# Bridging Digital History Methods and Source Criticism: A Research Agenda for the Study of Inquisition Records

# David Zbíral ២

Masaryk University, Faculty of Arts, Department for the Study of Religions, Centre for the Digital Research of Religion, Arna Nováka 1, 602 oo Brno, Czech Republic; david.zbiral@mail.muni.cz

# Kaarel Sikk <sup>D</sup>

Masaryk University, Faculty of Arts, Department for the Study of Religions, Centre for the Digital Research of Religion, Arna Nováka 1, 602 oo Brno, Czech Republic; kaarel.sikk@mail.muni.cz

# Robert L. J. Shaw<sup>D</sup>

Masaryk University, Faculty of Arts, Department for the Study of Religions, Centre for the Digital Research of Religion, Arna Nováka 1, 602 oo Brno, Czech Republic; robert.shaw@mail.muni.cz

**Abstract.** We outline the benefits of computational modelling approaches for extracting and analysing data derived from inquisition records, while also highlighting some drawbacks of digital history methods and the dangers of their superficial application. Most crucially, we propose ways of integrating those methods with source criticism. If source-critical information feeds into the analysis itself as data, computational modelling can improve the precision of argumentation, make assumptions and limitations more transparent, and allow digital methods to enhance the discipline of history at its core, paving the way for a genuine 'source criticism 2.0'.

**Keywords:** digital history, computer-assisted source criticism, computational modelling, data analysis, inquisition records

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#### INTRODUCTION

Digital history, and digital humanities more broadly, have been criticised for letting discussion of data and methods overshadow argument,<sup>1</sup> getting lost in data preparation and infrastructures at the expense of analysis,<sup>2</sup> and overinflating the real promise.<sup>3</sup> Digital approaches have also suffered from a self-taught<sup>4</sup> use of methods originating in a different discipline, mindset, and/or research need, and, understandably, not fully mastered by humanist practitioners, which has at times led to their idiosyncratic or 'pidgin'<sup>5</sup> application.<sup>6</sup> One clear example of this is the overreliance on an intuitive interpretation of visual outcomes, such as analytical maps and network visualisations.<sup>7</sup> More complex analytical techniques, in turn, often constitute methodological 'black boxes',<sup>8</sup> whose inattentive application can consequently obscure as much as illuminate historical questions. Many critics as well as supporters keen to raise the bar would also agree that digital approaches often bring about a simplistic use of information, reducing human complexity to quantifiable variables, and potentially overlooking agency, historical contingency, context, and semantic depth.<sup>9</sup> Finally and most specifically to digital history, practitioners have been reminded to engage more fully with the biases

- S. Robertson, L. Mullen. Arguing with Digital History: Patterns of Historical Interpretation. – Journal of Social History, 2021, 54, 4, 1005–1022. https://doi.org/10.1093/ jsh/shabo15; L. Mullen. A Braided Narrative for Digital History. – Debates in the Digital Humanities 2019. Ed. by L. F. Klein, M. K. Gold. University of Minnesota Press, Minneapolis, 2019, 382–388. https://www.jstor.org/stable/10.5749/j.ctvg251hk.34?seq=1.
- 2 M. Thaller. Controversies around the Digital Humanities: An Agenda. Historical Social Research / Historische Sozialforschung, 2012, 37, 3, 10; J. van Zundert. If You Build It, Will We Come? Large Scale Digital Infrastructures as a Dead End for Digital Humanities. – Historical Social Research / Historische Sozialforschung, 2012, 37, 3: 165–186.
- 3 C. Blevins. Digital History's Perpetual Future Tense. Debates in the Digital Humanities 2016. Ed. by M. K. Gold, L. F. Klein. University of Minnesota Press, Minneapolis, 2016. https://dhdebates.gc.cuny.edu/read/untitled/section/4555da10-0561-42c1-9e34-112f0695f523#ch26; Robertson, Mullen. Arguing with Digital History.
- 4 R. Ma, F. Xiao. Data Practices in Digital History. International Journal of Digital Curation, 2020, 15, 1, 14. https://doi.org/10.2218/ijdc.vt5i1.597.
- 5 J. van Zundert et al. DHBeNeLux: Incubator for Digital Humanities in Belgium, the Netherlands and Luxembourg. – Digital Humanities Quarterly, 2017, 11, 4, https://www. digitalhumanities.org/dhq/vol/11/4/000326/000326.html.
- 6 N. Z. Da. The Computational Case against Computational Literary Studies. Critical Inquiry, 2019, 45, 3, 601–639. https://doi.org/10.1086/702594.
- 7 J. Drucker. Humanities Approaches to Graphical Display. Digital Humanities Quarterly, 2011, 5, 1. https://www.digitalhumanities.org/dhq/vol/5/1/000091/000091.html.
- 8 J. J. van Zundert, S. Antonijević, T. L. Andrews. 'Black Boxes' and True Colour: A Rhetoric of Scholarly Code. – Digital Technology and the Practices of Humanities Research. Ed. by J. Edmond. Open Book Publishers, Cambridge, 2020, 123–162. https://doi.org/10.11647/0bp.0192.06.
- 9 M. Thaller. The Need for a Theory of Historical Computing [1991]. Historical Social Research / Historische Sozialforschung: Supplement, 2017, 29, 193–202; A.-C. Wackerhausen, K. L. Nielbo. Computationally Assisted Conceptual Analysis: What Is It Is, and How to Do It. – International Journal of Digital Humanities, 2022, 3, 1, 51–89. https://doi.org/10.1007/s42803-021-00041-4.

underlying the production and transmission of historical textual sources, without which their research falls short of history's source-critical requirements.<sup>10</sup>

To a degree, we acknowledge these critical points, and will expand on some of them, insofar as they guide our approach to digital research on heresy trial records and inform our methodological choices. We also recognise that computational modelling, in each of its steps, inherently involves contextual transformation, and thus necessitates careful reflection at each stage. Nevertheless, we argue that there are relevant and well-tested ways of addressing the pitfalls within the respective methodologies.

Specifically, we discuss and provide examples of the strategic use of data acquisition workflows and computational analytical methods to study our specific source material: medieval heresy trial records. Our central argument is that, beyond simply understanding the assumptions and limitations of computational methods (usefully termed 'tool criticism'),<sup>11</sup> digital history must also engage much more seriously and specifically with the defining feature of history as a discipline: source criticism. Rather than merely relegating the conditions of production and transmission of sources and the related biases to an introductory or concluding caveat, we propose specific and well-defined bridges between computational methods and source criticism. This 'source criticism 2.0' not only enhances the credibility of digital historical research, but also demonstrates that computational methods should have their firm place at the core, rather than at the margins, of history as a discipline.

O. Boonstra, L. Breure, P. Doorn. Past, Present and Future of Historical Information Science. DANS, Amsterdam, 2006, 83. https://doi.org/10.26530/OAPEN\_353255;
 I. Gregory. Challenges and Opportunities in Digital History. – Frontiers in Digital Humanities, 2014, 1, 1, 1–2. https://doi.org/10.3389/fdigh.2014.00001; M. Thaller. The Need for a Theory of Historical Computing; B. J. P. van Bavel et al. Climate and Society in Long-Term Perspective: Opportunities and Pitfalls in the Use of Historical Datasets. – Wiley Interdisciplinary Reviews: Climate Change, 2019, 10, 6, e611. https://doi. org/10.1002/wcc.611.

II K. van Es. Unpacking Tool Criticism as Practice, in Practice. – Digital Humanities Quarterly, 2023, 17, 2. https://www.digitalhumanities.org/dhq/vol/17/2/000692/000692. html.

## INQUISITION RECORDS: A LABORATORY FOR TESTING INTERDISCIPLINARY AND COMPUTATIONAL APPROACHES

Inquisition records provide ideal ground on which to deploy, develop, and critically discuss the practices of digital history, as well as gauge their benefits and costs. The reason is twofold. Firstly, these records usually offer detailed information on persons, locations, events, attitudes, and relations between them. Such detail can then quite naturally be modelled as data points and subjected to appropriate methods of data analysis. Secondly, inquisition records are notoriously partial documents, but also ones that often make the conditions of their production more transparent in comparison to many other source types. For instance, they often record the exact date and location of individual trial hearings, the inquisitor and notary involved, the circumstances behind each court appearance (for example, summons, investigative custody, financial pledge, judicial torture), the reasons for someone being called (for example, previous information on, or the reputation of, the defendant), the different sequential phases of the process, as well as testimonies of different deponents on the same person or event, offering additional perspectives. When taken in conjunction with external sources, such as inquisitors' manuals, these characteristics of heresy trial records allow us to understand some of the inherent biases and decision-making processes at work within the trials.

This is not the first time that the qualities of inquisition records have proved pertinent to the development of new theoretical and methodological approaches. They were central to discussions at the Royaumont conference (associated with the Annales school) in 1962, where social scientific approaches to the study of heresy were advocated. The papers at this conference promoted the systematic analysis of heresy trial records for the detail they provide on the social setting and geography of religious dissidence.<sup>12</sup> Subsequently, the multi-vocal narrativity of heresy trial records attracted those keen to apply an anthropological approach to religious dissidence and the world surrounding it. This research avenue, championed by Carlo Ginzburg<sup>13</sup> and Emmanuel Le

<sup>12</sup> Hérésies et sociétés dans l'Europe pré-industrielle. Communications et débats du Colloque de Royaumont présentés par J. Le Goff. (Civilisations et sociétés, 10.) Mouton, Paris, La Haye, 1968.

<sup>13</sup> C. Ginzburg. I benandanti. Stregoneria e culti agrari tra Cinquecento e Seicento. Einaudi, Torino, 1966; C. Ginzburg. Il formaggio e i vermi. Il cosmo di un mugnaio del '500. Einaudi, Torino, 1976.

Roy Ladurie,<sup>14</sup> gained significant traction and opened several key sourcecritical questions on the uses of these records.<sup>15</sup>

Currently, computational modelling holds potential to engage with key research concerns in ways that go beyond previous innovations. With heresy trial records, for instance, the pivotal debate concerns the extent to which they can be used as viable evidence of dissident practice and thought, or rather only as evidence of the way the inquisitors perceived and constructed heresy.<sup>16</sup> As we will suggest, computational modelling techniques offer a unique opportunity to take contextual details together with the complexity of narrative information in a way that is systematically source-critical, and thus illuminate both sides of the coin.

Computational modelling is never defined by a single action, the simple 'press of a button'. Rather, it should be understood as a process, entailing multiple steps, decisions, and opportunities for reflection and illumination.<sup>17</sup> Effective modelling takes place all along the research path, from data acquisition continuing through the different steps of data analysis, and all the way up to the final research product. As the inevitable starting point of modelling, data acquisition thus deserves critical consideration, since decisions taken at this point affect every later stage: whether one takes a manual or more automated approach, the exact choice should take into account the characteristics of the sources and

- 14 E. Le Roy Ladurie. Montaillou, village occitan de 1294 à 1324. Gallimard, Paris, 1975.
- 15 L. E. Boyle. Montaillou Revisited: Mentalité and Methodology. Pathways to Medieval Peasants. Ed. by J. A. Raftis. Vol. 2. Pontifical Institute of Mediaeval Studies, Toronto, 1981, 119–140; D. LaCapra. The Cheese and the Worms: The Cosmos of a Twentieth-Century Historian. – D. LaCapra. History and Criticism. Cornell University Press, Ithaca, 1985, 45–69; A. Del Col. Alcune osservazioni sui processi inquisitoriali come fonti storiche. – Metodi e ricerche, 1994, 13, 1–2, 85–105; A. Del Col. I criteri dello storico nell'uso delle fonti inquisitoriali moderne. – L'Inquisizione romana: Metodologia delle fonti e storia istituzionale. Ed. by A. Del Col, G. Paolin. Università di Trieste; Circolo culturale Menocchio, Trieste, Montereale Valcellina, 2000, 51–72; J. H. Arnold. Inquisition and Power: Catharism and the Confessing Subject in Medieval Languedoc. University of Pennsylvania Press, Philadelphia, 2001; C. Bruschi. The Wandering Heretics of Languedoc. Cambridge University Press, New York, 2009; D. Zbfral, R. L. J. Shaw. Hearing Voices: Reapproaching Medieval Inquisition Records. – Religions, 2022, 13, 12, 175. https://doi. org/10.3390/reli3121175; S. Pihko. The Construction of Information in Medieval Inquisition Records: A Methodological Reconsideration. – I Quaderni Del m.æ.s. – Journal of Mediæ Aftatis Sodalicium, 2024, 22, 1, 165–189. https://doi.org/10.6092/issn.2533-2325/19030.
- 16 H. Grundmann. Ketzerverhöre des Spätmittelalters als quellenkritisches Problem. Ausgewählte Aufsätze. Bd. 1. (Schriften der Monumenta Germaniae Historica, 25.) Anton Hiersemann, Stuttgart, 1976, 364–416; R. E. Lerner. The Heresy of the Free Spirit in the Later Middle Ages. University of California Press, Berkeley, 1972; G. G. Merlo. Eretici e inquisitori nella società piemontese del Trecento. Claudiana, Torino, 1977; M. G. Pegg. The Corruption of Angels: The Great Inquisition of 1245–1246. Princeton University Press, Princeton, Oxford, 2001.
- 17 For a dynamic, processual view of modelling, and a definition of the digital humanities through modelling, see W. McCarthy. Modeling: A Study in Words and Meanings. – A Companion to Digital Humanities. Ed. by S. Schreibman, R. Siemens, J. Unsworth. Blackwell, Oxford, 2004. https://companions.digitalhumanities.org/ DH/?chapter=content/9781405103213\_chapter\_19.html.

the aspiration to retain and enhance the understanding of the source's conditions of production. Here we present two possible modes and their analytical potential: (1) the slow but illuminating path of manually modelling texts as a series of syntactic-semantic data statements, and (2) the automated possibilities and potential new source perspectives offered by Large Language Models (LLMs).

## DATA ACQUISITION: MODELLING SOURCES AS DATA

## Beyond tables: Modelling textual sources in research-oriented knowledge graphs

Analysing inquisition records in a way that draws together narrative richness and contextual detail (including that related to conditions of production) ideally requires the ability to treat these types of information in a deeply relational manner. Filling out two-dimensional tables with data derived from texts may be completely appropriate for many purposes, but will inevitably fall short where discursive nuance and its fullest context need to be placed at the heart of analysis. For such research needs, data capture techniques founded on syntactic-semantic data statements, effectively allowing researchers to transform source texts into multi-layered knowledge graphs, prove more promising. There are now a number of data capture workflows and data models founded on syntactic-semantic data statements, directed at different research needs.<sup>18</sup> One of the newest developments within this domain – Computer-Assisted Semantic Text Modelling (CASTEMO) – aims to address the

18 The pioneering effort, founded on subject-predicate-object triples, was the manual statement-based data collection workflow that formed part of Roberto Franzosi' Quantitative Narrative Analysis (QNA) methodology; see R. Franzosi. From Words to Numbers: Narrative, Data, and Social Science. (Structural Analysis in the Social Sciences, 22). Cambridge University Press, Cambridge, 2004; R. Franzosi. Quantitative Narrative Analysis. (Quantitative Applications in the Social Sciences, 162.) Sage, Thousand Oaks, 2010. An automated data capture process aimed at extracting the core of what is needed for the analysis of narrative alone (a sequence of subject-predicate-object data statements) is provided by: S. Bastholm Andrade, D. Andersen. Digital Story Grammar: A Quantitative Methodology for Narrative Analysis. – International Journal of Social Research Methodology, 2020, 23, 4, 405-421. https://doi.org/10.1080/13645579.2020.17232 05. The STAR model expands the triple-format data statement (subject-predicate-object) to a quintuple (adding 'asserter' and 'source') in a way well suited to capturing potentially conflicting assertions for historical databases: J. Baillie et al. Modelling Historical Information with Structured Assertion Records. – Digital History Berlin (blog), 2021. https://dhistory.hypotheses.org/518 (25.03.2025); T. L. Andrews, M. Deierl, C. Ebel. Gender Assignment as an Event: A Contemporary Approach for the Adequate Depiction of Historical Gender Categories. – Digital Scholarship in the Humanities, 2024, 39, 1, 5–12. https://doi.org/10.1093/llc/fqad100.

concern that some properties of historical data "simply do not fit into the clean rectangular tables of relational software" and require "software tailored for historical use".<sup>19</sup> The CASTEMO data collection workflow and its data model allow both the very close modelling of texts and the addition of rich analytical annotation.<sup>20</sup>

The CASTEMO data model is founded on data statements with a quadruple structure, reflecting the ubiquity of clauses containing both direct and indirect objects. Statements - quadruples designed to model textual clauses – link entity/ies in a 'subject' slot to those in the 'actant 1' and 'actant 2' slots (i.e. objects) via an entity filing the 'action' slot. These slots can be modified to reflect semantic nuance: for instance, the 'action' slot has 'mood' (for example 'indication', 'question', 'allegation', etc.) and 'mood variant' ('realis', 'irrealis') options for capturing the semantic modality. Other varieties of quadruple - Relations (basic semantic and ontological relationships), References (linking information to a source), and Properties (any other sort of characterisation) - allow entities to be extensively characterised. Those entities fall into two basic types: specific (Person, Group, Object, Location, etc.) and generic (Action and Concept), the latter playing a key role in structuring everything else that is captured. Actions govern the 'action' slot in Statements, specifying the syntactic-semantic qualities of the other slots, while Concepts, among other uses, help situate entities of every variety via Properties and Relations; together they form a user-defined network linked by semantic Relations (for example 'Superclass', 'Synonym', 'Action-Event Equivalent'). Meanwhile, epistemic levels ('textual', 'interpretive', 'inferential') clarify the relationship of data statements or any element within them to the source text, delineating textual modelling from analytical additions. While CASTEMO is thus capable of capturing vast complexity, its ease of use and accessibility is ensured by a purposebuilt open-source data capture environment, InkVisitor,<sup>21</sup> and the ability to readily project what is modelled into a Neo4j graph database. In the latter, the text and its surrounding analytical framework can effectively be represented and explored in knowledge-graph form, as can be seen in Figure 1, which represents a sequence of Statements modelling part of a heresy trial deposition.

- 19 M. Thaller. The Need for a Theory of Historical Computing, 196.
- 20 D. Zbíral et al. Model the Source First!: Towards Computer-Assisted Semantic Text Modelling and Source Criticism 2.0. – Zenodo, 06.08.2022. https://doi.org/10.5281/ zenodo.6963579.
- 21 D. Zbíral et al. InkVisitor 1.4. 24.05.2024. https://github.com/DISSINET/InkVisitor/.





The ability to model and query texts in the manner enabled by CASTEMO allows for unprecedented analysis of the complex relationality contained within historical trial records, due not only to the characteristics of the resultant data, but also the slow, methodical process of manual acquisition behind it: as an informative process, it is anything but superficial, a charge sometimes levelled against data capture in digital history. For instance, a study of a thirteenth-century register of heresy trial verdicts and sentences (that of the inquisitor Peter Seila, 1241-2) has demonstrated how complete CASTEMO capture of such a source can provide a platform for studying sentencing practice. By capturing the text in its entirety, CASTEMO allowed for decisions over the categorisations of potentially influencing factors - different crime semantics, types of social interactions and relations - to be refined gradually, rather than made at the outset. The course of slowly encoding the text indeed contributed to a definition of independent and dependent variables in such a way that the systematicity of inquisitor's sentencing could be reliably corroborated through analysis.<sup>22</sup> More pertinently to the issue of source criticism, the same CASTEMO data acquisition can also directly inform the analysis of the constructive processes behind trial records. In the course of completely capturing another heresy trial record (the trial of Bernard-Oth of Niort, 1234 or 1235), we noticed frequent recourse to hearsay in witness responses (captured in part by applying 'allegation' mood to the 'action' slot of Statements) and a complex relational web between responses (for example, "said the same as", captured by Properties). In analysis, these relational details were brought together (along with the social characteristics of the witnesses) to show that responses seemingly founded on hearsay were frequently summarised by the notary within "said the same as" testimony chains, as is apparent in the analytical graph depiction of testimonies in Figure 2. Overall, the ability of CASTEMO to capture and annotate all manner of textual information contained within such records - including complexities like tone of response, conflicting statements, narrative sequence, as well as all contextual details (for example trial circumstances, social characteristics of participants) - provides a strong platform for analyses where both content and conditions of production count.

<sup>22</sup> R. L. J. Shaw, T. Hampejs, D. Zbíral. Modeling Systems of Sentencing in Early Inquisition Trials: Crime, Social Connectivity, and Punishment in the Register of Peter Seila (1241–2). – Historical Methods: A Journal of Quantitative and Interdisciplinary History, 2023, 56, 3, 176–197. https://doi.org/10.1080/01615440.2023.2270404.



*Figure 2.* A diagram of the 1234/5 Niort family trial documents. Responses to four stated charges (the four squares behind each witness, running clockwise from the top left, i.e. first charge) and key social categories of the witnesses, as well as the referential links between witness depositions are shown. Unlinked witness depositions have been placed on the left. The black bars indicate document sections, labelled in [textual order]/[chronological order] format: for example 2/3 = second document section, representing the third sitting of the trial. Diagram by Tomáš Hampejs

# Into the black box and out again: Annotating historical texts using LLMs

The manual collection of syntactic-semantic statements is, in many ways, close to the interpretive practice of standard (qualitative) history based on close reading of sources. It is thus hard to beat for a fruitful marriage between data-oriented quantitative analysis and source criticism. However, such manual data collection efforts can now be usefully supplemented with LLMs. Even using LLMs heuristically, to find relevant passages and summarise them, can inform research in

important ways. However, their most unprecedented potential within digital history lies in extracting structured data. Considering this task, it is not an understatement to say that LLMs open a new era for the notoriously underfinanced humanities: they can become invaluable research assistants, able to handle most languages in which historical sources are written with an accuracy that surpasses that of many a student assistant. The cost for tasks performed on large textual corpora, whose size is well beyond the life-time close reading capacity of a single researcher, typically remains affordable even with commercial LLMs. However, LLMs are also, quite inherently, a black box. The reasoning approach of their neural network architecture can be summarised generally, but not specifically (i.e., with regard to the process they follow in answering a particular question regarding a particular text segment); indeed, such networks do not even necessarily produce exactly the same response when asked to repeat a task. Interpreting the meaning and representativeness of their output can thus be challenging. As the use of LLMs to extract information from historical texts is still not very widespread, it is hopefully not inappropriate to suggest some healthy principles of LLM-based information extraction that would make research based on such data more reliable and reproducible:

- 1. Set the model to behave as deterministically as possible, for example, setting 'temperature' (the parameter controlling randomness) to 0, so that with everything remaining equal (input, model and model version used, model settings), the output also remains (virtually) the same if the task is repeated.
- 2. *Manually create a gold-standard sample dataset*, i.e., follow the same prompts yourself to annotate a random sample of passages from the corpus.
- 3. *Measure the performance* against this gold-standard dataset, i.e., determine 'recall' (what proportion of relevant information was retrieved, and thus what proportion was missed) and 'precision' (in what proportion of observations retrieved was the value outputted by the LLM correct).

Building upon an example from our research in progress: We preprocessed (without the use of LLMs) a corpus of heresy trial records to obtain individual clauses, making each clause (denoting one action or state) the unit of observation. For each clause, we prompted the LLM to decide whether it is valid or invalid (i.e., whether it is a clause at all); whether the action described is portrayed as real or not real (given how many clauses in inquisition records do not denote reality, for example, open-ended questions, hypothetical statements, etc.); and whether the clause relates to the trial (for example, interactions between the interrogator and the deponent), or testimony given at a trial hearing (for example, reports about dissident activities). In another prompt, applied only to clauses evaluated as 'valid', 'real' and 'testimony', we asked the LLM to list all human actants (subjects and objects) of the clause and assess whether they are a person or a group; male, female, or generic (for example, potentially mixed-gender groups); and subject or object. In a third prompt, applied only to the same clauses in which at least one 'person' actant was recognised, we asked the LLM to classify the action by choosing one of eleven categories (Communication, Movement, Ritual, etc.). For each task, we defined a closed set of categories. For instance, taking just our prompt concerning gender:

Is the Actant Male or Female or Generic? Both Person and Group can be either Male or Female or Generic. A Person whose gender cannot be identified from the name, pronoun, social relation (e.g. wife, sister, father) or description is Generic. Group names implying female-only membership (heretice, mulieres, etc.) are Female. Any other group name which might represent a generic mixed-gender group (omnes, heretici, credentes, homines, persone, familia) rather than a male-only or female-only group is Generic.

Instead of narrative answers, we specifically requested answers in a predefined structure employing specific delimiters. For instance, in the case of the clause actants, the output looked as follows:

Arnalda Arimanda|Person|Female|Subject Guillelmus Prunelli|Person|Male|Subject Bernardus Tilhol|Person|Male|Subject duas alias hereticas|Group|Female|Object

Such structured LLM outputs provide easily parsable data (in this instance, data on the reported actions of and interactions among persons, including the type of action). If we cannot yet emulate the semantic richness provided by something like CASTEMO via LLMs – which nevertheless remains our long-term goal –, it is certainly feasible to include some of the contextual richness relevant for a critical use of source information by requesting it in our prompts.

The current version of our prompts summarised above achieves the precision of ca. 0.7-0.84 (70-84%), and the recall of ca. 0.62-0.78 (62-78%), depending on the specific task. We of course did not expect 1.0

(100%) scores, and they are not needed for valid research, as quantitative methods are generally able to deal with known amounts of missing and incorrect data. Furthermore, it is well known – while still little tested specifically in data work performed by historians – that even expert human coders annotating a corpus do not achieve complete agreement.<sup>23</sup> Our initial tests of pairwise intercoder agreement among five medieval historians annotating Latin-language inquisition records produce agreement scores of ca. 0.69–0.95 (69–95%), depending on the task, which is not so vastly different from the 0.70–0.84 (70–84%) agreement between the LLM output and gold-standard data. These preliminary results suggest that in such tasks, some of them reasonably complex, LLMs can achieve very respectable levels of accuracy comparable to expert human coders.

On balance, while care in setting up prompts, configuring the model, and measuring its performance does not change the fact that we enter a black box whenever using LLMs, it does allow us to exit it with outputs that can be analysed with well-defined confidence. It is to methods that allow us to fulfil such analyses that we now turn.

## DATA ANALYSIS: MODELLING DATA FOR RESEARCH

#### Beyond connected dots: Social network analysis

Social network analysis (SNA) is a theoretical approach and methodology that models social phenomena through relationships ('ties' or 'edges') between elements ('nodes' or 'vertices') of a larger whole ('network' or 'graph'). Under the label of historical network research (HNR), its use in history is now well established. Taking root at the turn of the 1990s,<sup>24</sup> and well-served by early programmatic articles,<sup>25</sup> HNR has

- 24 M. C. Alexander, J. A. Danowski. Analysis of an Ancient Network: Personal Communication and the Study of Social Structure in a Past Society. – Social Networks, 1990, 12, 4, 313–335. https://doi.org/10.1016/0378-8733(90)90013-Y; J. F. Padgett. C. K. Ansell. Robust Action and the Rise of the Medici, 1400–1434. – American Journal of Sociology, 1993, 98, 6, 1259–1319. https://doi.org/10.1086/230190.
- 25 B. Wellman, C. Wetherell. Social Network Analysis of Historical Communities: Some Questions from the Present for the Past. – The History of the Family, 1996, 1, 1, 97–121. https://doi.org/10.1016/S1081-602X(96)90022-6; B. H. Erickson. Social Networks and History: A Review Essay. – Historical Methods: A Journal of Quantitative and Interdisciplinary History, 1997, 30, 3, 149–157. https://doi.org/10.1080/0615449709601182; C. Wetherell. Historical Social Network Analysis. – International Review of Social History, 1998, 43, 6, Supplement, 125–144. https://doi.org/10.1017/S0020859000115123.

<sup>23</sup> R. Artstein, M. Poesio. Inter-Coder Agreement for Computational Linguistics. – Computational Linguistics, 2008, 34, 4, 555–596. https://doi.org/10.1162/coli.07-034-R2.

become a burgeoning field: there are up-to-date review, introductory and companion texts,<sup>26</sup> as well as a dedicated *Journal of Historical Network Research* (JHNR). Medieval studies have likewise benefitted from exposure to HNR methods.<sup>27</sup>

However, most HNR research to date suffers from too much reliance on visually exploring and describing networks: for instance, on highlighting network topology by clustering techniques, or identifying the most important nodes via centrality scores. This stands in stark contrast to the use of SNA in the social sciences: the majority of recent studies in disciplinary journals, such as Social Networks, contain no network diagrams at all and, where centrality measures are discussed, it is in relation to centrality score distributions rather than individual actors. Most crucially, in this context, SNA is employed as a true computational method intended to model (and thus explain) the operation of social networks. Already in its earliest uses by Jacob Levy Moreno in the 1930s, the point of analysing relationships between inmates and students was to offer an explanatory account of their behaviour: where predictors such as social background failed, Moreno set out to explore the dynamics of interaction and behavioural contagion.<sup>28</sup> Now, with the development of statistical models for networks, we are able to test hypotheses about the likely influences even on relatively small-scale networks (i.e., tens of nodes). Such models allow us to analyse how node attributes (such as gender), dyadic attributes (such as gender combinations of a pair of

- 26 C. Lemercier. Analyse de réseaux et histoire. Revue d'histoire moderne et contemporaine, 2005, 52, 2, 88–112. https://doi.org/10.3917/rhmc.522.0088; M. Grandjean. Introduction to Social Network Analysis: Basics and Historical Specificities. HNR+ResHist Conference, Luxembourg, 2021. https://doi.org/10.5281/zenod0.5083036; T. Brughmans. Connecting the Dots: Towards Archaeological Network Analysis. Oxford Journal of Archaeology, 2010, 29, 3, 277–303. https://doi.org/10.1111/j.1468-0092.2010.00349.x; T. Brughmans, A. Collar, F. Coward. Network Studies in Archaeology and History. Ed. by T. Brughmans, A. Collar, F. Coward. Oxford University Press, Oxford, 2016, 3–19; R. Gramsch-Stehfest. Von der Metapher zur Methode. Zeitschrift für Historische Forschung, 2020, 47, 1, 2–40. https://doi.org/10.3790/zhf.47.1.1; Handbuch Historische Netzwerkforschung: Grundlagen und Anwendungen. Hrsg. von M. Düring et al. LIT, Berlin, 2015.
- 27 R. Gramsch. Das Reich als Netzwerk der Fürsten: Politische Strukturen unter dem Doppelkönigtum Friedrichs II. und Heinrichs (VII.), 1225–1235 (Mittelalter-Forschungen, 40.) Thorbecke, Ostfildern, 2013; Maths Meets Myths: Quantitative Approaches to Ancient Narratives, Understanding Complex Systems. Ed. by R. Kenna, M. MacCarron, P. MacCarron. Springer, Cham, 2017. https://doi.org/10.1007/978-3-319-39445-9; M. Hammond, C. Jackson. Social Network Analysis and the People of Medieval Scotland 1093–1286 (PoMS) Database. 2017. https://poms.kdl.kcl.ac.uk/documents/110/WHOLE\_ BOOK\_Ptt.pdf (14.05.2025); K. P. Fazioli. Modeling the Middle Ages: A Review of Historical Network Research on Medieval Europe and the Mediterranean World. – Social and Intellectual Networking in the Early Middle Ages. Ed. by K. P. Fazioli, M. J. Kelly. Punctum Books, Santa Barbara, 2023.
- 28 J. L. Moreno. Who Shall Survive? A New Approach to the Problem of Human Interrelations. Nervous and Mental Disease Publishing Company, Washington, 1934.

nodes), and network formation mechanisms (such as tie accumulation) might have contributed to the observed network.

Heresy trial records are proving to be an ideal setting in which to apply such approaches. Building on the fruits of programmatic or theoretical articles concerning the use of SNA within the field,<sup>29</sup> and the pioneering empirical applications of network analysis to heresy trial records made by Elisabeth Timberlake-Newell and Delfi Nieto Isabel,<sup>30</sup> the latest wave of research seeks to explain network patterns observed within these sources, thus far particularly those concerned with incrimination (i.e., suspects naming others as involved in illicit activities or holding heterodox attitudes). Jean-Paul Rehr uses network analysis to assess a clearly defined hypothesis (if not formally test it statistically), arguing that a large-scale investigation of heresy in mid-1240s Lauragais was in fact politically biased by the specific targeting of members of consular families.<sup>31</sup> Employing formal statistical modelling, José Luis Estévez et al. show how pressure of a 1335 Piedmontese inquisitorial investigation gradually eroded the suspects' protection of close contacts, starting with their congregation members and finally reaching even their family members.<sup>32</sup> In a recent study, we used a statistical model to examine the predictors of incrimination in a register of the Bologna inquisition from around 1300, and found that in this register, women were more likely to incriminate other women, while the same tendency was not observed for men.<sup>33</sup> Such studies, which move beyond 'connecting the dots' towards truly explaining patterns observed in a network, show how SNA can directly engage with source criticism: by quantitatively

- 29 P. Ormerod, A. P. Roach. The Medieval Inquisition: Scale-Free Networks and the Suppression of Heresy.– Physica A, 2004, 339, 645–652; D. I. Nieto-Isabel, C. López-Arenillas. From Inquisition to Inquiry: Inquisitorial Records as a Source for Social Network Analysis. – Digital Humanities and Christianity: An Introduction. Ed. by T. Hutchings, C. Clivaz. (Introductions to Digital Humanities – Religion, 4.) De Gruyter, Berlin, 2021, 195–212. https://doi.org/10.1515/9783110574043.
- 30 E. Timberlake-Newell. Consigned to the Flames: An Analysis of the Apostolic Order of Bologna, 12-90–1307, with Some Comparison to the Beguins/Spiritual Franciscans, 1300-1330. Ph.D. thesis. University of Glasgow, Glasgow, 2012. http://these.gla. ac.uk/3592/1/2012Timberlake-NewellPhD.pdf; D. Isabel Nieto-Isabel. Communities of Dissent: Social Network Analysis of Religious Dissident Groups in Languedoc in the Thirteenth and Fourteenth Centuries. Ph.D. thesis, Universitat de Barcelona, Barcelona, 2018.
- J.-P. Rehr. Vidit Cum Hereticis: Remapping Networks of Accusations at the Great Inquisition of Toulouse, 1245–1246. 2nd-year thesis. Université Lumière Lyon 2, Lyon, 2018; J.-P. Rehr. Re-Mapping the 'Great Inquisition' of 1245–46: The Case of Mas-Saintes-Puelles and Saint-Martin-Lalande. – Open Library of Humanities, 2019, 5, 1, 1–52. https:// doi.org/10.16995/olh.414.
- 32 J. L. Estévez, D. Salihović, S. V. Sgourev. Endogenous Dynamics of Denunciation: Evidence from an Inquisitorial Trial. – PNAS Nexus, 2024, 3, 9, pgae340. https://doi.org/10.1093/ pnasnexus/pgae340.
- 33 D. Zbíral et al. Gender, Kinship, and Other Social Predictors of Incrimination in the Inquisition Register of Bologna (1291–1310): Results from an Exponential Random Graph Model. – PLOS One, 2025, 20, 2, e0315467. https://doi.org/10.1371/journal.pone.0315467.

analysing the way suspects incriminated others and inquisitors followed up those leads, computational modelling can systematically illuminate a key stage in the production of these sources.

### Beyond maps: Spatial analysis

Maps have long served as an essential visualisation tool in historical research for discovering and presenting the stories of the human past at various degrees of scale. Spatial analysis, largely facilitated by geographic information systems (GIS), adds a further dimension by allowing various spatial aspects of historical data to be examined. Typically, it aims to express the spatial distribution of phenomena, detecting patterns in those distributions, and testing specific hypotheses in relation to them. The point of departure for most analyses is a dataset of locations which are geocoded, i.e., provided with geographic coordinates, and related to some target phenomenon (for example, places of residence of suspects, places of interaction between them). Coordinates can either be taken from available gazetteers or – as is often necessary – created expressly for the purpose of specific research; specialised assistance software for historical geocoding is available for these purposes.<sup>34</sup>

Inquisition records contain a large amount of spatial information concerning suspects (their geographic ties, places of activity, mobility, etc.) as well as the trials (locations of hearings, places of origin of inquisitors and staff, etc.). Such details can tell us something about the spatiality of both dissidence and its repression, although often in a conjoined manner: our knowledge of the former is effectively limited by the reach of the latter. The information also often has uncertainties, both with regard to geocoding (i.e., to what exact point a place name in the source actually corresponds), and interpretation (for example, what does "Someone of somewhere" actually mean in terms of spatial relation). Nevertheless, transforming such details into data and subjecting them to careful spatial analysis has the potential to systematically unravel the story of what they convey and place bounds on our uncertainties.

For instance, in a recent study of Peter Seila's register of inquisition sentences from the Quercy region of Languedoc, we systematically captured and (where possible) geocoded the toponymic surnames of those sentenced, which is largely the only source of spatial information

<sup>34</sup> For example, A. Mertel et al. Historical Geocoding Assistant. – SoftwareX, 2021, 14, 100682. https://doi.org/10.1016/j.softx.2021.100682.

about these individuals available.<sup>35</sup> Mapping the geocodable surnames alongside and in relation to the nine different regional centres where the sentences were handed down (see Figure 3) on its own only tells us so much. While we can see that most of the toponyms are securely geocoded, this information remains very difficult to interpret, not least since, *prima facie*, we do not know what sort of spatial information these surnames actually represent. However, a simple spatial analysis focused on the distances between the distinct toponyms derived from the suspect surnames and their associated sentencing centres (see Figure 4) illuminates the scene. At the sentencing events held in at larger towns (Montauban and Moissac), where very few suspects had geocodable toponymic surnames, the rather distant associated toponyms appear primarily to relate to inward migration; at the other centres, typically small villages, where a much greater proportion of suspects have such surnames, the relatively close distribution seems more likely to



*Figure 3.* Geocoded toponymic surnames of those sentenced by Peter Seila, showing geolocation ambiguities. Lines connect individuals to locations denoted by their surnames. Map by Kaarel Sikk

35 R. L. J. Shaw, K. Sikk, D. Zbíral. Toponymic Surnames and the Spatiality of Heresy Prosecutions: Peter Seila's Register of Sentences from the Quercy Region (Languedoc), 1241–1242. – Humanities and Social Sciences Communications, 2024, 11, 1, 1–14. https:// doi.org/10.1057/s41599-024-02689-z.



*Figure 4.* Distances between distinct mapped toponyms and associated sentencing events. The central rectangle in each boxplot represents the common range of these distances (25th–75th percentile). The line inside the rectangle denotes the median distance. The 'whiskers' extending from the box indicate variability outside the middle 50%, while significant outliers are plotted as individual points

relate to a spread of regional residences. Taken together with external sources showing that townspeople in the region were less likely to have toponymic surnames, we were able thus to conclude that the inquisitor primarily focused on urban dwellers during trials based in towns (with little penetration into the rural surroundings), but pushed for a fuller regional coverage during those which were centred on villages. In turn, understanding the effective reach of the inquisitorial spotlight framed our understanding of dissidence in the Quercy region.

More advanced modelling techniques can generate comparative insights regarding the importance of space in the interaction between inquisitors and local societies. In an as yet unpublished study of trial documents from an inquisition in Stettin, 1393–4, we were able to show, by a comparison of Pearson correlation coefficients, that distance to Stettin is much more relatable to the order in which the inquisitor, Peter Zwicker, interviewed suspects than any other factor investigated, including weight of prior incriminations by others within the process. This inquisitor, it seems, approached his investigation largely from a geographically organised existing list of suspect names and progressed, to a degree, outwards from Stettin itself into the surrounding parts.

Spatial analysis derived from such historical materials always remains challenging due to the limitations of our sources. There are always missing data and informational ambiguities. We also very often lack complementary demographic and geographic datasets concerning local societies that would allow us to enhance these analyses and fully contextualise our findings, forcing us at times to reach for proxies from different periods or neighbouring areas. Nevertheless, there remains a power in carefully collecting and classifying whatever spatial data is available, and analysing it with reference to whatever else is known of context and a clear understanding of what remains unknowable. The examples presented here illustrate not only this, but also the power of spatial analysis to move beyond what can be read visually from maps to interrogate the historical interactive processes behind inquisition records. In this sense, they too can contribute an angle to our source-critical knowledge of the sources.

### Beyond Ctrl+F: Computational text analysis

The concept of computational text analysis (CTA), virtually synonymous with that of quantitative text analysis,<sup>36</sup> stands for the use of computational methods to discover and interpret patterns within texts in relation to a research problem. In the context of digital history, CTA is arguably a better term to describe such research endeavours than the more engineering-oriented concept of natural language processing (NLP).<sup>37</sup> NLP techniques obviously constitute the essential building blocks of all CTA research pipelines, but as a field of activity, NLP mainly aims at algorithm development, while CTA aims at using corpora to answer specific research questions.

Of all computational methodologies, CTA – sometimes described as 'distant reading', following Franco Moretti<sup>38</sup> – has probably found the most use in historical studies, making inroads from quite an early stage and with continued impetus. Seeking to comprehend texts from a new angle, it has perhaps proved more persuasive to most humanists than other computational approaches. History is of course no different from most

<sup>36</sup> K. L. Nielbo et al. Quantitative Text Analysis. – Nature Reviews Methods Primers, 2024, 4, 1, 1–16. https://doi.org/10.1038/s43586-024-00302-w.

P. DiMaggio. Adapting Computational Text Analysis to Social Science (and Vice Versa). – Big Data & Society, 2014, 2, 2, 205395171560290. https://doi.org/10.1177/2053951715602908.

<sup>38</sup> F. Moretti. Distant Reading. Verso, London, New York, 2013.

other humanities in its preoccupation with texts, and the rapid advance of CTA within it has gone hand in hand with the considerable efforts towards the digitisation of written historical documents. Nevertheless, Ian Gregory's 2014 caveat that "digital sources are often interrogated using techniques that are not properly understood but are nevertheless used uncritically", as well as his reminder that historians worthy of this name "are in the business of taking complex, incomplete sources that are full of biases and errors, and interpreting them critically to develop an argument that answers a research question",<sup>39</sup> still apply today. The democratisation of CTA, driven by the ever increasing availability of digitised texts, accessibility of CTA tools, and now the availability of LLMs as a generalistic CTA tool, thus bring challenges as well as opportunities.

Many different types of corpus-based CTA research can be performed on historical documents such as heresy trial records. Most concentrate on identifying observations relevant to a selected research topic via a variety of textual search mechanisms, ranging from classical keyword search through to more complex semantic searches (which can now also be powered by LLMs). The results are then typically collated in a tabular form to facilitate analysis of patterns. While often delivered by complex algorithms, there is thus an apparent simplicity in this sort of 'search' work, which is at once alluring to non-technical minds, but can also lead to glib analyses. There are two fundamental areas in which digital history can raise the bar in its use of CTA: (1) paying attention to the quality of algorithmic outputs, above all to 'recall' (i.e., what proportion of relevant textual information that should have been retrieved was actually retrieved) and 'precision' (i.e., what proportion of the retrieved textual information is validly classified); and (2) testing the statistical robustness of the patterns we seem to observe in the descriptive statistical results.

Concerning the first point, we can validate information extraction results in different ways. The absolute minimum is estimation based on expert knowledge of the content of the sources: if the number of results is visibly below expectations, we know the recall is poor and further changes to the process are required; similarly, we can make a reasonable estimate of precision by grading a sample of the extracted observations. The best approach, however, is to formally measure precision and recall

39 I. Gregory. Challenges and Opportunities in Digital History.

against an adequately sized and adequately sampled human-annotated portion of the original textual data.

Concerning the second point, statistical analysis, it should be noted that while observed patterns in search outputs might immediately suggest conclusions to us, many will ultimately not stand the test of statistical significance even when taken alone. Furthermore, the apparent patterns may well disappear if source-critical variables are also brought into the analysis. Being able to show that results remain significant with at least the most evident potential source biases accounted for in the statistical model certainly brings the argument to a higher level.

Taking an example from our research in progress, we employ methods generally used for authorship attribution, plagiarism detection, and the study of collaborative writing to shed light on the relative importance of the notarial vs. inquisitorial signal in an extensive inquisition register that features several inquisitors and notaries. We look at the choice of words, sub-words, and multi-word expressions, as well as common sentence structures, evaluate how strongly they identify particular notaries and inquisitors in the register (controlling for statistical significance), and through this derive the relative contribution of the particular notary and inquisitor in each collaborating notaryinquisitor pair. Finally, we summarise these contribution ratios into the overall contribution of all notaries vs. all inquisitors in this register. We thus put a complex data processing pipeline and statistical analysis to work in addressing a crucial source-critical question concerning the intermingling of voices in heresy trial records.

## Beyond 'positive data': Source criticism 2.0 in data-oriented history

Throughout this paper, we have drawn attention to issues of source criticism. Digital history may be digital by the virtue of applying computational methods to historical sources, but it hardly amounts to good history without organically integrating this defining feature of the discipline.<sup>40</sup> Source criticism stands for being systematically mindful of conditions of production (which lead to selective and tendentious perspectives in the information that sources convey) as well as the conditions of preservation (affected not only by chance events but also by conscious selection along the whole chain of transmission).

40 For a useful recent review, see C. Backerra. Source Criticism for Cultural History. – Rethinking History, 2024, 28, 2, 194–216. https://doi.org/10.1080/13642529.2024.2361214.

As discussed in our opening remarks, digital history is in a great position to move beyond simply mentioning the biases and limitations of sources in introductory and concluding remarks, as computational techniques can themselves be used, in various ways, to enhance source criticism. With their help, we can in fact aspire towards a 'source criticism 2.0'. To avoid misunderstanding, by this notion we do not mean digital textual criticism,<sup>41</sup> critical use of computational methods ('tool criticism'<sup>42</sup>), or mere attention to digital forms of representation as a new layer in source criticism. All of these are pivotal for different aspects of digital history's research process; we have, for instance, raised 'tool criticism' at several points in this article. However, by computerassisted source criticism, or 'source criticism 2.0', we mean something quite specific: seeking systematic assistance from computational methods in order to make the conditions of production and narrative perspectives of sources a key aspect, indeed even the central object, of the research process. We have already shown some examples of how this form of source criticism can be applied in relation to both data acquisition (by drawing together a richness of discursive and contextual details in relational data) and data analysis (by focusing the attention of computational techniques on the interactions and perspectives that featured at various stages of source production).

Building on these considerations related to specific methods, there are more multi-applicable approaches that can serve to bring source criticism from the margins to the centre of digital history. One of the most immediate and most general opportunities for using computational methods to help achieve the age-old goals of source criticism lies in the practice of statistically controlling for potentially confounding variables related to source bias. In practical terms, this means including variables that do not directly target a given research question, but which might nevertheless influence the observed effect. Without controlling for them, we risk a false attribution of the effect to a focus variable. To illustrate how crucial it is not to miss this opportunity, we can take a specific example from the field of statistical models for networks. We might be interested, for instance, in differences between centrality scores of men and women in a network of dissident interactions. Far from only focusing on comparing the two centrality score distributions (one for men, the other for women), the best research practice is to introduce

<sup>41</sup> F. Fischer. Digital Corpora and Scholarly Editions of Latin Texts: Features and Requirements of Textual Criticism. – Speculum, 2017, 92, SI: S265–S287. https://doi. org/10.1086/693823.

<sup>42</sup> K. van Es. Unpacking Tool Criticism as Practice, in Practice.

variables relating to the production conditions of information conveyed by our sources, which might very well confound the observed pattern. For instance, if men appear to be more connected within a network (i.e., have higher 'degree'), we might wish to control for the potentially biased perspectives of the sources. In case we have multiple investigators involved in the production of a register, does the apparent higher centrality of men remain if we control for which investigator is interrogating? That is to say, might the bias of a particular inquisitor towards investigating the actions of men be the real driver of the effect initially attributed to suspect gender alone? Perhaps even more crucially in this instance, we might also want to control for the gender of deponents giving evidence concerning interactions. It is realistic that men might tend to talk more often about other men than about women (and vice versa). If so, and if men also happen to be better represented among deponents (a situation not uncommon in medieval inquisition registers), it may be these factors driving the observed effect, rather than the actual propensity of men to be better connected in medieval religious dissidence. If we include the gender of the deponent under each data point and we build the statistical model in such a way that deponent gender becomes a control variable, we effectively ensure that the model evaluates whether the apparent higher centrality of men still holds true when controlling for this potential deponent gender bias.

The ability to be systematically mindful of such source-critical factors is, in fact, one of the key advantages of computational approaches to history. Qualitative approaches in history are arguably less conducive to holding such potential influences in mind at every point in the course of reading and analysis; it is much harder to state confidently, in the conclusions, that they were taken into account. This strength of computational approaches can of course, however, only be put to use if relevant source-critical information is systematically captured within the data themselves, as we have stressed in our discussion of data acquisition.

Another area in which computational research can provide strong support for source criticism is missing information. Historians often note how many sources have been lost, as well as the lack of information authors might have included but chose not to. The vast extent of what will forever remain unknown is among the most common caveats in historical writing. We cannot efface this problem via quantitative approaches of course, but computational modelling can help us do a lot more to assess more precisely the effect of information gaps on our results. It can do so in two different ways: (1) by simulating the loss of a portion of existing data; and (2) by 'imputing' data, that is, generating replacement data under controlled conditions.

The first, more conservative, path can teach us a lot about the likely impact of lost and unknown data on our research. A recent article of Sébastien de Valeriola is an exemplary study in this regard, deploying simulation-based assessments of how robust network centrality measures are in the face of historically plausible scenarios of information loss (for example, loss of whole documents rather than of random nodes or edges) and distortion (for example, transcription errors).<sup>43</sup>

Concerning the second use, there is broad literature on data imputation in network analysis,<sup>44</sup> spatial analysis<sup>45</sup> as well as other fields. Specific considerations concerning the imputation of historical data are now also taking shape.<sup>46</sup> Taking an example from our in-progress research, we analysed a set of documents from Peter Zwicker's inquisition in Stettin, 1393–4, where we know we possess 195 depositions from an original number of 455. Our analysis of the surviving testimonies suggested that deponent incriminations of new suspects were given only limited investigatory follow-up by the inquisitor. However, we were conscious of just how much this conclusion could depend on the loss of more than half of the depositions. Therefore, we simulated the incriminations in the lost depositions based on the salient patterns observed in the extant material. The new density level of the network prompted us to seek – and gain – confirmation of our initial findings through alternative statistical methods.

The use of control variables concerning conditions of production and/or transmission, simulations concerning data loss, as well as the other techniques discussed in the course of this article, highlight the potential of computational methods not only to take source criticism into account,

- 43 S. de Valeriola. Can Historians Trust Centrality? Historical Network Analysis and Centrality Metrics Robustness. – Journal of Historical Network Research, 2021, 6, 1. https://doi.org/10.25517/jhnr.v6i1.105.
  44 M. Huisman. Imputation of Missing Network Data: Some Simple Procedures. – Journal
- 44 M. Huisman. Imputation of Missing Network Data: Some Simple Procedures. Journal of Social Structure, 2009, 10, 1, 1–29. https://www.cmu.edu/joss/content/articles/ volumero/huisman.pdf; R. W. Krause, M. Huisman, T. A. B. Snijders. Multiple Imputation for Longitudinal Network Data. – Statistica Applicata: Italian Journal of Applied Statistics, 2018, 30, 1, 33–57. https://research.rug.nl/en/publications/multipleimputation-for-longitudinal-network-data; R. W. Krause et al. Missing Network Data: A Comparison of Different Imputation Methods. – 2018 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining (ASONAM), August 2018, 159–163. https://doi.org/10.1109/ASONAM.2018.8508716.
- 45 K. A. Henry, F. P. Boscoe. Estimating the Accuracy of Geographical Imputation. International Journal of Health Geographics, 2008, 7, 1, 1–10. https://doi. org/10.1186/1476-072X-7-3.
- 46 P. Tran, S. Arlei. History as a Data Science: Missing Data Imputation on the the Slave Voyages Dataset. – Proceedings of KDD Under- Graduate Consortium (KDD-UC '22). ACM, New York, 2022; R. Spicer et al. Predicting the Past: Imputation of Historical Data. – OSF, 20.07.2023. https://doi.org/10.31234/osf.io/9gpwf.

but also to bring it to genuinely new heights. Rather than a perceived weakness of digital history, source criticism can become digital history's greatest strength, placing computation at the centre, rather than the margins, of the wider discipline.

#### CONCLUSION

The examples in this paper have been drawn primarily from the use of computational methods in the study of heresy trial records. However, the key lessons are applicable to any strand of digital history in which texts represent the key source category. By (1) recording and relating both discursive and contextual detail through more carefully designed data acquisition, (2) going beyond basic or even ill-informed use of tools to take advantage of the most penetrating possibilities in analysis and modelling, and, in the process, (3) placing source-criticism at the heart of computational research, digital history can address all of its key criticisms: that it is too positivistic, too superficial, and/or too narrow in its focus.<sup>47</sup> In doing so, the space for exchange with standard qualitative history can be broadened, since we more fully engage with the same core historical issues. As the techniques and methods described here become ever more accessible - and with the advent of LLMs to assist at every step, including programming, they will do so at great speed – the entirely correct insistence that digital historians be aware of and engage with more qualitative perspectives should find its converse complement. Indeed, historians of a more classical bent may soon find themselves asked why they haven't engaged with the computational possibilities for deepening their research and critically approaching the sources of their knowledge.

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<sup>47</sup> For another defence of digital history against such lines of criticism, see F. Jannidis. Digitale Geisteswissenschaften: Offene Fragen – Schöne Aussichten. – Zeitschrift Für Medien- Und Kulturforschung, 2019, 10, 1, 63–70. https://doi.org/10.28937/ZMK-10-1\_5.

## DIGIAJALOO MEETODITE JA ALLIKAKRIITIKA ÜHENDAMINE: UURIMISKAVA INKVISITSIOONIALLIKATE ANALÜÜSIMISEKS

#### David Zbíral, Kaarel Sikk, Robert L. J. Shaw

Digiajaloole on sageli ette heidetud allikmaterjali ja tööriistade kasutamist lihtsustatud viisil ning allikakriitika tagaplaanile jätmist. Käesolev artikkel näitab keskaegsete inkvisitsiooniprotokollide põhjal, et digitaalseid meetodeid allikakriitikat arvestaval viisil kasutades on võimalik jõuda argumentide täpsema sõnastuseni, muuta eeldused läbipaistvamaks ning selgemalt kirjeldada saavutatud järelduste usaldusväärsust.

Artiklis (1) tutvustatakse keskaegsete inkvisitsiooniprotokollide analüüsimiseks sobilikke andmehõivemeetodeid; (2) rõhutatakse kvantitatiivsete meetodite strateegilise kasutamise vajalikkust, arvestades ajalooliste allikate võimalusi ja piiranguid; ning (3) pakutakse viise allikakriitika paremaks sidumiseks kvantitatiivsete uurimisprotsessidega, selmet piirduda vaid sissejuhatavate või järeldavate märkustega.

Keskaegsed inkvisitsiooniprotokollid kujutavad endast suurepärast ainest nii kriitiliseks aruteluks digiajaloo uurimispraktikate üle kui ka nende väljatöötamiseks ja rakendamiseks. Esiteks sisaldavad inkvisitsiooniprotokollid sageli detailset infot isikute, asukohtade, sündmuste või hoiakute ja nende omavaheliste seoste kohta ning seda infot on hõlpsalt võimalik töödeldaval kujul andmetena esitad. Teiseks on inkvisitsiooniprotokollide tekkelood paljude teiste allikatüüpidega võrreldes oluliselt läbipaistvamad. Need omadused loovad head eeldused allikakriitiliseks ja andmekeskseks lähenemiseks.

Artiklis pakutakse välja kaks võimalikku andmete kogumise meetodit. Esimene neist on alliktekstide käsitsi teisendamine süntaktilissemantilisteks kirjeteks, mis kajastavad inkvisitsiooniprotokollide narratiivset sisu ja konteksti relatsioonilisel kujul. Selle meetodi näiteks on arvutipõhine semantilise teksti modelleerimine (CASTEMO). See süvitsi minev andmehõiveprotsess pakub otseseid vahendeid ka allikakriitilise analüüsi jaoks. Teiseks meetodiks on struktureeritud relatsiooniliste andmete automaatne ekstraheerimine suurte keelemudelite abil. Artiklis arutletakse selle meetodiga kaasneva nn musta kasti efekti üle ning pakutakse võimalusi, kuidas tulemusi hinnata ja parendada. Andmehõivemeetodite järel vaadeldakse kolme analüüsimeetodit: sotsiaalvõrgustike analüüsi, ruumianalüüsi ja arvutuslikku tekstianalüüsi. Kõigi nende puhul keskendutakse sellele, kuidas liikuda kaugemale lihtsakoelistest kasutusviisidest, mida digiajaloo puhul sageli kohtab. Võrgustikuanalüüsi põhjal näidatakse, kuidas saab statistiliste mudelite abil allikates kajastatud inimestevahelisi suhteid mitte lihtsalt kirjeldada või visualiseerida, vaid ka seletada. Ruumianalüüsi abil on omakorda võimalik lisaks kaardistamisele ja ruumilisele andmete visualiseerimisele tõlgendada ajalooallikates peituvaid geograafilisi andmeid ja nendevahelisi keerukaid seoseid. Arvutusliku tekstianalüüsiga minnakse aga kaugemale pelgalt otsingupõhisest ja kirjeldavast lähenemisest ning allikteksti ülesehituse uurimisel rakendatakse statistilist analüüsi koos mitmesuguste valideerimismeetoditega.

Arutluse käigus rõhutatakse digitaalsete meetodite otsest rakendamist allikakriitika teenistusse näiteks allikate loomise, edasikandumise ja säilitamise tingimuste või kallutatuse uurimisel. Artikli lõpuosa pakub välja kaks üldisemat viisi allikakriitika lõimimiseks kvantitatiivsesse analüüsi, need on allikakriitiliste tegurite statistiline kontroll ning kadunud või puuduva teabe mõju mõõtmine uurimistulemuste usaldusväärsusele. Hoolikalt valitud ja valideeritud digitaalsete andmehõive- ja analüüsimeetodite abil on digiajalool võimalus viia allikakriitika uuele tasemele ning asetada end seeläbi ajaloouurimise keskmesse.