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Introduction

Computational drama analysis is the field of research that attempts to model, analyze, and interpret dramatic texts using computational methods. It is part of the larger field of computational literary studies and, even more broadly, the digital humanities. Computational drama analysis is part of the current boom in quantitative data analysis methods including machine learning and artificial intelligence. More and more work is done on structuring, analyzing, understanding, or generating literary texts with the help of algorithms.

The papers in this volume are the result of the two-day workshop on "Computational Drama Analysis: Achievements and Opportunities," held at the Theaterwissenschaftliche Sammlung of the University of Cologne[1] on September 14–15, 2022. Following an open call for papers published in March 2022, nine papers were presented at the workshop, each accompanied by an in-depth discussion. All papers were extensively revised on the basis of the discussions and additional reviewer comments and are now available in this volume.

1 Challenges in Computational Drama Analysis

Compared to other literary genres, dramatic texts have unique characteristics that make them both well suited and challenging for quantitative and formal methods. On the one hand, they have a very clear structure, manifested in the segmentation into acts and scenes, a clear separation between stage directions and character speech, and mostly unambiguous speaker designations. These elements can be automatically recognized and formally modeled relatively easily. Importantly for quantitative analysis, these elements allow for an unambiguous and descriptive approach: no interpretation is required to know which character speaks a particular utterance and when. With the DraCor corpora,[2] the community of computational drama analysis also has an exemplary resource at hand that provides large corpora of TEI-encoded plays for many languages.

1 https://tws.phil-fak.uni-koeln.de.

2 https://dracor.org.

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On the other hand, there are also a number of challenges which require our attention. The multiple internal structures of plays can also be a challenge in the application of computational methods, many of which were developed for continuous text. Computational drama analysis therefore needs to adapt methods to account for this structure and the multiperspectivality that it represents.

Due to the easy computational accessibility of the surface features of dramatic texts, research in computational drama analysis has had a strong focus on these formal features. While this already leads to interesting insights, the majority of non-computational scholarly work on drama does not focus on these formal features, making it difficult to integrate computational and non-computational research in literature. In addition, formal features are less reliable than they might seem at first glance. While most – but not even all – plays feature a segmentation into acts and scenes, the way these segments have been used by playwrights differ significantly. Interpreting results based on these formal features must take this development into account.

Dramatic texts are (often, not always) intended to be performed on stage. This adds an additional layer to the text that is very difficult to access computationally, as a reader's experience may drastically differ from that of an audience in a live theater. Investigating such differences, for example, would require the incorporation of multi-modal data, such as recordings of theater performances. Such recordings are not available on the same scale as text corpora. They would have to be extensively processed before the essence of the plays could be analyzed in relation to the text. Here, a close exchange and collaboration with the field of theater studies would be beneficial and one possible avenue for computational drama analysis would be to foster this interdisciplinary endeavor.

Resources such as DraCor, which provide a standardized format for dramatic texts and comparable corpora for several languages, allow for another strand of analysis that has not yet been widely explored: the comparative analysis of drama across languages and cultures. This can be achieved by focusing on formal, language-independent features of drama or by analyzing the speech contents more closely, but in a multilingual setting. Another possibility is to rely on translations, either of full texts or of the resources used for analysis. With the current, stunning developments in natural language processing, we can expect this to be a viable path of increasing quality.

While it is possible to automate many types of analysis today, there are still tasks that require manual labor by researchers. This is especially true as we move away from the text surface and attempt to account for more complex phenomena that promise easier interpretation of the findings in terms of the traditional literary studies. This means that many analyses will not scale well to large corpora, making the goal of e.g. analyzing the historical development difficult to achieve. By

closely following the technological development in natural language processing, computational drama analysis could be able to propose more powerful methods as well.

In summary, computational drama analysis is a field of research that has established a solid foundation of shared research questions, data, and methods and is now ready to tackle the next level of complexity. The papers in this volume hopefully give a sense of how this might be put into practice.

2 Chapters in this Volume

In the following we will give a short overview of the papers in this volume and how they address the issues and desiderata of computational drama analysis.

One crucial limitation for any digital analysis is the availability of data. This has led to an imbalance in representation, as efforts at digitizing plays have been mainly made for large language communities like English, German, and French. **Ruiz Fabo, Bernhard, Briand, and Werner** tackle this issue by creating a drama corpus for Alsatian, which is already partly available via the DraCor platform (pp. 53–85). Their paper gives us background on the Alsatian dramatic tradition that is influenced by both German and French drama and centered around the comic genre. The authors share valuable insights in some of the challenges of such an endeavor, like the semi-automatic creation of TEI versions of the plays, and dealing with spelling variation. They also present a manual annotation of character properties like gender, profession, and social class. Preliminary analyses show, for instance, that the plays mirror urbanization in a decline of characters involved in agriculture and an increase in the crafts.

Trilcke, Ustinova, Börner, Fischer, and Milling observe on pp. 6–33 that comparative work on drama that crosses language boundaries is still rare, even though data is available. Network analysis is particularly suited for comparative analyses as network metrics abstract away from concrete words. They work towards a typology of dramatic networks starting with the "Small World" concept. This concept describes networks that are highly clustered, but these clusters are also connected by rather short paths. The authors explore and compare different operationalizations of the concept with regard to their potential for typological descriptions of drama. A diachronic case study exemplifies this potential by revealing distinct distributions of small world plays across time and language.

Szemes and Vida also contribute to a language-independent typology of drama based on character networks (pp. 166–188), this time framed as a classification task about the dramatic genres of tragedies vs. comedies. In contrast

to most previous work, they strive to find measures that are independent of the networks' size and contribute to the plays' interpretation. For this purpose, they define 16 measures based on network properties, some new, some commonly used. Results from a principal components analysis and a classification based on a support-vector machine show that there is a lot of overlap between the groups, but instructive tendencies can be derived. For instance, comedies have a denser character network and more characters with a lot of speech, while in tragedies, characters tend to have longer utterances. The authors also test the hypothesis that it is mainly the last act that determines the structure of the network (as the protagonist typically ends up isolated in tragedies vs. celebrating their wedding with everybody in comedies). Especially for the Shakespeare corpus, such a tendency can be confirmed.

On pages 85–105, **Hicke and Mimno** provide us with a feminist view on Shakespeare's comedies, which feature many prominent female characters. In order to analyze more closely how female characters enact power in the comedies, they approximate a character's influence in a play by measuring how much they speak and how many other characters they speak to. They provide interactive visualizations of how this influence measure changes in the course of the play. In a number of examples that productively complement the visualizations with close readings, the authors show that women influence the plays' development in many different ways, for instance by continuously gaining in influence throughout the play, appearing as an influential character right away, or by avoiding societal limitations by cross-dressing.

Krautter and Pagel (pp. 122–148) also focus on characters, albeit one specific group of characters: the schemer, i.e., characters that somehow interfere with the main plot. They identify schemers in the plays by reviewing secondary literature and attempt to train an automatic classifier based on machine learning that predicts which characters belong to the class of schemers. Drawing on a broad range of features like stage presence, speech, sentiment scores, topic modeling, and network metrics, they arrive at a model with high precision, but low recall, meaning that it identifies almost all schemers as schemers, but also predicts many characters to be schemers that do not belong to this group. The authors assume that the group of schemers is very diverse and therefore hard to pin down by generalizable features.

Character speech is at the core of the paper on pages 148–166, written by **Šeļa, Nagy, Byszuk, Hernández-Lorenzo, Szemes, and Eder**. More specifically, they analyze the distinctiveness of a character: is character speech dominated by author style or are characters identifiable by their speech? The authors present and compare two methods for measuring character distinctiveness that build on measures in authorship verification. The first is comparing the probability distribu-

tions of character trigrams based on bootstrapping. The second is measuring the area under a word keyness curve, which is smaller if a character is only characterized well by few keywords and larger if many keywords reach high scores for the character. Both compare the speech of a target character to all other characters' speech in a play. The two measures complement each other as the one based on trigram probabilities has more statistical power while the measure based on keywords informs interpretation by these words.

One important aim that points into the future of computational drama analysis is going beyond structural features and tackling the content of plays. **Mareček, Nováková, Vosecká, Doležal, Musil, and Rosa** (pp. 105–122) attempt this by focusing on situations as building blocks of plays. They update dramatic situations described in the literature and use the new categories to annotate 52 mostly contemporary Czech plays. It is a promising avenue to see how plays are composed of sequences of situations like "Interrogation," "Parting," and "Seduction" and Mareček et al. hope to at some point use it for the generation of plays. However, their annotation effort shows that this is a difficult task, as the agreement between annotators is moderate and also the attempt of automating the annotations presents many challenges. More data is required to make this feasible.

While most approaches to drama are based on spoken text, **Gavazza, Glaser, Mastellari, and Novokhatko** enrich the volume with a theater studies perspective on drama that focuses on material objects and their role in the play (pp. 33–53). Based on material engagement theory, they argue for the importance of objects in ancient Greek comedy and show how the interaction of characters and objects can create humorous effects, among others. The authors present the Lexicon of Objects from Greek Comedy, which collects information on all material objects in a mySQL database. This comprehensive resource can be used, for instance, to explore the quantitative distribution of object categories in ancient Greek comedy, showing that food is the most popular category overall, which corresponds to what scholars know about the genre.

On pp. 188–215, **Dennerlein, Schmidt, and Wolff** go beyond character speech by focusing on emotions in stage directions. They observe that emotions can be directly or indirectly expressed in character speech, but can also appear in stage directions, which we might consider a more reliable source than character speech. Based on the German Drama Corpus and manual as well as automatic annotations, they analyze the differences in emotions mentioned in character speech vs. stage directions and how their relation develops diachronically. They find an increase in emotion depiction in stage directions, which corresponds to known trends towards more narrative patterns in drama. Their paper provides a fine-grained analysis of developments for individual emotions like abhorrence, friendship, and despair.

Tab. 1: Summarizing metadata about the papers in this volume

Authors	Data	Methods	Target of Analysis
Trilcke et al.	Very Big Drama Corpus (VeBiDraCor)	Network analysis	Typology of character networks
Gavazza et al.	Ancient Greek drama	Manual annotation, database creation	Use of objects
Ruiz Fabo et al.	MeThAL Corpus (Alsatian)	Corpus creation, machine learning, manual annotation	Spelling variation, character properties
Hicke and Mimno	Shakespeare's plays	Manual annotation, speech patterns	Female speech distribution
Mareček et al.	Modern Czech plays	Manual annotation, classification	Dramatic situations
Krautter and Pagel	German Drama Corpus (GerDraCor)	Classification	Character type 'schemer'
Šeļa et al.	French Drama Corpus (FreDraCor), German Drama Corpus (GerDraCor), Russian Drama Corpus (RusDraCor), Shakespeare Drama Corpus (ShakeDraCor)	Distinctiveness measures	Character speech
Szemes and Vida	Shakespeare Drama Corpus (ShakeDraCor), German Drama Corpus (GerDraCor)	Classification, network analysis	Network typology, genre differences
Dennerlein et al.	German Drama Corpus (GerDraCor)	Manual and automatic annotation	Emotions

Table 1 provides a concise overview of the papers in this volume with a focus on their target of analysis as well as the data and methods used.