Prospects for Computational Hermeneutics

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Abstract

English. The central concern of the humanities is the understanding of human artifacts. This goal requires interpretation and makes hermeneutics a core element of their methodology. So far, the digital humanities have been mostly concerned with providing tools that either support human interpretation or that permit scholars to record results of their interpretation through annotation. However, if we understand digital humanities as the construction of formal models in the humanities, we must also strive to integrate hermeneutics into these models. In this paper, we reflect on the role of hermeneutics in digital humanities and sketch an approach for combining human interpretation with formal models.

Italiano. La preoccupazione centrale delle scienze umane è la comprensione dei artefatti umani. Questo obiettivo richiede interpretazione e fa dell'ermeneutica un elemento centrale della loro metodologia. L'informatica umanistica si è finora occupata soprattutto di fornire strumenti che supportano l'interpretazione umana o che permettono agli studiosi di registrare i risultati della loro interpretazione attraverso l'annotazione. Tuttavia, se intendiamo l'informatica umanistica come la costruzione di modelli formali nelle scienze umane, dobbiamo anche cercare di integrare l'ermeneutica in questi modelli. In questo lavoro riflettiamo sul ruolo dell'ermeneutica nell'informatica umanistica e tracciamo un approccio per combinare l'interpretazione umana con i modelli formali.

1 Introduction: The Theoretical DH

The interpretation of human artifacts in order to understand their "meaning" is the central concern of the humanities. They are therefore often characterized as being "qualitative-hermeneutical," in contrast to the natural sciences and to computer science, which are supposedly "empirical," "quantitative," and much less dependent on interpretation. However, as Piotrowski (2018) argues, disciplines are not defined by their methods alone but rather by a "unique combination" of a research object and a research objective; research methods, he notes, are "secondary in that they are contingent on the research object and the research objective." In addition, technical and scientific progress not only enables methods to evolve, but also requires them to adapt, while research objects and objectives largely remain stable. Even though particular methods may be "typical" for a particular discipline, all disciplines can, in principle, use any methods, including computational ones, as long as they fit their research objectives. As Orlandi puts it, "un po' di aritmetica ha sempre fatto parte delle discipline umanistiche" (Orlandi, 1990, 114). Conversely, other fields also use methods commonly associated with the humanities. For example, Frodeman (1995) has argued that geology is really a "historical and interpretive science," rather than a "derivative science, relying on the logical techniques exemplified by physics" (see also Comet, 1996). Similarly, artificial intelligence (e.g., Winograd, 1981) and computer science more generally (e.g., West, 1997) attempted to formalize and apply the key concept of hermeneutics, namely, *understanding*.

The research carried out under the heading of "Digital Humanities" (DH) currently tends to focus on quantitative analyses, which have long been difficult or even impossible in the humanities and which

yield important new insights complementing traditional ("manual") qualitative analyses. However, if we understand DH as the construction of formal models in the humanities (Piotrowski, 2018; McCarty, 2014; Orlandi, 1990), we must not neglect the qualitative-hermeneutic dimension. If the humanities want to succeed in answering their research questions—which are primarily qualitative in nature—they cannot rely on quantitative methods alone. Instead, a multilayered research process is required, one in which quantitative and qualitative analyses continuously alternate.

One of the main challenges for the *theoretical digital humanities* (Piotrowski, 2018) remains to find ways to *integrate* hermeneutic methods and insights into formal models, rather than keeping interpretation detached, as a kind of afterthought to automatic analyses (or vice versa). In this regard, there are noteworthy initiatives to exploit the computer as a "modeling machine" (McCarty, 2014, 256) while continuing the long philosophical tradition of hermeneutics (e.g., Dilthey, Heidegger, Gadamer, Ricœur, Iser, Jauss etc.). However, there does not seem to be a transfer back in the other direction. The goal of this paper is thus to outline the prospects for a novel approach that might be called *computational hermeneutics* and to stimulate a wide discussion on the possibility of a unified science bridging the gap between the humanities and the sciences.

2 Hermeneutics and Understanding

The main goal of any hermeneutic approach is to achieve what Dilthey called *Verstehen*, an "understanding" of human artifacts in order to answer questions about the "Why?" and "How?" and to uncover underlying patterns (Bod, 2015). But what exactly is *understanding*, and the *understanding* of what? One may argue that hermeneutic interpretation aims at uncovering the meaning of a given text by reference to the author's intention (whether empirical or idealized), the envisaged reader, and the dense web of meanings invoked by the text. *Understanding* thus involves a reconstruction of (a) the reasons why a given author (or group of authors) produced a particular text (*text* understood in a broad sense), (b) the overt or hidden layers of meaning of a given text, (c) the type of recipient envisaged by the author and/or the text, and (d) the potentially infinite number of contexts in which the reconstruction of meaning can take place (Ricœur's "conflit des interprétations").

Whenever we interpret language, we need to rely on some *pre-understanding* that provides the basis on which to build an interpretation. It is thus a recursive process, in which (pre-)understanding is necessary for interpretation, which in turn produces understanding, and so forth—hence the term *hermeneutic circle* (for an illuminating discussion see Göttner (1973)). Since this process leads to a progressive approximation to an (ideally exhaustive) understanding of a given text, Bolten (1985) has proposed the more apt metaphor of a *hermeneutic spiral*.

Despite the supposed "death of the author" (as famously heralded by Roland Barthes), authorial intention remains an important component of *pre-understanding*: the interpretation of texts cannot be successful when one just relies on lexical meanings and sentence semantics alone, both of which may not even be available when we understand texts in a broad sense. For an interpretation to be sound, one has to make complex inferences that rely on vast knowledge about the world and on the attribution of mental states (especially intentions) to the author. Here Grice's conversational maxims play a particularly important role in guiding the inferential process. It is characteristic of the ways in which hermeneutics is commonly construed that these inferential processes about *the other mind*, however foreign, are rarely reflected in depth (see Winograd's *model of the speaker* as part of the reader's model of the world (Winograd, 1981)). Nonetheless, despite the importance of authorial intention, it is necessary to draw a distinction between the meaning of a text and the meaning as intended by the (empirical rather than ideal) author. In other words, the meaning of a text cannot be reduced to the intended meaning either.

3 Hermeneutics and Digital Humanities

There are essentially two "native" strands of interpretation in DH, which both now have long traditions going back to the beginnings of computing in the humanities.

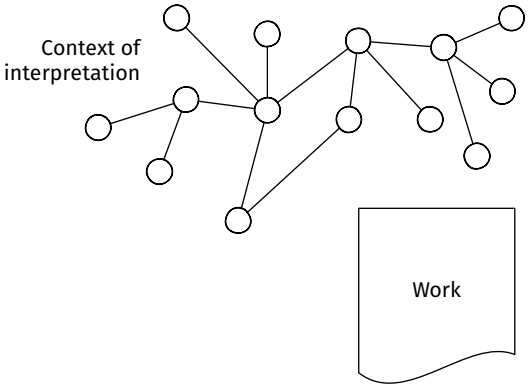

Figure 1 – Hermeneutics considers a work in a particular context of interpretation, peculiar to a reader, here modeled as a network of concepts. Links between concepts can be of various types; they can be thought of as mental associations.

One strand is that of *annotation*, exemplified by the Text Encoding Initiative (TEI, 1987).[1] It goes back to an even longer editorial tradition in philology, focusing primarily (though not exclusively) on a single text and the textual phenomena therein. It is thus a relatively "weak" form of interpretation, in the sense that it makes only limited connections to the extra-textual (which for Ricœur (2017, 103) is a defining feature of interpretation)—but intentionally so: editions are generally used as a basis for a later interpretation of the text.

The other strand, which Rockwell and Sinclair (2016) call "computer-assisted interpretation," builds on an equally long-standing tradition in literary studies, in particular concordancing, stylometry, and other quantitative analyses, and belongs to the first applications of computers in the humanities (see, e.g., Kroeber, 1967). The modern evolution of this strand can be exemplified by Rockwell and Sinclair (2016) and their work on Voyant.[2] This strand is oriented towards tools and automatic analyses informing human interpretation. Rockwell and Sinclair's notion of the "hybrid essay, an interpretive work embedded with hermeneutical toys" (Rockwell and Sinclair, 2016, 17) illustrates well the idea of the computer providing scholars with new evidence.

Both strands are not limited to philology and literary studies; they can also be found in other humanities disciplines, and images or other artifacts may replace texts as research objects. Outside of DH, computer-assisted interpretation (in the above sense) remains controversial (see, e.g., the debates following the publication of Da, 2019); critics typically question the legitimacy of quantitative methods in general.

However, both annotation and computer-assisted interpretation have an inherent limitation in common, which is rarely, if ever, discussed: human interpretation remains outside of the formal framework. In the case of annotation, the (formal) annotation is the result of a preceding human interpretation that motivates a particular annotation (say, that tagging of some text as "deleted"), but only the result (in the form of a `<del>` tag) is formally documented, the reasoning for this choice generally remains inaccessible, at least to the computer. Furthermore, it is usually difficult, or even (practically) impossible, to record alternative interpretations.

4 Proposal

How, then, could we link hermeneutics to formal models, so that human interpretations can be taken into account as well and different types of methods can be combined to truly complement each other? The idea of *mixed methods*, which originated in the social sciences (Kuckartz, 2014), certainly cannot be transferred to the domain of the humanities without modification. It is important to stress that the goal cannot be to "automate" interpretation; the bedrock of *Verstehen* is a shared understanding of the *conditio humana*.

[1] https://tei-c.org
[2] https://voyant-tools.org

The goal must rather be to support the scholar by making it possible, for example, to process qualitative human interpretations alongside the results of automatic quantitative analyses.

The basic idea of our proposal is to model the context of interpretation—i.e., a reader's knowledge of cultural concepts and the associations between them—as a *semantic network* or *knowledge graph* (see Fig. 1), and interpretation as the linking of features of the interpreted object to nodes of this network, i.e., the construction of a new network, as illustrated in Fig. 2. Understanding can thus be defined as the integration of the object's properties into a preexisting network.

Computationally, this model can be represented using Semantic Web and Linked Data technologies, which has the advantage that existing tools and methods can be leveraged. In particular, we propose to use *nanopublications*, a knowledge representation approach originally developed in bioinformatics (Groth et al., 2010), although the conceptual model is neutral with respect to a particular implementation. Nanopublications were developed as a common framework for describing scientific statements together with contexts (e.g., original publication, authors, organisms involved) in a machine-readable fashion, so that scientific results are easier to discover, unambiguously referenced and connected to particular scholars, and can be automatically aggregated and analyzed.

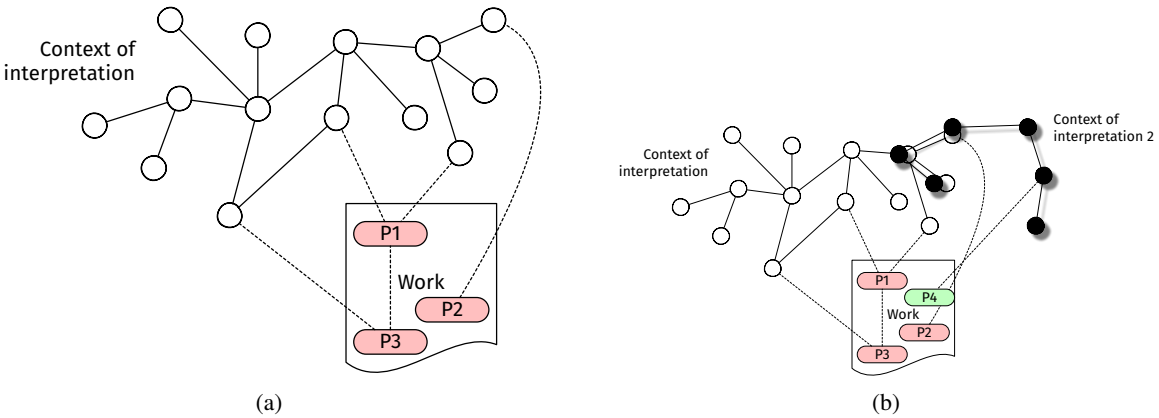

Figure 2 – (a) Interpretation links features of the work (here: passages P1–3) to concepts in the reader's context of interpretations. (b) The contexts of interpretation of different readers may partly overlap (and thus share associations) but may also have different relations and thus come to different interpretations of the same work.

5 Case Study

Is it possible to model the temporal (and geographical) dynamics of the *horizon of expectations*? Let us consider an example from music history to demonstrate our approach to computational hermeneutics. In his review of a symphony by Robert Volkmann (which is little known today), Selmar Bagge wrote: "Volkmann's Dmoll-Symphonie ist eine durchaus pathetische Production" (AmZ 48, 1863, col. 806). Suppose this sentence originated from a present-day source. In this case, a translation such as the following would be perfectly possible: "Volkmann's symphony in D minor is a quite emotive work". However, since a model of understanding contains assumptions about the author and the time of his or her writing, such a translation would ignore that the German word *pathetisch* has undergone a significant semantic shift. Today, *pathetisch* has a rather negative connotation and would thus have to be translated as 'melodramatic' or 'pompous.' To reveal the (historical) meaning likely to be intended by Bagge, we need to explore and model the contexts in which *pathetisch* has been used. These contexts have to be distinguished according to their distance to the target object of interpretation. Generally, an interpretation is more likely if it is supported by sources that show proximity in terms of time and space. In other words, sources that have been written around the same time and in the geographical vicinity of the source under investigation are to be preferred over sources that show greater temporal and geographical distance. Both temporal and geographical distances can best be modeled using network approaches (see above).

When consulting one central source, the approximately contemporaneous *Deutsches Wörterbuch* by the Brothers Grimm, we find *pathetisch* glossed as 'powerful,' 'dignified,' or 'solemn.' In addition, the word is linked to both the *passionate* and Schiller's concept of the "pathetic-sublime" (1793). Both of these usages are confirmed by much earlier sources: In Johann Georg Sulzer's *Allgemeine Theorie der Schönen Künste* (1793), the "pathetic" is considered a synonym of the "passionate." In Heinrich Christoph Koch's *Musikalisches Lexikon* from 1802, the reader interested in the meaning of "patetico, pathetisch" is directed to the entry on the "sublime" (Koch, 1802), thus suggesting that *pathetisch* and "sublime" are synonyms. More distant 18th century sources even suggest an association of the sublime with the "(delightful) horror." Given the historical distance, this connotation is less likely to be conveyed in Bagge's statement. Considering this complex semantic history, the modeling task consists in (1) linking related semantic concepts, (2) qualifying these links (e.g., as synonym, as super- and subcategory, or as semantic overlap), and (3) weighing links according to temporal proximity.

The model reader that Bagge had in mind when making his statement about Volkmann's symphony as being pathetic is somebody who had a certain prior knowledge of that concept (as reconstructed from the sources just mentioned). In addition to the semantic history of words, further contexts that need to be considered concern a dense web of musical works. The prototypes of a pathetic work, as invoked by Bagge, are Beethoven's 5th and 9th symphonies. Readers of the time likely understood this to be the primary context of Volkmann's symphony without which a proper understanding could not be achieved. Further works featuring "pathetic" in their titles are Beethoven's piano sonata op. 13 and, much later, Tchaikovsky's 6th symphony, the distance between these two works being roughly a hundred years. However, despite the lack of a title, many earlier symphonies (by other composers) from the late 18th century on have been referred to as invoking the "sublime," and hence are "pathetic" in Koch's sense. The reason for Bagge's aesthetic judgment thus lies in the shared musical properties of all the works contained in the set of pathetic or sublime symphonies: the minor mode, the orchestral setting, a particular tempo, etc. As a result, a hermeneutic reconstruction must consider both the semantic tradition (and change) of the word "pathetic" and the corresponding musical production.

6 Conclusion: Implications and Prospects

As outlined at the outset of our paper, the humanities and the sciences are widely assumed to be separated from each other by their respective methods, objects, and objectives. However, as suggested above, the humanities and the sciences face a common challenge: both have to address explicitly the issues of interpretation and decision-making under uncertainty. In particular, they need to formalize and model the contexts of interpretation and the inferential processes under uncertainty, seeking to exploit the rich potential of the computer as modeling machine (Piotrowski, 2019). The development of suitable probabilistic tools (Pearl, 2000) for modeling network-like relationships between objects is a crucial task for the whole scientific community, one that brings us closer to the ideal of a truly unified science.

The use of formalization and modeling is often met with a certain hostility in the humanities. Many humanities scholars subscribe to the notion that interpretation can in principle never come to a conclusion, and indeed the fascination of hermeneutics seems to lie in its inherent incompleteness. In addition, it is assumed that multiple interpretations can exist alongside each other without the need (or even the possibility) to prefer one over the other; this is in keeping with the cherished notion of plurality and multiplicity of perspectives in the humanities. Yet exactly in this respect a computational approach may offer obvious advantages, as the possibilities of formally representing interpretations, their contexts, and the inference procedures allow scholars to better compare different interpretations and assign different probability values to them (for applying a Bayesian approach to historiography and the problems of assigning prior probabilities (see Tucker, 2004; Carrier, 2012). More generally, this approach can give rise to the idea of *progress* in the humanities (something that is notoriously rejected by many humanities scholars). Thus the essential challenge of the theoretical digital humanities is to come up with a convincing approach to a "hermeneutic computer science" (West, 1997), whose tasks involves modeling interpretation contexts, inferential processes, and uncertainty.

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