Visualization, Digital Humanities, and the Problem of Instrumentalism

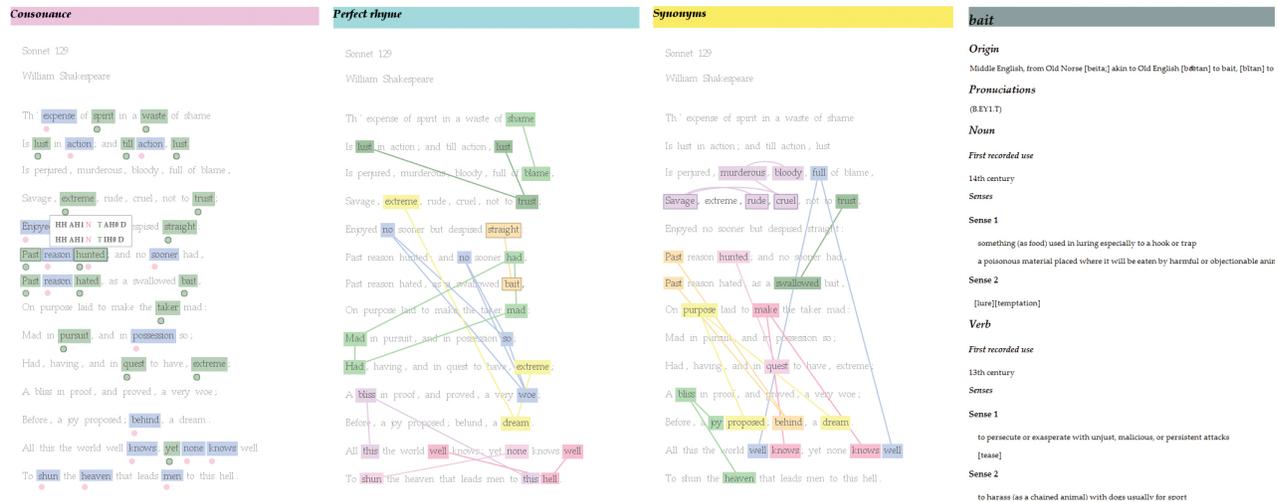Adam James Bradley, Hrim Mehta, Mark Hancock, and Christopher Collins

Fig. 1. Four Metation Interface information tiles. Phonetic relation tiles, such as consonance, are interactive. Here, hunted has two consonant phonemes, as indicated by the green and pink dots. Word pairs that rhyme are highlighted using colours and lines. Synonyms are grouped into sets through the use of colour with one-to-one relations being shown by lines. Word detail tiles are titled with the query word and detailed information is provided in a structured layout.

Abstract—In this paper we present the concept of "slow analytics" that attempts to bridge the gap between humanities tasks and visualization. Often within technological disciplines the pursuit of speed and efficiency are paramount. But, with domain experts like literary critics, slow and methodical interaction with texts is part of the work flow and sense-making process. By challenging the paradigm of efficiency we can design visualizations and interactions that are much more human and aid in our interactions with technology.

Index Terms—Digital Humanities, Visualization, Instrumentality

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1 INTRODUCTION

On some level information visualization and the humanities are incompatible. This is simply because the purported outcomes of the disciplines are very different. Within the humanities disciplines these goals can also vary widely. In geography or history departments, where data from each discipline has a quality that allows for measurement (such as historical time lines, or GIS data) this is not a problem. But in disciplines such as literary studies, where interpretation and not objective measurements make up a large bulk of the work flow, it becomes important to think of the data in this discipline as the opportunities for interaction and not simply an account of what is printed in a text.

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This paper addresses this issue in relation to the two epistemologies that need to be brought together if the humanities and information visualization are to be combined in a productive way.

2 THE CHALLENGES OF INTERDISCIPLINARY WORK

Technology has been used to aid in literary criticism for centuries. We have a tendency to ignore the fact that what is now low-tech at one time were great innovations. When we think of paper, pencils, ball point pens, and to some extent large machines like the printing press, there is a tendency to forget in the digital age that we now live in that these were all high tech advancements during their time. The high-tech digital tools we now have access to are often referred to in terms of their newness, but they are simply another stage of development in the technology that can be used for literary studies. That being said, these changes happened over long periods of time and adoption was slow. In the current climate the technological advances are changing at a rate that is much faster than previous technological revolutions and because of that interdisciplinary work is becoming more and more necessary.

One of the main challenges of work between disciplines is the time it takes to understand and build a bridge between the different epistemological concerns related to each. This is no different when trying to incorporate the technology of information visualization into literary studies. David N. Wear writes "the fundamental challenge to interdisciplinary communication is the different ways we see the world, that is our constitutive metaphors. The greater the divergence between

these foundations, the more difficult it is for communication to be effective" [8, p. 299]. The simple act of attempting work across disciplines comes with the added challenge of understanding exactly how both approaches generate and disseminate knowledge. In literary studies this knowledge gathering is often rhetorical as a result of experience and, in contrast, information visualization is objective as a result of experience. The bridge between the two needs to be built with an understanding of how the individual disciplines create experiential knowledge and not how they deal with facts. This idea can be understood by first looking at the computer itself.

The nature of the machine, which processes data immensely fast, but does little else that we can relate to in terms of 'thinking', demands that questions asked of it are appropriate for its capabilities. This is both a problem of what to measure (in the case of texts) and what to display in relation to those measurements (in the case of visualization). Recent approaches in the Digital Humanities, such as Franco Moretti's distant reading (using machines to process text corpora), invert this process where research questions are generated from large amounts of data and processed before reading of the actual text takes place. But this approach is problematic. It is not the idea of distant reading that we challenge, but the application of the technique. The problem lies in the processing and counting of facts, the parts of texts that are often utilized for visualization, and we suggest that this process is a misunderstanding of how knowledge is created in the humanities, guised as a reinvention.

To develop a method for approaching texts through technology it is helpful to set up a model for understanding how texts and technology interact. Martin Heidegger provides a useful analogy for understanding this relationship and we will lean on his conception of technology to identify how processing and interaction differ in terms of literary criticism.

3 HEIDEGGER'S VISION OF TECHNOLOGY

In "The Question Concerning Technology" Heidegger writes "[t]he current conception of technology, according to which it is a means and a human activity, can therefore be called the instrumental and anthropological definition of technology" [4, p. 2]. Although this framework (like any appropriated theory) is not perfect, it is useful to look at questions of visualization and literature through the lens that Heidegger provides. When trying to bring together textual analysis and visualization, the understanding of how technology functions as technology and how it functions in relation to the human using technology is of vital importance if we are to combine the two approaches. If we understand that the instrumental purpose of technology is as Heidegger writes "a means to an end", we can decipher a much clearer conception of what our critical relation to technology should be. In terms of a technological object the means to an end is characteristic of its purpose in design. For example, a potato peeler as a piece of technology has an instrumental purpose of removing the skin from potatoes. In Humanities Computing the computer has an instrumental purpose of processing data quickly. To confuse that with interpretation is to confuse computers with artificial intelligence.

But Heidegger is concerned with the revealing nature of technology and the relationships that humans hold to those revelations. In his essay he outlines technology as poeisis, a bringing forth of its own existence. This is what visualization sets forth to do. To create an experience of data that a viewer can participate in. In the words of Carl Mitcham and Robert Mckay, "Heidegger rejects the common conceptions of technology as applied science and instrument...[he] understand[s] technology as a special mode of discovery, and a transformation of being from one state to another" [6, p. 25]. This sounds a lot like the purpose often described for visualization. To grasp this mode of discovery, what is necessary is an understanding that the expressed purpose of the technology itself (its instrumental existence) and our engagement with it (its anthropological potential) are separate parts of a technological whole. It is the separation of these parts that become a useful metaphor for how we should engage with technology to yield results that can be used for literary interpretation.

Stanley Fish characterizes this idea what he calls directionality, which relates to a text-first approach versus a top-down application of theory. Fish writes that "The direction is the reverse in the digital humanities [from what he practices]: first you run the numbers, and then you see if they prompt an interpretive hypothesis. The method, if it can be called that, is dictated by the capability of the tool" [3]. The capability of the tool that Fish describes is its instrumental nature. What is missing from Fish's critique is the understanding that the development of these tools are critical acts. The danger is that the critical position of the digital humanist can be literally codified into the program and thus any 'reading' by the machine will be the same no matter how many times the program is run. This is a top-down approach that takes as premise that all texts operate in similar ways. We are hard wiring a critical position into the code that cannot change. This is a point where visualizations can intervene. The nature of interaction and the potential for visualization to allow for human engagement and insights make it a good tool for approaching these problems.

4 BRINGING TOGETHER ART AND TECHNOLOGY

Attempts to bring together literary criticism and technology, such as Franco Moretti's work on distant reading [7] or Matthew Jocker's *Macroanalysis* [5] have been inadvertently based around a model of human interaction with language that closely mimics the idea of homo economicus found in economic theory. Instead of a rational agent interacting with efficient markets, the premise is one that treats language and literature as if it operates efficiently in its transfer of meaning. If we are to understand the current state of digital humanities projects in relation to this idea, it makes sense that a solely instrumental treatment of technology in service of an imagined wholly rational agent can explain how and why the digital humanities has not lived up to their promise of a technological criticism. We must understand the anthropological or irrational possibilities that technology holds within it, and design and build tools and interactive processes that allow for the conditions of interaction under this rubric.

These concerns have been expressed about all technology and we are currently seeing the predictions of Jacques Ellul in the *The Technological Society* come to fruition in the Digital Humanities. Ellul outlines the idea of technique, which he defines as the "totality of methods rationally arrived at and having absolute efficiency (for a given stage of development) in every field of human activity" [1, xxv]. Ellul also elucidates the problems of the machine when he writes "the machine is deeply symptomatic: it represents the ideal toward which technique strives. The machine is solely, exclusively, technique; it is pure technique, one might say" [1, p.4].

This extends to Heidegger's view of technology not only being rooted in a making process but defined as a mode of revealing. Heidegger labels the actions of technology as Gestell, or enframing and writes "[e]nframing is not a tool or an apparatus, but...the very condition of possibility for the truth to be revealed, poetically, to man" [4, p.293]. If we consider this revealing as the action of the irrational and one of the fundamental purposes of literary study, it then stands to reason that any approaches that exploit the instrumental foundations of technology but also interfere with the anthropological or the presencing of literature are undermining the critical approach.

As Heidegger tells us, technology has the potential to reveal itself to us anthropologically and to operate instrumentally at the same time. This is not the problem. If we consider literary art itself as a technology, then the instrumental aspects, or the rational, lead directly to the anthropological. There is a foundation already laid for this type of understanding of technology in relation to literature, within literature. In most cases the instrumental is so highly prized as some exemplar of truth that tools and investigations are based solely on that perception. The difficulty of designing experiments that expose the anthropological through technology is the challenge within this new paradigm.

Even failing at this has been described as worthwhile. Michael Whitmore, director of the Folger Library, and his colleagues Johnathon Hope and Michael Gleicher write: "We can now begin to see the need for interchange between digitally based and more traditional research techniques. There is no basis on which a purely iterative or algorithmic method can distinguish between genuinely interesting outliers (which are significant in a nonstatistical sense) and the expected

but meaningless statistical blips any data set includes". [9] There is no better technology for this, at the current time, then information visualization. But, if it is to be effective within the context of literary studies, it must be understood that data visualization for the humanities needs to be built more for experience than for the demonstration of fact.
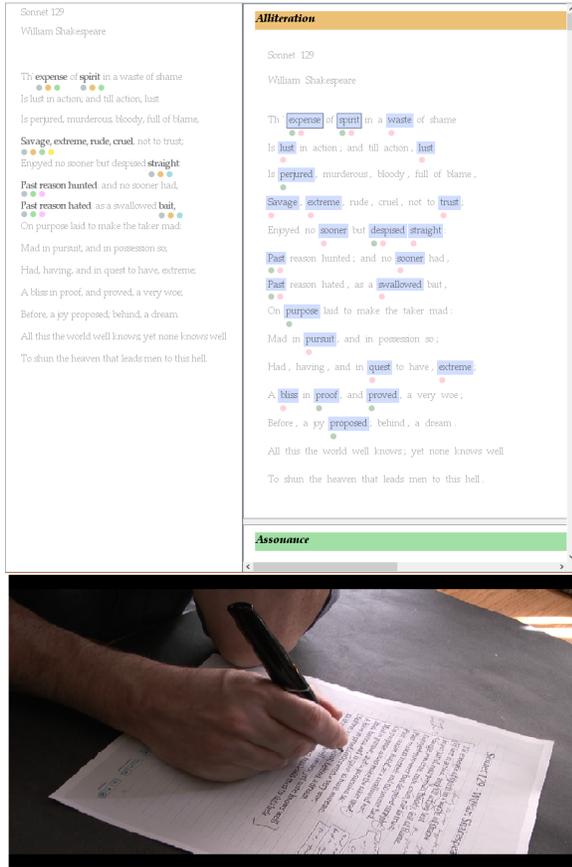

Fig. 2. The Metatation interface. The left worksheet viewer panel shows annotated words in bold, and available query results are indicated by colour-coded dots below the words. The right panel shows a stream of metadata tiles which present query results. The bottom image is of a participant using the metation system.

5 BUILDING SYSTEMS FOR EXPERIENCE

To try and address these differences we built a visualization system for interaction with poetry on paper. The idea was to use the existing work flow of literary critics (which we found from a study we conducted of domain experts was primarily pen and paper) to inform the design of the interaction. What we found was that previous systems used only the instrumentality of the machine and neglected that time and space were often needed for the human agent to process cognitively what was being presented. We have labelled this consideration of the pace of human cognition as "slow analytics". Specifically as analytics interleaved with critical thinking. This is instrumental technology adopted for anthropological interactions. It is the process of creating visualizations and interactions that allow the user room to think, or, technology that creates space for being human.

6 A SYSTEM FOR SLOW ANALYTICS

To construct a system that allows for "slow analytics" in the domain of literary criticism we conducted a study to first analyze the work flow of the domain experts. We recruited 14 participants (11 male and 3 female), comprising 3 PhD students and 11 university professors with varied areas of expertise, who publish on literary criticism and/or teach poetics, from three different universities in Canada. We asked these domain experts to "work" on poetry using Annoto pens and digital paper. We wanted to understand the timing involved in supporting these tasks that needed slow analytics.

6.1 Choice of Poetry

To ensure that our study data represented a breadth of poetic styles and time periods and that the poems we used were of recognized scholarly importance, we drew on the Norton Anthology of English Poetry [2] to create our study dataset. Literary critics, as a practice, generally specialize in specific time periods of literature. Thus, someone who is an expert in Modernist literature would not have comparable proficiency in Elizabethan drama. Consequently, ensuring the inclusion of works of diverse poetic styles from different eras was essential to mitigate the effects of expertise bias in our study. Dividing literary history into appropriate epochs is a complex problem and so we deferred to the well-respected anthology to supply the time constraints for our selection process as well as the texts themselves. We randomly selected 14 poems, two from each of the seven different time periods (1510–1620, 1620–1690, 1690–1780, 1780–1830, 1830–1880, 1880–1920 and 1920–). These fourteen poems were then randomly grouped into seven pairs, such that each pair included poems from two different time periods. To avoid expertise bias, such as having a Shakespearean scholar annotate a Shakespearean sonnet, pairs of poems were counterbalanced and randomly assigned to the participants for analysis so that each pair was analyzed by two participants, once in each ordering. As a result, none of our participants undertook the study with poems that fell within their area of expertise. Having two poems per participant and common poems between two participants permitted us to observe how the annotation practices varied based on both the reader as well as the work being analyzed.

6.2 Task & Procedure

Each participant was asked to perform a close reading (analysis) on one pair of poems. Each poem was provided in an assigned order on a separate sheet of Anoto paper, printed in Times New Roman with 1.5 line spacing. Participants were provided with a Livescribe[1] Anoto pen to use for annotations. The Anoto pen tracks pen position on the Anoto dot pattern permitting us to record pen strokes made by our participants as they annotate the printed sheets of paper.

Observational sessions were conducted in the regular work environment of the participants and were video and audio recorded. The video was recorded from two separate angles: one from directly above the desk to capture how the participant analyzed the poem, and another facing the participant to capture facial expressions. We also logged pen strokes from the Anoto pens and paper using the Anoto LiveScribe software and collected the physical paper at the end of the session.

Participants were instructed to perform a close reading on each poem in accordance with their own work practices. The participant was given a printed copy of the poem and instructed to conduct an analysis until they were finished or until 15 minutes had passed. In our pilot studies we discovered that this analysis process was a highly personal experience and the presence of the experimenter was found to be distracting. Therefore, the participants were left alone to work during each of these 15 minute periods.

Participants were not required to annotate the poem, but if they did, they were requested to use the provided LiveScribe Anoto pen. Participants were also permitted to access any form of available external resources that they would normally use. Following the analysis session, participants were asked to explain the function of the annotations they made through a retrospective think aloud process using the annotated poem as a guide. The same procedure was then repeated for the second poem assigned to a participant.

7 SENSE-MAKING AS A "SLOW ANALYTICS" PROCESS

What we found from our study was that literary analysts were making sense of poems slowly. The process was methodical[Fig. 3], with each iteration adding to the last in ways that built a larger and larger sense of
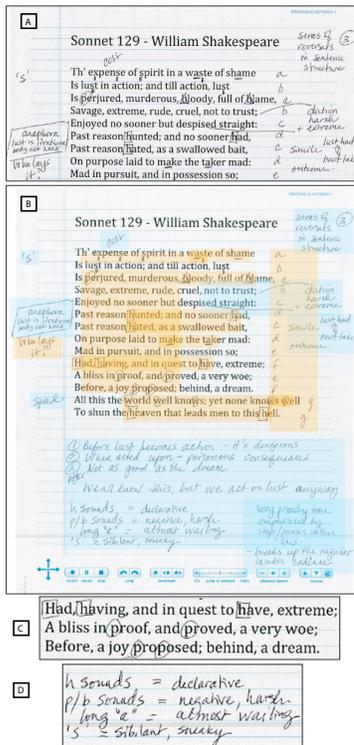
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[1] http://www.livescribe.com

Fig. 3. Annotations made during close reading of poetry. (A) Shows the raw annotated page as collected in our study. (B) shows *cognitive purpose* codes assigned to annotation units for one of the participants' annotations, as visualized by our coding tool. Orange and blue bounding boxes represent annotation units categorised as Cognitive Offloading and External Memory Loading respectively. (C) is an example of an annotation unit, identifying the repetition of sounds. (D) shows an example of an annotation unit, noting observations about repetitions of sound across the poem

the network of meanings found within a poem. Our task was to design a system that allowed for this type of interaction that worked in concert with a visualization system.

8 THE METATATION SYSTEM

We approached this problem by designing a system that only provided meta information [Fig. 4] after we could identify grouped units of words that the analyst had made using the digital pen and paper. What this means is that visualizations were only generated [Fig. 2] after the thinking and sense-making process had been started by the user. As an example of how the system works, one of our expert reviewers underlined the words 'bliss', 'dream', 'heaven', and 'hell' in Shakespeare's sonnet 129.

A bliss in proof, and proved, a very woe;
Before, a joy proposed; behind, a dream.
All this the world well knows; yet none knows well
To shun the heaven that leads to this hell.

Our system, Metatation added 'joy' to the set of {bliss, heaven} as a synonym addition and 'woe' to the set of {bliss, joy} as an added antonym. The participant realised that he had missed the word 'joy', highlighted by the system, which when taken together with the other annotated words lead the lines to convey a sense of parallelism.

This is exactly the type of interaction the system was intended for and exemplifies the "slow analytics" process. Understanding how these domain experts experience a text and how to augment that can have far reaching consequences for sense-making within the study of the artifact.
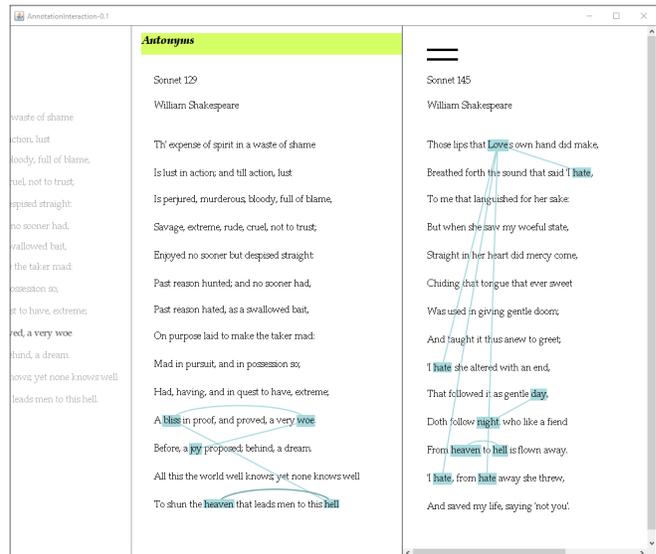

Fig. 4. An example of the system adding to the set that the literary critic had drawn on the Annoto paper.

9 CONCLUSION

The instrumentality of the machine is being used in both the digital humanities and information visualization as ways to augment how we access information. In DH the idea of distant reading is held up as an exemplar of the process and in InfoViz, the goal is often to present as much information as possible in ways that are digestible and understandable. But, when it comes to domains like literary studies, presenting all the facts can actually hinder the process of sense-making. By simply thinking about "slow anlaytics" and what that means to the work flow and epistemologies across disciplines we can start to understand *when* it is appropriate to leverage the speed and power of the machine and when we should be interjecting with information into processes that need time. We designed a prototype system that attempts just that. It allows literary critics to perform readings of poems on digital paper with Annoto pens and attempts to augment their work with additive visualizations. The implication is that efficiency may not always be the best measure of human interaction; or, in Heidegger's terms, efficiency may not be anthropological. The consideration of time and space when bringing together the digital humanities and information visualization is one way to ensure that the instrumentality of the machine is not being used simply because it can be.

REFERENCES

[1] J. Ellul. *The Technological Society*. Random House, New York, 1964. Trans. John Wilkinson.
[2] M. Ferguson, M. J. Salter, and J. Stallworthy. *The Norton Anthology of Poetry*. WW Norton & Company, New York, NY, 2005.
[3] S. Fish. Mind your ps and bs: The digital humanities and interpretation. nytimes.com, January 2012. [Online; posted 27-August-2012].
[4] M. Heidegger. *The Question Concerning Technology, and Other Essays*. Harper Collins, New York, 1982. Trans. William Lovitt.
[5] M. L. Jockers. *Macroanalysis: Digital Methods and Literary History*. University of Illinois Press, Chicago, 2013.
[6] C. Mitcham and R. Mackey. *Philosophy and Technology*. Macmillan, New York, 1983.
[7] F. Moretti. *Distant Reading*. Verso, 2013.
[8] D. N. Wear. Challenges to interdisciplinary research. *Ecosystems, Volume 2, Issue 4*, pp. 299–301, July, 1999.
[9] M. Whitmore. *The Oxford Handbook of Shakespearean Tragedy*, chap. Digital approaches to Shakespeare and Drama. Oxford UP, Oxford, 2016. with Johnathon Hope and Michael Gleicher.