data, in various research communities from bioinformatics and chemistry to climate change and digital humanities”. It provides methods for the analysis of data. See David De Roure, Carole Goble & Robert Stevens, “The Design and Realisation of the Virtual Research Environment for Social Sharing of Workflows”, in: *Future Generation Computer Systems*, 25:5 (2009).

⁶¹⁸ Willard McCarty, “Introduction”, in: Willard McCarty (ed.), *Text and Genre in Reconstruction: Effects of Digitalization on Ideas, Behaviours, Products and Institutions*, Oxford: Open Book Publishers 2010, p. 4.

Literary informatics, in conclusion, lead to different types of scholarly output. On the one hand, it results in a range of non-textual resources which expound their claims, mostly about their methodological assumptions, in an implicit form. On the other hand, the field also results in different types of textual publications, which document and which scrutinise the nature and the genesis of practical applications. Chapter 6, 7 and 8 of this thesis may be viewed as examples of this latter class of scholarly texts.

10.2.3. Different form of discovery

Machine reading enables scholars to observe patterns within collections in their entirety. The abstract phenomena that are observable at the macro-level are particularly valuable for studies in the field of literary history, of which Moretti's experiments with distant reading form clear examples. Visual representations of data can enable scholars to effectively investigate the synchronic or diachronic developments in phenomena such as genres or literary productivity. As has been explained, however, algorithmic criticism employs machine reading in support of literary criticism, which is a line of research which centrally aims to expose the unique properties of a singular work of literature. Within the context of literary criticism, a bare form of number crunching, which fully distances itself from the contents of the texts, is generally insufficient. The main value of abstract representations of collections lies in the fact that they can inspire more focused forms of readings at the microlevel. Exceptional data values can mostly be explained only by examining actual fragment in the texts which have produced these values. Martin Mueller argues that, while algorithmic processing can be applied initially to expose rough patterns within the corpus as a whole, the eventual aim of these abstractions is to suggest fragments which can subsequently be examined in more detail. Mueller uses the term "scalable reading" to describe the possibility to explore aspects of the corpus at different levels.⁶¹⁹

Scholars who make use of digital methods to address the predicaments that result from abundance relegate the responsibility of making selections to the machine. The aim of algorithm-based filtering is typically to discriminate texts with relevant characteristics, or to expose aspects of texts which can in turn lead to new ideas about these texts. Algorithmic criticism is based on a mediated reading⁶²⁰ in which algorithms are used to filter a text corpus. While the selection of texts often takes place haphazardly in analogue criticism, computation enables scholars to search methodically for texts which deviate from specific norms and which appear to warrant further reflection. Computational methods can mitigate the influence of

⁶¹⁹ Martin Mueller, *Stanley Fish and the Digital Humanities*, 2012, Martin Mueller, "Stanley Fish and the Digital Humanities", 2012, <<http://cscdc.northwestern.edu/blog/?p=332>> (12 March 2013).

⁶²⁰ Shawna Ross, "In Praise of Overstating the Case: A Review of Franco Moretti, *Distant Reading* (London: Verso, 2013)", in: *Digital Humanities Quarterly*, 008:1 (2014), n.pag.

existing canons and can highlight texts which are distinctive on the basis of statistic grounds.

Algorithmic filtering is particularly useful if it results in unexpected selections. A number of authors have argued, nevertheless, that the algorithms that are used to filter large data collections can also reinforce existing subjective prejudices. Responding to Negroponte's prediction, made in 1995, that newspaper companies would develop personalised newspapers which exclusively contain the articles that are of relevance to a particular reader,⁶²¹ Sunstein expresses the concern that such forms of personalisation may lead to "information cocoons" in which "we hear only what we choose and only what comforts and pleases us".⁶²² In the *The Filter Bubble*, Pariser alleges in a similar vein that the manner in which we consume information is increasingly being determined by intermediaries which filter and organise this information. A crucial aspect of the type of filtering that is applied by search engines and social media platforms such as Google, Facebook and Twitter, however, is that it largely takes place outside of the awareness of their users. Pariser argues that, when personalisation is based on previous queries, this reinforces and sustains existing behaviour. Filtering mechanisms hide information which is unfamiliar to us and "indoctrinat[e] us with our own ideas".⁶²³ When scholars devise their own algorithms, there may likewise be the risk that these mechanism spin an "information cocoon" in which the list of results unchangeably reflects the author's own interests. The particular algorithms that are chosen can subconsciously reinforce the existing preconceptions and expectations of the scholar. Ramsay argues that text mining in general is based on the assumption that the correct path towards the relevant information can be calculated. Such a logical and rational approach towards information retrieval may primarily produce results which are in step with a particular line of thinking. As such, text mining may frustrate serendipitous discoveries. As an alternative, Ramsay proposes a form of engagement which he refers to as "screwmenetics".⁶²⁴ Rather than enabling users to find objects via the process of filtering, digital libraries ought to facilitate an unrestrained navigation through the corpus. Users may have general interests, but they may not know beforehand which type of documents can actually meet these broad information needs.

The case study that was conducted as part of this thesis has shown, nevertheless, that machine reading can still lead to results which can unexpectedly

⁶²¹ Nicholas Negroponte, *Being Digital* (New York: Knopf 1995), p. 153.

⁶²² Cass Sunstein, *Infotopia: How Many Minds Produce Knowledge* (Oxford: Oxford University Press 2006), p. 9.

⁶²³ Eli Pariser, *The Filter Bubble : What the Internet Is Hiding from You* (New York: Penguin Press 2011).

⁶²⁴ Stephen Ramsay, "The Hermeneutics of Screwing Around; or What You Do with a Million Books", in: Kevin Kee (ed.), *Pastplay: Teaching and Learning History with Technology*, Ann Arbor: University of Michigan Press 2014.

initiate the thinking process. Due to the broad variability and the intrinsic unpredictability of literary phenomena, the results that are produced using a rule-based approach have error margins. For scholars who develop algorithms, it is generally impossible to foresee the full implications of a particular algorithm, and the results of such rule-based searches are likely to include unexpected text fragments. Whereas human beings often have a clear notion of what makes a text significant or interesting, algorithms can only compute. This stalwart focus on quantification, in combination with inherent imperfection of algorithms, may fortuitously lead to serendipitous discoveries.

10.2.4. Different types of arguments

Algorithmic criticism is based on an alternative form of reading in which literary texts are converted into qualitative or quantitative data. Such data are generally used to gauge the differences and the similarities between these texts. Via digital methods, scholars can describe aspects of texts which are imperceptible to scholars who concentrate solely on paper-based resources. Examples of such supplementary stylistic indicators include the type-token ratio of a text, the text's average number of syllables per word or the standard deviation in the use of perfect rhyme within an entire volume of poetry. Whereas human analyses tend to focus on relatively limited collections of texts and on a relatively small set of literary devices within these texts, machine reading is a wholistic or an embracing form of engagement in which the exact same types of metrics can be produced about the occurrences of widely diverse textual aspects such as repeated words, rhyme, grammar, metre and figures of speech. For human critics, it is generally difficult to be attentive to all of these aspects simultaneously, especially if some of these phenomena occur very frequently. Computer-based stylometric analyses may reveal, for instance, that the early work of a poet makes a very different use of pronouns than the later work of this poet. Such a distinction can be interesting from a critical point of view, but it is mostly strenuous to see such differences without computation. At the same time, it is also difficult for human readers to notice the absence of specific phenomena. Digital methods can easily establish, for instance, that some poems make a very extensive use of alliteration, while other poems are completely devoid of this device. Such relevant distinctions can easily be overlooked in conventional criticism.

Critics of the algorithmic approach often insist that these new forms of analyses rarely lead to relevant new insights, and that these methods merely confirm what is known or suspected already.⁶²⁵ In answering this criticism, it is important to emphasise, firstly, that algorithmic criticism does not develop new questions in itself.

⁶²⁵ Adam Kirsch, "Technology Is Taking Over English Departments: The False Promise of the Digital Humanities".

It needs to be viewed as a new methodology within the overarching field of literary studies, and it is meant to serve the same scholarly objectives. The aim of algorithmic criticism, like that of conventional criticism, is to arrive at a better understanding of the various aspects of literary works, such as their meaning, the relationship between form and content, and their relationship to other works in the same genre or literary period. Computational methods can be used to address questions which have likewise been investigated via conventional close reading, albeit in different ways. In the case study that was conducted for this thesis, for instance, a number of analyses have focused on the differences between MacNeice's poetry of the 1950s and the poetry written before and after this phase. When computational methods are applied to replicate traditional research, the findings of algorithmic criticism may either corroborate or repudiate the earlier findings. When quantitative analyses confirm what is known already, the very fact that a particular observation is confirmed by a fastidious computer-based analysis clearly adds authority to the scholarly claim. Because of the general differences in the overall methodology, because of the absence of subjective preferences for particular texts, and because of a general lack of knowledge about the historical or social context in which texts have originated, digital methods invariably answer these existing questions in fundamentally dissimilar ways.

The opposite situation, in which the results of computational methods contradict existing convictions, can be equally productive. Hugh Craig explains that the results of statistical processing can be especially interesting if they are surprising. Paradoxically, he expects to be "reassured by seeing patterns already familiar from the way texts are usually discussed, yet also to be surprised so that they seem more than a restatement of the obvious".⁶²⁶ Conflicts between the expected results and the actual results may prompt scholars to find explanations for this discrepancy, and such additional analyses often lead to new ideas about the texts. As is also stressed by Jockers, the results of digital methods should not be viewed as conclusive evidence.⁶²⁷ Answers obtained via quantitative methods may be still be contested via qualitative arguments. Ramsay stresses similarly that statistical processing has no more "claim to truth" than traditional forms of analysis.⁶²⁸ Computational analyses can establish new perspectives from which texts can be analysed, and they can beneficially challenge accepted views. They can supply a range of new and disparate arguments which literary scholars may adopt to support and to undergird their scholarly claims.

⁶²⁶ Hugh Craig, "Stylistic Analysis and Authorship Studies".

⁶²⁷ Matthew Jockers, "So What?", *Matthew L. Jockers*,
<<http://www.matthewjockers.net/2014/05/07/so-what/>> (7 May 2014).

⁶²⁸ Stephen Ramsay, *Reading Machines: Toward an Algorithmic Criticism*, pp. 14–15.

10.3. Continuities

10.3.1. Subjectivity

While there are clear differences between close reading and machine reading, the case study that was conducted for this thesis also underscored an important similarity. Various authors have claimed that the digital humanities can initiate a transition towards a more scientific form of scholarship, and that the empirical and factual observations that can allegedly be generated by computers can serve as a corrective to the subjectivity and the idiosyncrasy that prevails in many humanities disciplines. Moretti has argued, for instance, that distant reading is a form of textual engagement which rests “solidly on facts”.⁶²⁹ Rieder and Rohle explain that the perception of objectivity of digital method derives from the positivist conviction that the use of instruments, and the resultant eradication of human bias, leads to “results with a higher epistemological status”.⁶³⁰ The claim that computational methods automatically replace the subjective response of the individual reader with an objective scientific rigour seems deceptive, nevertheless, as the process of data creation is often steered to a large extent by subjective views. Algorithms for the generation of data are essentially hypotheses which speculate on the manner in which specific textual phenomena may be recognised. Data about the frequencies of tokens, for instance, demand a prior conceptualisation of the term “word”. Different applications implement different rules for treating hyphenated words or compound nouns. Small modifications of these hypotheses may lead to widely different data. Algorithms ought to be viewed as cultural phenomena, as they are constructed by human software engineers who consciously or unconsciously take decisions on the types of results that they aim to produce. The phenomena which are annotated, moreover, do not constitute inherent properties of these texts. They are properties which scholars, working within a particular critical tradition, ascribe to these texts. Flanders and Jockers note astutely that “tools bring the data into existence, not just into view”.⁶³¹ The data that are produced by text mining algorithms do not necessarily have a higher degree of objectivity than annotations which are compiled manually.

Like the procedures for the creation of data, the ways in which data sets are analysed are frequently driven by idiosyncratic or project-specific preferences. Analytic procedures such as clustering and the calculation of correlations have largely been standardised, and, as a result of this, the use of these statistical operations is often associated with increased objectivity. Particular forms of statis-

⁶²⁹ Franco Moretti, *Distant Reading*, p. 44.

⁶³⁰ Bernhard Rieder & Theo Rohle, “Digital Methods: Five Challenges”, p. 72.

⁶³¹ Matthew Jockers & Julia Flanders, *A Matter of Scale. Keynote Lecture from the Boston Area Days of Digital Humanities Conference. Northeastern University, Boston, MA. March 18, 2013*, p. 16.

tical processing often bear the marks of individual proclivities, however. In the context of authorship attribution studies, for instance, researchers frequently eliminate specific variables from the analysis, in order to produce more compelling results. Scholars who explore texts statistically typically explore texts via different methods, and may notice that certain analytic methods yield more befitting results than other methods. As analytic methods are usually informed by specific expectations of what scholars hope to find, the results of statistical analyses should not necessarily be treated as irrefutable and objective evidence.

10.3.2. Alternation between inductive and deductive reasoning

Computational methods can in theory be applied to a corpus without any prior knowledge of the contents of the texts, and without any expectation of what these methods ought to yield. Analyses do not necessarily need to buttress a concrete research question, and they can initially be applied solely to search for specific patterns within the data. The fact that digital methods can be applied without a theoretical basis has frequently incited fierce criticism. Stanley Fish, for instance, repudiates the digital humanities in a series of blog posts for licensing free experimentation, and for attenuating the relevance of central research questions. Fish surmises that, while initial theories and hypotheses serve as indispensable search lights in humanities research, the focus within the digital humanities on the creation of abstract patterns which cannot be perceived directly by human readers impedes the formation of initial hypotheses. Since it is impossible to know beforehand which patterns will be produced by computer applications, the research cannot begin “in a motivated — that is, interpretively directed — way”. According to Fish, unmotivated experiments bear the risk of exposing “a correlation between a formal feature the computer program just happened to uncover and a significance that has simply been declared, not argued for”.⁶³² The unmotivated forms of research which are rejected by Fish are exemplified by the studies which are described in Chris Anderson’s essay “The End of Theory”. Anderson depicts explorations in which researchers randomly apply statistical procedures to big data sets, to find out only afterwards which hypotheses their results may support.⁶³³

The form of research that Fish advocates is essentially deductive in nature. Deduction departs from a central hypothesis, and aims to find data in support of the suggested proposition. Induction, by contrast, starts with the collection of observations, and aims to extract general principles or explanatory theories from these data. It is specious, however, to suggest that traditional research is exclusively deductive and that research driven by digital methods is exclusively

⁶³² Stanley Fish, “Mind Your P’s and B’s: The Digital Humanities and Interpretation”, *New York Times*, 2012 <http://opinionator.blogs.nytimes.com/2012/01/23/mind-your-ps-and-bs-the-digital-humanities-and-interpretation/?_r=0>, n.pag.

⁶³³ Chris Anderson, “The End of Theory: The Data Deluge Makes the Scientific Method Obsolete”.

inductive. Kell and Oliver stress that deduction and induction ought to be viewed as complementary and equally valuable methods for producing knowledge, and note that most disciplines make use of a combination of inductive and deductive methods.⁶³⁴ This is clearly the case for literary research as well, as a literary scholar rarely begins to read a new book with a fully developed hypothesis. In a first exploratory reading, critics usually search for remarkable passages or for specific reoccurring features. This initial examination may be viewed as an example of induction. On the basis of the qualities that were observed during the first reading, the scholar may develop a theory about this work, which can then be investigated in a deductive mode during subsequent, and more focused, encounters with the text.

Literary informatics research can likewise follow both inductive and deductive approaches. As was demonstrated during the case study that was conducted for this thesis, digital methods do not necessarily need to be motivated by an antecedent conjecture, and theoretical explanations can follow the formation of patterns. During initial explorations, scholars can cast their nets very widely and apply many different analytic techniques in a seemingly random manner, in order to generate patterns which can spark novel ideas. It is important to stress that such exploratory experiments seldom take place in a critical vacuum. In general, analyses can be productive only if they depart from a prior suspicion about relevant correlations and about meaningful patterns. The very design of experiments is generally based on a concrete research interest and on an initial curiosity. Researchers, importantly, need to take decisions on the texts that need to be compared, or on the variables that need to be correlated. A degree of knowledge about the general nature and the context of the corpus is clearly necessary to understand what makes patterns interesting in the first place. Dan Dixon shrewdly observes that this particular way of producing knowledge forms an adequate example of the general process which C.S. Peirce's referred to as abduction. Peirce proposed the term to formalise the hunches, suspicions and hypotheses that can be generated via the recognition of patterns and correlations in data collections. Kell and Oliver view abduction as a specific form of induction. Abduction is a random or haphazard process which is not based on logic, on formal rules or on a prior hypothesis.⁶³⁵ As such, abductive reasoning curtails the preponderance of traditional research interests, and can function as a catalyst for neoteric ideas unskewed by conventional conceptions.

⁶³⁴ Douglas B. Kell & Stephen G. Oliver, "Here Is the Evidence, Now What Is the Hypothesis? The Complementary Roles of Inductive and Hypothesis-Driven Science in the Post-Genomic Era", in: *BioEssays*, 26:1 (2004). According to Kell and Oliver, mathematics forms the only exception, as this area of research is exclusively inductive.

⁶³⁵ Dan Dixon, "Analysis Tool or Research Methodology? Is There an Epistemology for Patterns?", in: David Berry (ed.), *Understanding Digital Humanities*, Basingstoke: Palgrave Macmillan 2012, pp. 201–202.

By contrast, scholars can also design experiments specifically for the purpose of trying to corroborate or to refute pre-defined hypotheses. Contrary to what is claimed by Fish, the fact that scholars cannot know beforehand which patterns will be produced does not mean that they cannot perform experiments in support of a specific theory. Because algorithmic analyses can produce highly unexpected results, they often encourage a critical reflection on these hypotheses. It is often the case that experiments which flow naturally from a central hypothesis do not yield any meaningful results. The absence of such results can inspire scholars either to experiment with alternative analytic procedures, or to revise the initial theory. Statistical processing may expose qualities of the corpus which previously eluded the frame of reference of scholars, and such serendipitous findings can often lead to new experiments, conducted in an inductive fashion. In turn, such altered insights may spawn entirely new hypotheses. Like conventional criticism, algorithmic criticism frequently consists of an alternation of inductive and deductive approaches.

10.3.3. Critical reflection on the methodology

Like scholars using conventional methods, researchers who base their analyses on computation carry the responsibility to evaluate whether or not the methods they use can genuinely serve the central scholarly objectives of literary studies. Matching methods to specific pre-determined goals can be challenging, as technologies often set specific demands. Adherents of the technological determinism theory would assume that users of technology are woefully incapable of shaping the nature of their tools. In this extreme situation, the research agenda would be ruled entirely by what seems possible from a technical point of view, rather than by what is desirable from the perspective of literary criticism. Research which is principally driven by what can be studied rather than what should be studied is compared by Martin Mueller to “the old joke about the drunk who is looking for his lost car key under a lamp post because that is where the light is”.⁶³⁶ The historian of science Thomas Hughes takes a stance which is less extreme, as he argues that users of technological systems often have a range of options concerning the way in which these technologies are applied. He emphasises, nevertheless, that technological systems can still “acquire momentum”⁶³⁷ at some point in their development. Under such conditions, opposing the dictates of technology is more exacting. Jacques Ellul argues along similar lines that technologies tend to be organised according to the “one best way”. Once it has been proven that a particular method ensures the maximal efficiency, it becomes more difficult to alter

⁶³⁶ Martin Mueller, “Digital Shakespeare, or towards a Literary Informatics”, p. 295.

⁶³⁷ Thomas Hughes, “The Evolution of Large Technological Systems”, p. 76.

the course of technological development. Ellul described this tendency of technology to become self-directing using the phrase “automatism of technical choice”.⁶³⁸

One of the central challenges within literary informatics is to move against the automatism that inheres in technological development. The digital technologies that are adopted by literary scholars are often accompanied by specific obligations or requirements which can have important consequences for the ways in which scholarly aims are realised. Using the TEI format, for example, demands a prior acceptance of the OHCO theory, and the use of RDF crucially demands what Stefan Gradmann refers to as “thinking in the graph”.⁶³⁹ Standardised text analysis tools similarly have the tendency to encourage particular types of research. They are typically based on textual aspects which can be detected with a degree of reliability, such as words, sentences or parts of speech. Because of this emphasis on formal textual aspects, text analysis tools often nudge scholars into the direction of stylometrics or authorship attribution research. They simultaneously discourage other forms of criticism, however, by not supplying any appropriate support. Tools invariably lack an out-of-the box support for performing feminist, Marxist, biographical or post-colonial readings of texts, for instance. Such forms of criticism may conceivably be boosted by creating a lexicon of terms with a Marxist connotation, or by building classifiers which can identify texts with a feminist slant, on the basis, for instance, of Naïve Bayes. Tools are crucially based on methodological and epistemological assumptions, and most of the existing text analysis tools implicitly assert the irrelevance of the critical approaches that are not supported. Scholars who identify such lacunae in the toolset ought to signal these shortcomings, and, if possible, they should carry out projects in which such deficiencies can be addressed. Without such a critical and practical engagement, the field will cease to evolve, causing a risk that particular approaches will be cemented as the disciplinary standard.

Algorithmic criticism demands programming skills and a proficiency in statistics, and such new competences are likely to have an impact on the manner in which scholars operationalise research questions. This development may potentially produce a number of undesirable effects. Wilkens fears that scholars who are frequently exposed to graphic renditions of data sets about text collections may partly lose their proficiency in traditional close reading.⁶⁴⁰ Digital methods may stimulate scholars to analyse literary works predominantly in a mathematical manner, and to address questions of literary criticism in a facile manner by reducing these to differences and similarities which can be calculated. Since text mining necessarily focuses on textual aspects which can be detected algo-

⁶³⁸ Jacques Ellul, *The Technological Society*, p. 79.

⁶³⁹ Stephann Gradman, ‘The Web & Digital Humanities: What about Semantics?’, in *WW2012*, (Lyon), slide 2.

⁶⁴⁰ Matthew Wilkens, ‘Canons, Close Reading, and the Evolution of Method’, in: Matthew Gold (ed.), *Debates in the Digital Humanities*, Minneapolis: University of Minnesota Press 2012, p. 256.

rhythmically, aspects which are difficult to quantify, such as the tenor of a metaphor, instances of ironical language or the connotations of words, may increasingly escape the scholar's radar.

An important risk that inheres in the adoption of digital methods is also that it can limit the scholarly focus to aspects which can be observed objectively and to claims which can be derived logically from these empirical observations. An adamant belief in the objectivity and the rationality of computation may undesirably lead to a restoration of the nineteenth century positivist belief that empirical and objective observations form that sole basis for reliable and authoritative knowledge. The attempt to present literary informatics as an approach which can unproblematically unearth the facts of a text is acutely out of step with current humanistic practices. Tymoczko stresses that the positivist aim of amassing facts "does not suffice in a post-positivist, globalizing world and will doom any field that adheres to such principles".⁶⁴¹ Within the humanities, the ideal of objective knowledge has largely been superseded by the insights that knowledge is perspectival and that human language can be arbitrary and ambiguous. Humanistic research focuses strongly "on multiplicity and ambiguity, on heterogeneity and difference".⁶⁴² Instead of merely concentrating on the rational aspects, this thesis has also stressed the subjective nature of algorithms, the methodological bias of text analysis tools and the continued need for human explication.

To ensure that computational methods can genuinely be of relevance to literary research, the functionalities that are offered by text analysis tools, and the methodology of literary informatics in general, must be scrutinised diligently and critically. The question of whether the outcomes of digital exertions are useful or meaningful can be evaluated, crucially, by connecting these to the central epistemological orientations of literary studies. The discipline is certainly not concerned solely with descriptive observations about texts. It also aims to interpret literary works, and to uncover the various layers of meaning that may exist within texts. David Levy usefully explains, more broadly, that there ought to be room for two distinct classes of activities within humanities research. Ratio refers to "the power of discursive thought, of searching and researching, abstracting, refining and concluding" while "intellectus refers to the ability of 'simply looking' to which the truth presents itself as a landscape presents itself to the eye".⁶⁴³ Computers can partly automate rational tasks such as searching and filtering, and they can help scholars to make systematic descriptive analyses of texts. The critical process must not stop at making these observations, however. The patterns and the properties

⁶⁴¹ M. Tymoczko, "Will the Traditional Humanities Survive in the 21st Century?", in: *Organization*, 8:2 (1 May 2001), p. 290.

⁶⁴² Ibid.

⁶⁴³ David Levy, "No Time to Think: Reflections on Information Technology and Contemplative Scholarship", in: *Ethics and Information Technology*, 9:9 (2007), p. 73. Levy's terminology is derived, in turn, from Joseph Pieper's book *Leisure, the Basis of Culture*.

that can be detected by computers ought to form the building blocks for the eventual interpretation and evaluation. To avoid a barren ossification of the field, algorithmic criticism should not focus exclusively on the rational aspects of the methodology. It ought to manifest itself clearly as a distinctly humanistic discipline, driven by the imperative to interpret, to explain and to criticise.

The validity of an interpretation cannot be computed, however, and activities such as reflection, interpretation or synthesis almost inevitably remain quintessentially human. The aim of literary informatics is not to make the human researcher redundant. By contrast, its critical limitations underscore the continued need for scholars who can perform higher criticism. This thesis has emphatically presented text mining not as an alternative but as an addendum to traditional scholarship.⁶⁴⁴ It provides a supplementary range of methods which can enhance and enrich the existing discipline with new types of insights. In all cases, human critics continue to bear the responsibility for evaluating the relevance of the information that is extracted by digital research instruments. Tools can be used to generate hypotheses, but they cannot be used to prove them. Statistical analyses can provide the premises of an argument, but they cannot independently reach a conclusion from these premises.

Large collections of machine-readable texts, combined with the continuous advances in text technology, often arouse great expectations about new types of information and new types of insights, inaccessible to previous generations of scholars. This thesis has studied a number of ways in which the sundry possibilities that are offered by quantification and by algorithmic analyses may meaningfully be harnessed. As noted, discussions of the impact of computation tend to be highly positivist, and frequently highlight the widening of the scope and the acceleration of academic discoveries. In the spirit of such optimism, it may be stated that algorithmic criticism can veritably expand the scope and the diversity of literary research, by methodically exposing the structural and formal features of texts, and by facilitating studies that span different genres, different periods and different nationalities. At the same time, it seems clear that the digital medium also implies clear challenges and important restrictions. Capturing information requires “the discipline of expressing oneself within the limitations of computability”.⁶⁴⁵ Furthermore, the perfunctory and ratiocinative manner in which data are analysed appears to be in a stark opposition to other hermeneutic principles which are often valued in the field of literary research, such as empathy, intuition and serendipity. In stressing both the affordances and the limitations of literary informatics, this

⁶⁴⁴ Matthew Jockers concurs that, although his work concentrates on analyses of large text corpora, analyses at the micro-level remain necessary for a large number of tasks. He uses the concept of “close mining” as an analogy. Excavating machines can be used to clear the pathway towards the places where diamonds can be found, by a human digger with a handpick is needed to actually reveal these gems. See Matthew Jockers, *Macroanalysis : Digital Methods and Literary History*, p. 171.

⁶⁴⁵ John Unsworth, “Knowledge Representation in the Humanities”, (1993).

thesis aimed to avoid both an undue positivism and a luddite techno-scepticism. Because of its crucial limitations, it is improbable that conventional close reading can ever be fully supplanted by machine reading. Because of the simultaneous affordances, however, literary informatics ought to be welcomed as a valuable additional method for studying the intricate effects that can be produced by literary works.

In “The Heresy of Paraphrase”,⁶⁴⁶ Cleanth Brooks stresses that, because well-written poems typically have a unique structure, consisting of meticulously balanced applications of literary techniques, any concise rendition of the text’s meaning in an alternative phrasing is inevitably reductive. If the attempt to paraphrase a poem into plain prose is viewed as heretic, the aim to represent a literary work as a number, which is a central activity in algorithmic criticism, would likely be considered even less commendable by the New Critics. Such conversions into numerical data are generally needed, nonetheless, to allow for equitable comparisons of works of literature. All computer-based analyses must be preceded by a careful consideration of both the aspects which are quantified and the ways in which these aspects are quantified. Machine reading and data visualisation inherently imply abstraction and simplification, but such reductive methods are mostly applied for condonable reasons. The numbers which are generated do not form goals in themselves, as the ultimate objective of the various metrics is to reveal novel types of aspects and to spark fresh and startling ideas about the texts which are rendered numerically. Within texts which have already been examined closely and seemingly exhaustively, computational analyses may still discover characteristics which were previously unseen. Algorithmic criticism ultimately seeks to apply the power of computation to invigorate human interpretation, and to explore what can be gained from the heresy of quantification.

⁶⁴⁶ “The Heresey of Paraphrase” is the final chapter in Cleanth Brooks, *The Well Wrought Urn: Studies in the Structure of Poetry*.