Computational emotion classification for genre corpora of German tragedies and comedies from 17th to early 19th century

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Abstract

This article presents a method of emotion analysis for German drama from the 17th to the 19th century that significantly goes beyond previous research approaches in computational literary studies. It is based on annotations of 17 dramatic texts resulting in 11,939 annotations which were used as training material to fine-tune a German language BERT model that achieves an average accuracy of 73% for the single-label emotion classification of fourteen emotion types in cross-validation. We apply the emotion classification on a corpus of 141 comedies and 92 tragedies to compare these genres. For tragedies, the mean proportion percentages of 'suffering' and 'abhorrence' are higher than for comedies. Inversely, mean percentages of 'anger' and 'joy' are higher for comedies than for tragedies. A new finding is the surprisingly high proportion of 'anger' in comedies. Emotion distribution of the last scenes in dramatic texts also proves the quality of the classified data in terms of literary studies. In addition, the emotion distribution for several subgenres of comedy is investigated including non-canonical works of wide circulation which reached the recipients directly through the depicted emotions in the *Kasperl* Plays. Comedies from 1740 to 1770 are characterized by a pairing of higher amounts of 'friendship' and 'love'. Satirical comedies from the same period stand out due to high rates of 'anger' as well as 'suffering'. The very successful *Kasperl* plays turn out to be characterized by a comparatively large percentage of 'schadenfreude' and 'joy'.

1 Introduction

Concepts of emotions see a quick rise to become fundamental categories of thought during the 17th century in Germany, backed by the theories of Descartes, Spinoza, and Thomasius (see Grimm, 2010, p. 29 f.). The arts, especially music and theatre, are considered as the best media to demonstrate these concepts in action. The rise of the German-language drama to the most popular literary genre in the period from 1650 to the early 19th century (Krause, 1980; Schulte-Sasse, 1980; Zeman, 1985; Brenner, 1999; Meid, 2009, p. 327–501) is closely linked to its development to a 'school of affects' (Rotermund, 1972, p. 25). This means that drama should help to feel desired emotions and to deal appropriately with unwanted ones such as fear, envy, or suffering (Schings, 1971; Wiegmann, 1987; Schulz, 1988; Zeller, 2005; Schonlau, 2017). Therefore, in this period, emotions are also crucial for the differentiation of existing genres and the emergence of new ones.[1] In the genre of tragedy, for example, forms emerge in which the final catastrophe is shown as an effect of emotions (Grimm, 2010, p. 26). In the genre of comedy, the plot begins to be structured by intrigues that are often shaped and motivated by emotions (Kraft, 2011, pp. 64–66); in the emerging genre of German opera, love becomes the central emotion. Subgenres of drama also develop along the emotions of admiration, pity, and moving (Schings, 1980; Meier, 1993). In traditional literary studies, this knowledge about the relationship between genre and emotion is gathered by scholars by examining in detail a few dramatic texts as examples for one specific emotion. Consequently, little is known about which emotions are used in dramatic texts at a larger scale of representation.

In this article, we use state-of-the-art language models to investigate emotion representation in dramatic texts from 1650 to 1815 and will thereby considerably exceed previous research approaches. We aim to cover several hundreds of texts and up to fourteen classes (thirteen emotions and a no emotion class). We first define a meta-linguistic concept of emotion that is appropriate to our object of study, the intended character emotions.

Then we define and outline our set of thirteen emotions. We also report the annotation results of seventeen German dramatic texts as well as the selection and evaluation of computational emotion classification methods. The first goal of the article is to compare the results of the computational emotion classification on 233 dramatic texts with existing knowledge from historical literary studies. For this sake, we investigate whether there are anticipated differences in terms of character's emotions between tragedies and comedies, and what new insights can be gathered. We distinguish between the emotion profiles of the texts as a whole and those of the final scenes. The second goal of the article is to gain new insights into emotion distributions of several subgenres of comedy in the 18th century. For this purpose, we also chose non-canonical works of wide circulation to compare them to better known comedy subgenres of the Enlightenment period. Here we take a step in the direction to the expansion of the very narrow canon of dramatic texts treated in literary studies of our period under investigation (Meyer, 1986 ff.; Krämer, 1998; Müller-Kampel, 2003; Dennerlein 2021).

2 Related work

Sentiment analysis, also often called opinion mining, deals with computational methods to predict and analyse sentiment in written text (Liu, 2015). Sentiment analysis is often regarded as a classification task for valence or polarity categories, meaning if a text is rather positive, negative, neutral, or mixed (Mäntylä, Graziotin, Kuutila, 2018). The neighbouring area of emotion classification, which is the focus of this article, deals with the analysis and prediction of multiple emotion categories like anger, joy, or sadness. Among the most common application areas for these methods are social media and product reviews (cf. Mäntylä, Graziotin, Kuutila, 2018).

However, both methods have also received a lot of attention in digital humanities and computational literary studies for various narrative text genres in recent years. As early as 2005, Alm and Sproat explored the annotation of emotion and the application of sentiment and emotion analysis in fairy tales. Scholars also investigated sentiment and emotion progressions and distributions (Mohammad, 2011; Kim, Padó, Klinger, 2017) as well as creative visualization methods (Kakkonen and Galić Kakkonen, 2011) in novels and fairy tales. Zehe *et al.* (2016) evaluated the possibility to use emotion analysis to predict happy ends in novels. Reagan, Mitchel, Kiley, *et al.* (2016) used sentiment analysis on more than 1,000 fictional texts to identify six reoccurring basic shapes for emotional arcs. Recently, researchers also used sentiment and emotion analysis to inspect the various facets of the genre of online 'fan fiction' (Kim and Klinger, 2019b), not just

focusing on the prose text but also on comments (Pianzola, Rebora, Lauer, *et al.*, 2020).

In the context of historical dramatic texts, Mohammad (2011), Nalisnick and Baird (2013), and Yavuz (2021) explored the dramatic texts of Shakespeare to investigate character relationships and their developments. Schmidt and Burghardt (2018) evaluated sentiment analysis approaches on dramatic texts of the German playwright Lessing. For a more in-depth overview of this research field, see Kim and Klinger (2019a). Examining the state of this field shows that most of the research is focused on the analysis of valence or polarity and mostly on individual authors (Mohammad, 2011; Nalisnick and Baird, 2013; Schmidt and Burghardt, 2018). Kim and Klinger (2019a) further point out (1) that the majority of the applied methods are lexicon-based (working with predefined lists of annotated words), which are regarded as outdated in the natural language processing (NLP) community and (2) that there is a lack of annotated corpora to perform more advanced machine learning (ML)-based approaches and evaluate the applied methods. In the following article, we address several of these problems and gaps in German historical dramatic texts by annotating a large corpus to train transformer-based models for emotion classification and applying this to a larger number of texts.

3 Emotion definition

There are quite a few different terms for emotions in the 17th and 18th centuries. The German terminus 'Affekt' (or 'affectus', 'affectio', 'Gemüthsbewegung') stems from philosophical as well as medical theories, meaning strong and quick alterations of emotional states which are often linked to the idea of their effects (see Grimm 2010, p. 29). It has to be distinguished from the term 'passio', or 'Leidenschaft' meaning longer lasting emotional states related to characteristics of a person as the definition of Kant fixes it in 1772. The term 'Gefühl' first appears at the end of the 17th century and is discussed during the 18th century (see Ewert 1974, p. 82). It is located in philosophical, psychological, and cultural contexts and it is not until 1800 that it is established as the generic term for emotional states in general (see Kellner, 2007, p. 23). While we take into account that we will find various different terms for emotional states in the period under study we will use the term 'emotion' as a metalinguistic term to cover the following range of phenomena that we find in dramatic texts:

- Emotions are intended emotions experienced by and attributed to characters in dramatic texts. We assume that characters in dramatic texts are created in a way that an inner experience is attributed to them.
- Emotions are changing states, which are experienced as mental and physical condition at the same

time and which are evaluated positively or negatively. Both cause and directionality play a role in the processing of emotions. Characters may be aware of emotions to varying degrees.

- Emotions are understood as ego-related throughout the period under study, but only very late as completely individual states. Before that, emotions are understood as determined by class and gender, but also by religious beliefs, political views, and other cultural aspects (Grimm 2010). In addition, dramatic texts are strongly shaped by rhetorical conventions, which only become weaker in the last 3rd of the 18th century (Arnold, 2012; Schonlau, 2017, pp. 100–127).

In our research we do not consider the emotions of authors or recipients.[2] While recipient emotions are a crucial element in the poetics of drama and determine the composition of dramatic texts, a computational literary studies approach to these emotions is only reasonable after understanding the emotions on a representational level.

4 Set of emotions

To discover and explore literary change with NLP methods for literary studies purposes, we defined a set of emotions[3]:

- Emotions of affection/Zuneigung
  - desire/Lust (+)
  - love/Liebe (+)
  - friendship/Freundschaft (+)
  - admiration, reverence/Verehrung, Bewunderung (+)
- Emotions of pleasure/Freude und Glück
  - joy/Freude (+)
  - schadenfreude (+)
- Emotions of anxiety/Angst und Sorge
  - fear/Angst (−)
  - despair/Verzweiflung (−)
- Emotions of rejection/Ablehnung
  - anger/Ärger (−)
  - abhorrence/Abscheu, Wut, Hass (−)
- Emotions of suffering and empathy/Leid
  - suffering/Leid (−)
  - compassion/Mitleid (−)
- being moved/emotionale Bewegtheit (undetermined).

In the period from 1650 to 1815, there are several historical category systems for emotions and related

phenomena, which often show a mixture of virtues and emotions (Grimm, 2010). Especially in philosophy, the true number and nature of emotions has been reflected upon a lot (Zeller, 2005, p. 692). To grasp the change in the weighting of emotions in our time period, it is necessary to abstract from these concepts in such a way that they can be applied to the entire period as well as to represent reweightings and changes. The main criterion for the selection of emotion categories for us was to enable the representation of changes in literary history and differences in genre. This meant that we would have to include emotions that hardly play a role in certain periods of time, but then suddenly become central categories (like, for example, 'compassion', cf. Schings, 1980). Therefore, we have chosen to use the superordinate categories of 'affection', 'pleasure', 'anxiety', 'rejection', and 'suffering/empathy', and to further subtype them. The following examples illustrate the necessity of differentiation: The category of 'suffering/empathy', which is undoubtedly central to the entire European drama, must be complemented by the newly emerging category of 'compassion', which, with the author Gotthold Ephraim Lessing, becomes the central category from the middle of the 18th century (Schings, 1980). Similarly, 'love' is to be supplemented by two categories. On the one hand, that of 'desire', which plays a central role in the devaluation of characters, for example, in Baroque drama or later in the drama of the Storm and Stress period. On the other hand, a hyperonymous category is needed here, titled 'affection', to include friendship. The latter is central to Enlightenment anthropology and, together with compassion and the absence of desire, is probably characteristic of the epochal shift from Baroque to Enlightenment drama (Sauder, 1980; Lukas, 2005). Added to this was the category 'rejection' that includes 'anger' and 'abhorrence' because they are crucial for a basic understanding of the plot. Finally, the category 'being moved' is necessary in order to be able to distinguish strong and unspecified emotional agitation. It occurs fairly often that the characters do not know what they (should) feel and/or that they vacillate between several feelings.

With this scheme—especially with the division into main and sub-emotion classes—we deviate from emotion category systems commonly used in NLP. Most often they rely on psychological emotion category systems (Plutchik, 1980; Wood et al., 2018a,b). In such models, 'fear', 'anger', 'joy', and 'sadness', which we also use, are central categories, but also some others that we have not adopted as main emotion labels, such as 'confidence', 'anticipation', 'surprise', and 'disgust'. These emotions can also be annotated in our schema, but they are integrated into other concepts. 'Anticipation' is integrated with 'joy', 'surprise' with

'being moved', and 'disgust' with 'abhorrence' in the sense of strong rejection.

5 Corpus

We use a corpus of 296 dramatic texts in our research project so far but will focus on the subset of 233 trage-dies and comedies in the following. As far as possible, the dramatic texts are taken from the collection German Drama Corpus (GerDraCor, 222 dramatic texts, Fischer, Börner, Göbel, *et al.*, 2019)[4] because these dramatic texts are prepared for computational analysis, and corrections to the source material were made in the markup and in the full text (Hug *et al.*, 2021). However, we have also included fifty dramatic texts that are available in the TextGrid Repository (TGRep)[5] and prepared them semi-manually for further usage. The corpus is largely canonical (cf. Alt, 1994; Schulz, 2007). The dramatic texts canonized today for the period under study are not necessarily those that were most frequently performed, printed, or read at the time (cf. Meid, 2009, pp. 327–501; Dennerlein, 2021). Nevertheless, they form an important branch of tradi-tion, which was discussed and worked on. However, in order to map not only this branch of tradition, we also include dramatic texts that are no longer canonized today. Therefore, the corpus contains twenty-four *Kasperl* plays from the *Leopoldstädter Theater* in Vienna. These are operettas that had enormous com-mercial success and were widely distributed throughout the German-speaking area.

To address genres, we manually assigned genre labels to the dramatic texts. The assignment of genre labels was done through careful scholarly research. This was particularly important in the case of non-specific genre designations in the subtitles of the dra-matic texts. Roughly speaking, dramatic texts with bad ends were labelled as tragedies, those with good ends and humour were classified as comedies, and those with good ends without humour were classified as 'Schauspiele' ('dramas').[6] The last category now con-tains all those dramatic texts which bear genre labels like 'Schauspiel', 'Rührstücke', 'Schäferspiel', 'Historisches Schauspiel/Drama', or others. Following this classification, our corpus now comprises 92 trage-dies, 141 comedies, and 63 'dramas'. See Table 1 for general statistics about the overall corpus. In upcoming chapters we will also analyze comedy sub-genres (Table 2).

6 Annotation

In the following section, we describe the annotation process and the results of the annotation of seventeen dramatic texts.

6.1 Annotation process

The annotation was performed with the CATMA tool (Gius, Meister, Petris, *et al.*, 2020).[7] The annotators were students of German Literary Studies that were compensated monetarily for their work. They had ac-cess to detailed annotation guideline documents and were trained for the annotation process via various pi-lot annotations under the guidance of a literary scholar expert. Annotators annotated representative dramatic texts of our current corpus in their entirety. The reason for this is that annotators are assigned to perform context-sensitive annotations taking into account the entire plot and content of the dramatic text as well as specific attributes of the characters.

The annotation task consisted in indicating every ex-pression of one of the thirteen sub-emotions of the emo-tion scheme as defined in the annotation guidelines. Annotators could annotate stage directions and speeches (spoken text of characters, separated by the utterances of the other characters) and they could anno-tate variable text lengths meaning as many or few words as they see fit. They could also annotate the same passage with different classes as well as assign text pas-sages in an overlapping way. While such variable anno-tation settings are rare in NLP (Wood *et al.*, 2018a,b), we have chosen this approach in an iterative process of pilot annotations since it proved to best fit our annota-tion goal and the annotation practices of literary scholars.

Annotators had around 2 weeks to finish the annota-tion for one dramatic text. Each annotator annotated independently from the other annotator without access to the annotation of other annotators. In total, the an-notation process for one dramatic text took about 8–30 h depending on its complexity and the training of the annotator.

6.2 Annotated dramatic texts

As the material for the training and evaluation of ML-based emotion classification approaches, we annotated a representative sample of seventeen dramatic texts of our corpus. To our knowledge, it is the first corpus of emotion-annotated historical dramatic texts in German and of adequate size compared to other sentiment and emotion corpora in German (cf. Fehle, Schmidt, Wolff, 2021). The chosen texts are representative of our over-all corpus of 296 dramatic texts. Representativeness is not to be understood in purely statistical and quantita-tive terms but rather denotes a criterion that is gauged in terms of literary studies. The selection of texts includes one example of each of the major subgenres and literary movements of the period we investigate. Care was taken to ensure that a wide range of emotion expressions was present in the dramatic texts in order to best train a language model on emotion

classification. The following list shows the dramatic texts we annotated and some metadata:

- *Catharina von Georgien* by Andreas Gryphius (1657, tragedy).
- *Der Welt Erschröckende Attila*, anonymous (after 1682, drama).
- *Massaniello* by Christian Weise (1683, tragedy).
- *Ein wunderliches Schau-Spiel vom niederländischen Bauer* by Christian Weise (1669, comedy).
- *Die getreue Sclavin Doris*, anonymous (1720, drama).
- *Das Testament* by Luise Adelgunde Victorie Gottsched (1745, comedy).
- *Canut* by Johann Elias Schlegel (1746, tragedy).
- *Die zärtlichen Schwestern* by Christian Fürchtegott Gellert (1747, comedy).
- *Lucie Woodvil* by Johann Gottlieb Benjamin Pfeil (1757, tragedy).
- *Der Freigeist* by Joachim Wilhelm von Brawe (1758, tragedy).
- *Minna von Barnhelm* by Gotthold Ephraim Lessing (1767, comedy).
- *Der Postzug* by Cornelius von Ayrenhoff (1769, comedy).
- *Kabale und Liebe* by Friedrich Schiller (1784, tragedy).
- *Kasperl' der Mandolettikrämer* by Ferninand Eberl (1789, tragedy).
- *Menschenhass und Reue* by August von Kotzebue (1790, comedy).
- *Wallensteins Lager* by Friedrich von Schiller (1800, tragedy).
- *Faust* by Johann Wolfgang von Goethe (1807, tragedy).

Most of the texts stem from the GerDraCor corpus (Fischer, Börner, Göbel, *et al.*, 2019), *Catharina von Georgien* from the TextGrid repository. *Kasperl' Mandolettikrämer* was acquired from an open web repository,[8] *Die getreue Sclavin Doris, Der Welt Erschröckende Attila*, and *Ein wunderliches Schau-Spiel vom niederländischen Bauer* from separate editions (Weise, 1986; Noe, 2007). These texts had to be further prepared for the annotation process.

Each dramatic text was annotated by two annotators (independently from each other). Overall, five annotators performed the annotation with switching pairings throughout the annotation process in counterbalanced order.

6.3 Annotation results
The annotations of CATMA were exported and transformed to the JSON format and CSV files via a Python script we developed to calculate various results of the

annotation. Because of low to mediocre agreement metrics (see Table 6), we filtered every annotation on which annotators disagreed upon. We have collected 20,297 emotion annotations resulting in 11,939 annotations after removing full and partial disagreements between the annotator pairings. This includes all annotations independent of the length which can on maximum have the length of an entire speech. Extending this with the 11,349 non-annotated text units which we will refer to as no emotion class results in an overall corpus of 23,288 text units (51% emotion annotations, 49% no emotion). Of the 11,939 emotion annotations 50% (6,000) are negative, 40% (4,795) positive, and 10% (1,144) of the class being moved. Table 3 illustrates the annotation distribution for the main classes and sub-emotions only among the emotion annotations filtering the non-annotated material.

The most frequently annotated main classes are the *emotions of rejection* (24%). Concerning the sub-emotions, we can identify strong class imbalances. The most dominant sub-emotions are 'suffering' (15%), 'anger' (24%), 'joy' (14%), and 'love' (13%).[9] Sub-emotions that are rarely annotated are 'desire', 'friendship', and 'schadenfreude'.

We have analysed token distributions of the annotations via the NLTK Punkt Tokenizer.[10] We identified that annotators mark on average twenty-five tokens for a text unit. However, the annotators make significant use of the varied annotation spans ranging from one-word annotations to multiple sentences (max = 578 tokens; Std = 29.41). Overall, the most common annotation span is an annotation across 2–3 sentences.

To evaluate the validity of the annotation scheme and process, we also look at inter-rater agreement among the two annotators for each dramatic text. Traditional agreement metrics are dependent on fixed annotation sizes. We calculate agreement on speech level since the speech is the major textual unit of a dramatic text. To deal with varied annotation lengths and overlapping annotation, we assign each speech per annotator the emotion category that is annotated the most (measured in number of tokens). While this is a simplification of our annotation process, it enables us

Table 1. Overview, token, and sentence statistics for the overall corpus and the main genres[a]

Genre	# dramatic texts	# sentences	# tokens
Comedies	141	227,573	2,410,234
Tragedies	92	188,412	2,152,906
Dramas	63	110,470	1,212,830
Overall	296	526,455	5,775,970

[a] Token and sentence statistics refer to speeches and stage directions of the dramatic texts. # refers to the absolute number.

Table 2. Overview, token, and sentence statistics for subgenres[a]

Genre	# dramatic texts	# sentences	# tokens
Kasperl plays	24	40,649	396,996
Comedies (1740–70)	20	32,369	373,594
Satirical comedies	10	21,551	230,836
Overall	54	94,569	1,001,426

[a] Token and sentence statistics refer to speeches and stage directions of the dramatic texts.

Table 3. Distribution of main classes and sub-emotion categories in annotated dramatic texts among emotion annotations after filtering disagreements among annotators[a]

Emotion category	*N*	%
Main class (MC): Emotions of affection	**2,804**	**23**
Desire	71	1
Love	1,569	13
Friendship	240	2
Admiration, reverence	924	8
MC: Emotions of pleasure	**1,991**	**17**
Joy	1,689	14
Schadenfreude	302	3
MC: Emotions of anxiety	**989**	**8**
Fear	739	6
Despair	250	2
MC: Emotions of rejection	**2,856**	**24**
Anger	1,621	14
Abhorrence	1,235	10
MC: Emotions of suffering and empathy	**2,155**	**18**
Suffering	1,760	15
Compassion	395	3
Being moved	**1,144**	**10**
Overall	**11,939**	**100**

[a] The sums for the *main classes* (MC; marked in bold) are listed followed by the *sub-emotions*. Percentages are rounded.

Table 4. Average inter-rater agreement across all dramatic texts[a]

Categorical system	Average κ	Average %
Polarity	0.5	68
Main class	0.4	62
Sub-emotion	0.4	58

[a] Average κ refers to *Cohen's* κ and average % is the pairwise agreement among annotators.

to calculate traditional agreement metrics like the average *Cohen's* κ value. Table 4 illustrates the results for each emotion category system.

The agreement ranges from values of 0.5 (*polarity*) to 0.4 (*sub-emotions*) which is a moderate level of agreement according to Landis and Koch (1977). The agreement fluctuates from 0.35 to 0.62 depending on the dramatic text and the categorical system. We did not find significant differences in agreement with regard to annotator pairings. Overall, the agreements are

rather low compared to other annotation results in the context of sentiment analysis (cf. Mäntylä, Graziotin, Kuutila, *et al.*, 2018) but in line with similar research on historical and narrative text genres (Alm and Sproat, 2005; Sprugnoli *et al.*, 2015; Schmidt *et al.*, 2018; Schmidt *et al.*, 2019a,b). We argue that the inherent subjectivity and the various possibilities of interpretation are reasons for these results. As already outlined, we filtered the disagreeing annotations in the annotation results reported which proved to be beneficial for the subsequent ML approaches.

Please note that more information about the annotation process and results can be found in previous publications (Schmidt *et al.*, 2021a; Dennerlein Schmidt, Wolff, *et al.*, 2022c). More in-depth results considering annotation behaviour (e.g. pair/play-wise agreements) can be found online.[11]

7 Computational emotion classification

We performed multiple evaluation studies for different computational single-label emotion classification methods on varied text lengths with different iterations and settings of the annotations. We differentiate between three classification tasks depending on the hierarchical level: polarity (4 classes: differing between positive, negative, and no emotion), the main emotion classes (7) and the sub-emotions including no emotion (14). We evaluated the methods including several different instances of the annotated material. We found that the best performance can be achieved by filtering the annotations of both annotators per text to just those annotations they agree on fully or partially. That means we removed all full or overlapping annotations of both annotators if they did not belong to the same class depending on the hierarchical system (see Section 6.3). For an in-depth description of these experiments, we refer to previous work (Schmidt *et al.*, 2021b,c, 2022). In the following passage, we summarize the major results of these works and focus on the description of the final selection of the best emotion classification method according to our studies. Please note that all results are achieved with the filtered corpus as presented in Table 3 and Section 6.3. Using an unfiltered corpus that includes disagreeing annotations yields accuracy drops of up to 18%.

Considering the methods, we evaluated baseline methods like lexicon-based approaches (Schmidt and Burghardt, 2018) and traditional machine learning approaches based on bag of words models and support vector machines (SVM). The main focus of our work was on static word embeddings (e.g. *fastText* by Bojanowski, Grave, Joulin 2017) and transformer-based language models like BERT (Devlin, Chang, Lee, *et al.*, 2019) and ELECTRA (Clark *et al.*, 2020). The latter are currently regarded as state-of-the-art in the

area of sentiment analysis and emotion classification (Shmueli and Ku, 2019; Cao, Peng, Yin, *et al.*, 2020) and are advantageous for literary studies because the representation of tokens changes with context. We included the most established and well-known German transformer-based models from the platform Hugging Face[12] (Wolf *et al.*, 2020) in our analysis. As these models are trained primarily on contemporary language, we also included available models that were trained from scratch (e.g. the *German Europeana BERT*[13] by Schweter, 2020) or further pre-trained on historical or narrative language (e.g. a German BERT model by Brunner, Tu, Weimer *et al.*, 2020). We also developed models by further training base models with the texts of our corpus since this sort of domain-adaptive pre-training has been shown to be beneficial specifically for text types of special domains (Gururangan, Marasović, Swayamdipta, *et al.*, 2020).

In our final evaluation results, we found, however, that the best-performing model for all four classification tasks is the large German BERT model *gbert-large* by *deepset* (Chan *et al.*, 2020). The performance of the model ranges between 0.86 and 0.66 for accuracy depending on the hierarchical classification system.

For the results reported in this article, we use a model for sub-emotion classification. The model was trained and evaluated on the filtered corpus in a 5×5 stratified fashion and fine-tuned to the specific classification task for four epochs, a batch size of thirty-two, a learning rate of 4e-5, and the *Adam* optimizer as optimization algorithm with a Tesla P100 GPU. The model achieves an average accuracy of 73% and weighted f1-score of 72% for the classification task of fourteen classes in a stratified 5×5 cross-validation. Based on the sub-emotion classification, we derive the corresponding classes for main emotion category and polarity based on our annotation scheme.

For more precise information about the ML approaches, please refer to previous papers (Schmidt, Dennerlein, Wolff, *et al.*, 2021b,c, 2022). More detailed evaluation results (e.g. class based performance scores) can be found online.[14]

While we achieve state-of-the-art results for polarity classification in comparison to other German text genres (Chan, Schweter, Möller, 2020), we were not able to find classification results for German texts with a similar amount of sub-emotion classes. Accuracies of up to 86% have only been reached for the classification of four or more emotion classes in English non-fictional texts in contemporary language (Shmueli and Ku 2019; Yang, Lee, Whang et al., 2019; Cao, Peng, Yin et al., 2020). Thus, while there are possibilities for improvement that we will address in future work, we deem the current results sufficient for first large-scale explorations of classification results.

The concrete classification is performed on sentences of the dramatic texts of the entire corpus. For this, we segmented the stage directions and speeches into sentences using the NLTK Punkt sentence segmentation. The stage directions and speeches were either already annotated in the texts (*GerDracor* or *TextGrid* corpus) or added in an additional processing step and manually post-corrected. We chose the sentence as classification text span since it resembles the annotated text spans the most.

8 Emotion classification results for the overall corpus

Regarding the difference between a sentence which contains an emotion and a sentence which contains no emotion in all 526,455 sentences of the overall corpus of 296 dramatic texts, we identified that around 301,253 (57%) of the sentences are classified with no emotion while 225,202 (43%) sentences are classified with an emotion. In the following, we will present and focus on statistics that only include sentences classified as emotions.

The computational emotion classification yields results that are similar to the above-mentioned annotation distributions (cf. Table 5 for the classification results and Table 3 for the annotation). In the annotated corpus the most frequent single emotion is 'suffering' (cf. Table 3). In the classified data 'suffering' remains the most frequent sub-emotion (cf. Table 5). We see very small deviations in comparison to the percentage-wise distributions in the classified data when comparing them to the percentage-wise distributions of the annotations: +3.1% for 'suffering', +3.4% for 'being moved', −2.5% for 'love', and −1.7% for 'schadenfreude'. The remarkable difference of 0.9% for 'desire' is due to the very few cases in the annotated material.

9 Analysis of classification examples

In the following, we look at some examples of classified sentences and draw conclusions about how to evaluate the prediction results by these samples, bringing distant and close reading together. In preparation of the investigations in comedy subgenres in Section 12 of the article, we chose cases of 'joy' and 'schadenfreude'. For historical emotion definitions, we used three dictionaries from our period of study and compiled the basic aspects from the respective entries for 'joy', 'schadenfreude', and 'schadenfreude' (Zedler, 1732–1754; Adelung, 1793–1801; Grimm and Grimm, 1811).

Joy: reaction to a pleasant situation, the presence or happiness of loved ones or friends, situated in the past (memory) or in the future (hope, expectation). Joy can be—according to Zedler's definition—morally

Table 5. Distribution of classifications on the sentences of the overall corpus that are classified with an emotion

Category	N	%
MC: Emotions of affection	44,046	19.6
Desire	196	0.1
Love	23,704	10.5
Friendship	3,113	1.4
Admiration, reverence	17,033	7.6
MC: Emotions of pleasure	33,990	15.1
Joy	31,088	13.8
Schadenfreude	2,902	1.3
MC: Emotions of anxiety	19,808	8.8
Fear	14,568	6.5
Despair	5,240	2.3
MC: Emotions of rejection	51,350	22.8
Anger	28,264	12.6
Abhorrence	23,086	10.3
MC: Emotions of suffering and empathy	45,765	20.3
Suffering	40,868	18.1
Compassion	4,897	2.2
Being moved	30,243	13.4
Overall	225,202	100

Table 6. Percentage-wise distribution of emotion classifications in sentences of comedies and tragedies

Emotion category	% (com.)	% (trag.)
MC: Emotions of affection	18.6	20.1
Desire	0.1	0.1
Love	10.0	10.8
Friendship	1.5	1.2
Admiration, reverence	7.0	7.9
MC: Emotions of pleasure	17.2	12.6
Joy	15.5	11.6
Schadenfreude	1.7	1.0
MC: Emotions of anxiety	7.0	10.7
Fear	5.7	7.5
Despair	1.3	3.2
MC: Emotions of rejection	25.4	21.5
Anger	16.4	9.5
Abhorrence	9.1	12.0
MC: Emotions of suffering and empathy	16.9	23.3
Suffering	14.7	21.3
Compassion	2.2	1.9
Being moved	14.8	11.9
Overall	100	100

reasonable or unreasonable, physically violent or moderate. According to Adelung, joy can also arise from an object or be abstracted and described as an object itself, still meaning the emotion 'joy'.

These are examples of annotated passages that are in line with the above definition.

> Sisigambis: Schaut/Schwestern/welch ein Licht steigt auß so finstern Hölen. Die grosse Sultanin/die Ibrahim verschloß/Weil sie mein Engel war/ist wieder frey und loß.[15]

Here we see joy as a reaction to a hoped-for situation. In the following speech, Gretchen from Goethe's *Faust* is pleased about a Jewellery box:

> Margarete (mit einer Lampe). Wie kommt das schöne Kästchen hier herein? Ich schloß doch ganz gewiß den Schrein. Es ist doch wunderbar! Was mag wohl drinne sein?[16]

The subsequent sentences have been correctly classified with 'joy' by the computational emotion classification in regard to our definition of 'joy':

> Dorantino. [...] Es ist alles darauf eingerichtet, Bruder![17]

> Alle. [...] Ungemein schön![18]

Cases containing words like 'pleasure', 'cheerful', 'joyful', 'happy', etc. were as well classified correctly. This also applies to stage directions describing bodily expressions like 'Laughs and drinks' or 'smiling'.

Cases of 'joy' in tragedies that are likewise correctly classified are the following:

> Prothoe. Ein sel'ger Augenblick wär dir beschieden, Und in den Staub vielleicht, dir huldigend, Sähst du den Sohn der Götter niederfallen.[19]

The classifications become significantly worse the further one goes back in time. This starts around 1730 and deteriorates further back in the 17th century.

In the subsequent example, we find that the second speech is misclassified as 'joy':

> Pimpinone. In Opera und auf Balleten gehn? Vespeta. Diß thu ich nie.[20]

> Cardenio. [...] Ich lehrt vnd ward gelehrt; vnd klüger vor den Jahren/Manch greisser Bart erstarrt ob meinen gelben Haren/Auch muntert ich den Leib zu allen Künsten auff/Sprang auff ein hurtig Pferd/begab mich in den Lauff.[21]

In large part, this is probably due to the Baroque language, but also to the proliferation of verse plays and vocal parts in dramatic texts and parts of dramatic texts in the period from 1730 downwards. These problems can be addressed via further annotation and fine-tuning of the model.

In the following, we examine the sub-emotion 'schadenfreude'. We compiled a working definition from historical dictionaries: Schadenfreude: a special kind of joy, namely, joy at the misfortune or harm of another person. Making fun of someone and mocking someone also belongs to the spectrum of 'schadenfreude'. In our

emotion set presented in Section 4, we have marked 'schadenfreude' as a positive emotion because we use the evaluation from the point of view of the characters. For the characters in the dramatic texts, 'schadenfreude' is a positive emotion. They rejoice in the harm of others. While it is initially connected to resentment, jealousy, or antipathy towards the person who is the target of schadenfreude, at the moment of its occurrence it is a form of joy. It is based on felt ill-will, jealousy, or antipathy toward the person who is the target of the 'schadenfreude'. So far we have not discovered that the characters expressing 'schadenfreude' in our dramatic texts are aware of the fact that they should not rejoice in the harm of others.

In the annotated corpus, the two cases below are marked as cases of 'schadenfreude'.

> Lieschen. So ist's ihr endlich recht ergangen. Wie lange hat sie an dem Kerl gehangen![22]

A young woman from the neighbourhood taunts Gretchen about her illegitimate pregnancy, which leads to her social ostracism.

> Lotte. Ha! ha! ha! mein lieber Herr Bittermann, Sie haben sich ein wenig blamiert.[23]

The character Lotte here is laughing at Bittermann, delighting in the embarrassment of him. The harm is already inflicted.

The following examples of the classification are all taken from the *Kasperl* plays, because the last section of this article will give special consideration to 'schadenfreude' in these works. First, we look at some correctly classified sentences:

> Zickzack. [...] Der Bräutigam, Herr von Knerzel und Frau von Wampel, alle deine Feinde sind dabey—Du könntest sie auf einmal fangen.[24]

Here we have a correctly classified sentence in which one character ascribes 'schadenfreude' to another in the future.

> Kasperl. (äfft sie nach) Hi hi hi![25]

Kasperl here makes fun of Chara, who, because of her changed appearance, he thinks is an ugly old woman.

Additionally, we present a few examples which were not classified correctly:

> Dencker. Danck dir![26]

> Kilian. Laß er mir zugleich Margreth, und Bonavent herkommen.[27]

10 Emotion distribution results in tragedies versus comedies

In order to be able to verify not only statistically but also from a literary studies perspective that the classified data provides reliable results, we first ask whether the classified data show clear differences between tragedies and comedies in terms of emotions.[28] One would expect that tragedies contain significantly more 'suffering' than comedies and that 'joy' plays a central role in comedies.[29] Table 6 displays the percentage-wise distribution of sub-emotions among the sentences classified with an emotion (which means filtering no emotion classification).[30] It shows that tragedies and comedies are well distinguished from each other with regard to the emotion profile. In tragedies, characters are significantly more likely to talk about or feel 'suffering' (21.3% versus 14.7% in comedies) and 'abhorrence' (12% versus 9.1% in comedies). In comedies 'anger' (16.4% versus 9.5% in tragedies) and 'joy' (15.5% versus 11.6% in tragedies) are distinguishing emotions compared to tragedies. The high presence of anger in comedies is a counterintuitive result, but it may be explained by the conflict structure of the comedies and the entertainment value of anger as far as 'anger' is attributed to ridiculous characters.

11 Happy versus bad end

We will now further specify the evaluation of the classified data and inquire which emotions are classified with *gbert* for the drama endings. One would assume that the endings of tragedies and comedies are very clearly separated in terms of emotions. As far as the happy end is concerned, we know two main features (Kraft, 2011). First, the conflicts are supposed to resolve for the sympathetic characters, ideally relatively unmediated. On the other hand, the good end should feature a reunion of one or more couples in love, whose marriage(s) is (are) confirmed or celebrated at the end. The emotions felt and expressed by the characters are expected to be quite different from those observed at the end of tragedies, in which often enough a character dies and death or other suffering are mourned.

In performing the calculations for the drama endings, however, it was not possible to use all the dramatic texts in our corpus, because twenty-six (thirteen tragedies and thirteen comedies) do not contain a subdivision into scenes or are not marked in such a way that they can be meaningfully evaluated. Thus, when comparing the results on the whole texts with those on the last scenes, it should be noted that the database is reduced by 10%.[31] In this corpus, we find the following distinguishing sub-emotions (cf. Table 7).

- For tragedies 'suffering' is high with 20.2% (versus 13.7% for comedies).

- For comedies 'joy' is high with 18.8% (versus 12.4% for tragedies). 'Anger' also turns out to be a distinguishing category since there is a four percentage points difference between tragedies and comedies regarding this emotion.

Moreover, the last scenes for both genres show 'being moved' as second highest sub-emotion (12.9% in tragedies and 15.3% in comedies). This category is defined as follows: 'being moved' is a strong emotional agitation, which, however, is not specified more precisely in terms of content. Astonishment, excitement, strong embarrassment, and shame belong to it. In these cases, the character usually does not know what he or she is feeling, suppresses a feeling, or vacillates between feelings. The category was explicitly not annotated as a reinforcement of other, identifiable emotions. Here are some examples from the annotated material:

Wilhelm. Lucie, Lucie, was für einen Sturm haben Sie auf meine Seele getan![32]

Faust. indem er hinzustürzt, innehaltend.[33]

This category is often correctly classified, even in very short exclamations and sentences such as 'Nein/No!', 'Ist er der Vater/Is he the father?', 'Aber itzt?/But now?', and so forth.

For the last scenes of tragedies and comedies, the expected emotions would relate to the well-known plot events in dramatic texts. One would expect for tragedies a dominance of suffering in the face of death and loss or sadness over unrequited love, anger over spurning, and

Table 7. Percentage-wise distribution of emotion classifications in sentences in the last scenes in comedies and tragedies

Emotion category	% (com.)	% (trag.)
MC: Emotions of affection	22.2	18.3
Desire	0.0	0.1
Love	12.6	10.6
Friendship	1.6	1.2
Admiration, reverence	7.9	6.5
MC: Emotions of pleasure	20.1	13.2
Joy	18.8	12.4
Schadenfreude	1.2	0.8
MC: Emotions of anxiety	6.1	13.4
Fear	4.3	7.8
Despair	1.8	5.6
MC: Emotions of rejection	20.9	19.3
Anger	12.2	8.1
Abhorrence	8.7	11.1
MC: Emotions of suffering and empathy	15.3	22.9
Suffering	13.7	20.2
Compassion	1.6	2.6
Being moved	15.3	12.9
Overall	100	100

lack of success, for example. For comedies, one would anticipate joy due to the resolution of all conflicts or family reunions and expressions of love in the face of marriage. To explain the high presence of 'being moved', a close reading of some final scenes was performed, which showed that it is indeed mostly shortly before the end that some characters still experience strong turbulence because they are unsecure, torn or surprised.

12 Comedy subgenres

In this part of the article, we will use the classification data to explore subgenres of comedies. For this sake, we had to assign subgenres to the dramatic texts. This task is not quite easy, because on the one hand, lists of dramatic genres are relatively rare in literary studies of that period. On the other hand, digital copies of the respective subgenres are rare.[34] Considerable work remains to be done here, both in the field of metadata and in the domain of full-text digitization. However, from the already existing digitized material of German-language dramatic texts from 1650 to 1815, three groups of comedies could be formed, which, although not quite published at the same time, are nevertheless comparable:

- 10 copies of 'Sächsische Typenkomödie', a special type of Enlightenment comedy further named as 'satirical comedies' from the period (1740-1770). The selection follows Steinmetz, 1966.
- 10 Enlightenment comedies from the same time period (1740–70) which do not follow the model of satirical comedies. This group is called 'comedies 1740-1770'.
- 24 comedies of the *Leopoldstädter Theater* in Vienna[35]

Our comparative research reveals some telling differences between the three comedy subgenres concerning the emotions of the characters (Table 8).

- The satirical comedies are characterized by high rates of 'anger' (19.5% as opposed to 16.1% and 16.6% for the other comedy subgenres) as well as 'suffering' (15.5% as opposed to 14.3% and 12.2% for the other comedy subgenres). Close readings prove that the satirical comedies show characters being annoyed by a main, morally imperfect character, who in turn is angry with most of his fellow human beings (Steinmetz, 1966). Trouble arises both from the obstruction of the marriage envisaged from the beginning and from interactions with the negative protagonist.

- The comedies from 1740 to 1770 stand out by a combination of higher levels of friendship (2.6% while the arithmetic mean is 1.8%) and love (12.2% as opposed to 10.8% and 7.6% for the other comedy subgenres).
- The *Kasperl* plays are characterized by an unusually high proportion of 'schadenfreude' (2.6% as opposed to 1.2% and 1.6% for the two other comedy subgenres) and 'joy' (16.3% in contrast to 14.3% and 13.3% in the other two comedy subgenres). With respect to the *Kasperl* plays, some new insights also come to light here. So far, these comedies have been researched in theatre studies with an emphasis on stage conventions, motives, character types, and topics (Müller-Kampel and Kuzmics, 2010). Based on our results, emotional characteristics come to the fore.

13 Discussion

The comparative results for tragedies and comedies show that even a prediction accuracy of 73% already maps well the expected differences between comedies and tragedies. Compared to comedies, tragedies show higher percentages for 'suffering' (21.3% versus 14.7%) and 'abhorrence' (12% versus 9.1%). Comedies have high values for 'anger' (16.4% versus 9.5%) and 'joy' (15.5% versus 11.6%). Based on the surprising result that the scores for 'anger' in comedies are so high, we can tentatively derive the following hypotheses, which should be examined in further research:

- Anger is the equivalent action motivator to 'suffering' in tragedy. In tragedy, the characters act because they suffer or fear to suffer in the future.
- In comedy, on the other hand, the characters act out of anger at one or more situations that turn out for the better only at the end. They are tricked in their endeavours, betrayed, or are unsuccessful for other reasons and are angry about this.

Emotions profiles of the last scenes of the respective genres confirm this distinguishing quality. For tragedies 'suffering' is predominant: 20.2% compared to 13.7% for comedies. For comedies 'joy' is predominant with 18.8% (versus 12.4% for tragedies). 'Anger' also turns out to be a distinguishing category since there is a four percentage points difference between tragedies and comedies regarding this emotion. A next step will be to use both the progressions and the emotion profiles of the last scenes as textual enrichments, which should allow us to train a BERT model on genre recognition only.

We also used the emotion classification to gain new insights into three subgenres of comedy of that period (including less well-researched ones). The results show that the comedy subgenres can be distinguished very well on the basis of the emotion profiles.

- Comedies from 1740 to 1770 are characterized by a pairing of significantly higher levels of 'friendship' (2.6% while the arithmetic mean is 1.8%) and 'love' (12.2% as opposed to 10.8% and 7.6% for the other comedy subgenres). This suggests that the

Table 8. Percentage-wise distribution of sub-emotion categories among emotion classification in different types of comedies from 1740 to 1800

Emotion category	% (Kasperl)	% (Comedies 1740–70)	% (Satirical comedies)
MC: Emotions of affection	19.0	21.9	14.9
Desire	0.2	0.0	0.0
Love	10.8	12.2	7.6
Friendship	1.5	2.6	1.2
Admiration, reverence	6.5	7.2	6.1
MC: Emotions of pleasure	18.9	14.5	15.9
Joy	16.3	13.3	14.3
Schadenfreude	2.6	1.2	1.6
MC: Emotions of anxiety	7.1	6.2	6.4
Fear	6.2	5.1	5.5
Despair	1.0	1.1	0.9
MC: Emotions of rejection	25.0	25.3	28.0
Anger	16.6	16.1	19.5
Abhorrence	8.4	9.2	8.6
MC: Emotions of suffering and empathy	14.0	17.0	17.7
Suffering	12.0	14.3	15.5
Compassion	2.1	2.7	2.2
Being moved	15.9	15.0	17.0
Overall	100	100	100

majority of them are sentimental comedies, which should be checked on the basis of the texts. If this is the case, one would have to examine whether one can identify sentimental comedies solely on the basis of these emotional characteristics.

- Satirical comedies from the same period stand out due to high rates of 'anger' (19.5% as opposed to 16.1% and 16.6% for the other comedy subgenres) as well as 'suffering' (15.5% as opposed to 14.3% and 12.2% for the other comedy subgenres). This looks like the intention of the satirical comedies is implemented on an emotional level. The characters are annoyed with the laughable main character here and recipients are supposed to share that feeling. The love stories, obligatory for the comedy, seem to be brought down to a minimum in this subgenre presumably so that they do not interfere with the ameliorative intention.

- The *Kasperl* plays are characterized by a larger percentage of 'schadenfreude' (2.6%), which is higher than the arithmetic mean of 1.3%, and 'joy' (16.3% in contrast to 14.3% and 13.3% in the other two comedy subgenres). The high level of 'schadenfreude' may be explained by the characteristics of the central comic character who always tries to take advantage of others and is happy when they have less money, food, alcohol, or prospects for love affairs than he does. It is interesting to note that the *Kasperl* plays were the production of a theatre that was able to finance a standing business with this type of play for years. In addition, the *Kasperl* plays were also a blockbuster for many other German-speaking theatres. Further research should investigate the correlation of 'schadenfreude' and success.

On the methodological side, we intend to explore various promising approaches to improve classification accuracies. First, we suffer from class imbalances. Thus, we want to explore advanced methods to deal with class imbalances in our setting (Buda *et al.*, 2018). Second, we want to continue exploring the possibilities of historical language models by further pretraining existing contemporary models with a large number of texts. While we did apply these methods, our training texts were rather small in size and did not contain enough text for our specific historical domain. Other research, however, has shown that this method of domain-adaptive pretraining is beneficial in the use case of historical German texts (Labusch, Neudecker, Zellhöfer, *et al.*, 2019; Schweter and Baiter, 2019; Brunner, Tu, Weimer, *et al.*, 2020). Finally, distant and close reading as methodically different but complementary approaches to analysing literary texts may be

interpreted as digital humanities' specific version of a mixed methods approach (Pereira, 2019).

Authors' contributions

Katrin Dennerlein (Conceptualization, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Writing—original draft, and Writing—review and editing), Thomas Schmidt (Data curation, Investigation, Methodology, Software, Visualization, Writing—original draft, and Writing—review and editing), and Christian Wolff (Conceptualization, Funding acquisition, Project administration, Supervision, and Writing—review and editing).

Data availability statement

Data can be found here: https://github.com/lauchblatt/Emotions_in_Drama.

Notes

1. See for the discussion of this development in poetics of drama Meyer-Sickendiek (2005), Kraft (2011), and Ranke (2009).
2. In the field of emotion research in literary studies, a distinction is drawn between production-, reception-, text-, and context-related approaches (Winko, 2003). For an overview of emotion research in literary studies, see Winko (2019, pp. 397–402).
3. The emotion set was iteratively tested during our annotation work at the beginning of the project and adapted several times, as is common and recommended for the humanities (Reiter, 2020). The plus and minus signs refer to the evaluation of an emotion from the perspective of the feeling character. For the special case of the positive value for 'schadenfreude' cf. the definition in Section 9.
4. https://dracor.org/ger
5. https://textgridrep.org/

6. Cf. for these criteria Alt (1994); Dennerlein (2021, pp. 141–149).
7. https://catma.de/
8. http://lithes.uni-graz.at/maezene/eberl_mandolettikraemer.html
9. See Section 8 for interpretation of these results.
10. https://www.nltk.org/_modules/nltk/tokenize/punkt.html
11. https://github.com/lauchblatt/Emotions_in_Drama
12. https://huggingface.co/
13. https://huggingface.co/dbmdz/bert-base-german-europeana-cased
14. https://github.com/lauchblatt/Emotions_in_Drama
15. Lohenstein, Ibrahim Sultan, 1668, III ('Look / sisters / what a light rises from such dark woods. The great Sultana / whom Ibrahim locked up / because she was my angel / is free and clear again'. Own translation) The dramatic text does not have a scene structure.
16. Goethe, Faust, 1808, Abend. ('How did the beautiful box get in here? I certainly closed the shrine. It is wonderful! What may be inside?' Own translation)
17. Lenz, Die Freunde machen den Philosophen, 1775, I,2 ('It's all set up to make brother'. Own translation)
18. Tieck, Prinz Zerbino 1797, III,2 ('Tremendously beautiful!' Own translation)
19. Kleist, Penthesileia 1808, I,14 ('A blessed moment would be yours, And in the dust perhaps, paying homage to you, You would see the son of the gods fall down'. Own translation)
20. Prateorius, Pimpinone oder Die ungleiche Heirat, 1725, II ('Going to operas or ballets? I never will!'. Own translation)
21. Gryphius, Cardenio und Celinde, 1657, I,1 ('I taught and was taught; and wiser by the years / Many a greasy beard froze at my yellow hairs / I also revived the body to all arts / Jumped on a swift horse / Set out on the run'. Own translation)
22. Goethe, Faust, 1808, Am Brunnen ('It serves her right. How she clung to that guy for so long!' Own translation)
23. Kotzebue, Menschenhass und Reue, 1790, II,12 ('Ha! ha! ha! my dear Mr. Bittermann, you have made a fool of yourself'. Own translation)
24. Perinet, Baron Baarfuß, oder der Wechselthaler, 1804, III,10 ('The groom, Herr von Knerzel and Frau von Wampel, all your enemies are there - you could catch them all at once'. Own translation)
25. Hensler, Kasperl der unruhige Wanderer, 1799, III,2 ('(imitates her) Hi hi hi!' Own translation)
26. Karl von Marinelli, Die Liebesgeschichte in Hirschaum 1780, III,1 ('Thanks to ou!' Own translation)
27. Karl von Marinelli, Die Liebesgeschichte in Hirschau 1780, II,13 ('Let Margreth and Bonavent come here at the same time'. Own translation).
28. Former work with less annotated material shows that the emotion courses for 'suffering' and 'joy' in tragedies and comedies are clearly distinctive (cf. Dennerlein, Schmidt, Wolff 2022a,b).
29. In the following, we do not distinguish between stage directions and spoken texts. For an analysis of emotions in stage directions see Dennerlein, Schmidt, Wolff, 2023.
30. More data on the classification can be found on our github-repository: https://github.com/lauchblatt/Emotions_in_Drama

31. In our corpus, acts and scenes in the course of the drama are not always presented consistently and uniformly.
32. Pfeil, Lucie Woodvil 1756, I,2 ('Lucie, Lucie, what a storm you have caused on my soul!'. Own translation)
33. Klingemann, Faust, 1815, III,3 ('furious; by rushing over, pausing'. Own translation)
34. Cf. for example heroic tragedies in Lukas (2005); 'bürgerliche Trauerspiele' in Mönch (1993).
35. With kind permission of Beatrix Müller-Kampel, we were allowed to retrieve it from the platform *Mäzene des Kasperls* http://lithes.uni-graz.at/maezene/maezene_startseite.html.

References

Adelung, J. C. (1793–1801). *Grammatisch-Kritisches Wörterbuch der Hochdeutschen Mundart*. Wien, Austria. https://lexika.digitale-sammlungen.de/adelung/online/angebot (accessed 1 April 2023).

Alm, C. O. and Sproat, R. (2005). Emotional sequencing and development in fairy tales. In Tao, J., Tan, T., and Picard, R.W. (eds), *Affective Computing and Intelligent Interaction*. Lecture Notes in Computer Science. Berlin, Heidelberg, Germany: Springer, pp. 668–674.

Alt, P. (1994). *Tragödie der Aufklärung: Eine Einführung*. Tübingen, Germany: Francke.

Arnold, A. (2012). *Rhetorik der Empfindsamkeit: Unterhaltungskunst im 17. und 18. Jahrhundert*. Boston, MA: De Gruyter.

Bojanowski, P., Grave, E., Joulin, A. and Mikolov, T. (2017). Enriching word vectors with subword information. *Transactions of the Association for Computational Linguistics*, **5**: 135–46ArXiv: 1607.04606, arXiv: 1607.04606[cs]

Brenner, P. J. (1999). In Meier, A. (ed), *Die Literatur des 17. Jahrhunderts (Hansers Sozialgeschichte der deutschen Literatur vom 16. Jahrhundert bis zur Gegenwart, 2)*, München, Wien: Hanser Verlag 1999, pp. 539–574.

Brunner, A., Tu, N.D.T., Weimer, L. and Jannidis, F. (2020). To BERT or not to BERT-comparing contextual embeddings in a deep learning architecture for the automatic recognition of four types of speech, thought and writing representation. In *SwissText/KONVENS*. https://ceur-ws.org/Vol-2624/paper5.pdf (accessed 1 April 2023).

Buda, M., Maki, A. and Mazurowski, M. A. (2018). A systematic study of the class imbalance problem in convolutional neural Networks. *Neural Networks*, **106**: 249–59.

Cao, L., Peng, S., Yin, P., Zhou, Y., Yang, A. and Li, X. (2020). A survey of emotion analysis in text based on deep learning. In *2020 IEEE 8th International Conference on Smart City and Informatization (ISCI)*, Guangzhou, China, December 31 2020 to January 1 2021, pp. 81–88.

Chan, B., Schweter, S. and Möller, T. (2020). German's next language model. In *Proceedings of the 28th International Conference on Computational Linguistics*. Barcelona, Spain, December 2020, pp. 6788–96.

Clark, K., Luong, M., Le, Q. V. and Manning, C. D. (2020). ELECTRA: pre-training text encoders as discriminators

rather than generators. *ICLR*. https://openreview.net/pdf?id=r1xMH1BtvB (accessed 1 April 2023).

Dennerlein, K. (2021). *Materialien und Medien der Komödiengeschichte: Zur Praxeologie der Werkzirkulation zwischen Hamburg und Wien von 1678–1806*. Berlin, Germany: de Gruyter.

Dennerlein, K., Schmidt, T., and Wolff, C. (2022a). Emotionen im kulturellen Gedächtnis bewahren. *DHd 2022 Kulturen des digitalen Gedächtnisses. 8. Tagung des Verbands 'Digital Humanities im deutschsprachigen Raum' (DHd 2022)*. Potsdam, Germany: Zenodo, pp. 93–98.

Dennerlein, K., Schmidt, T., and Wolff, C. (2022b). Emotion courses in German historical comedies and tragedies. *Book of Abstracts, Digital Humanities 2022 (DH2022). Responding to Asian Diversity*. Tokyo, Japan: The University of Tokyo, pp. 193–197.

Dennerlein, K., Schmidt, T., and Wolff, C. (2022c). *Figurenemotionen in Deutschsprachigen Dramen Annotieren*. Zenodo. doi: 10.5281/zenodo.6228152 (accessed 1 April 2023).

Dennerlein, K., Schmidt, T., and Wolff, C. (2023). Emotions in stage directions in German drama of the early modern period: explorations via computational emotion classification. In Andresen, M., Reiter, N., Krautter, B. and Pagel, J. (eds), *Computational Drama Analysis: Achievements and Opportunities*, Berlin, Germany: de Gruyter, pp. 166–194.

Devlin, J., Chang, M.-W., Lee, K. and Toutanova, K. (2019). BERT: pre-training of deep bidirectional transformers for language understanding. In *Proceedings of the 2019 Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies, Volume 1 (Long and Short Papers)*. Minneapolis, MN, June 2019, pp. 4171–4186. https://doi.org/10.18653/v1/N19-1423.

Ewert, O. (1974). Gefühl. In Ritter, J., Gründer, K. and Gabriel, G. (eds), *Historisches Wörterbuch der Philosophie. 13 Vls*, 3rd volume G-H. Darmstadt, Germany: Reinbeck Bei Hamburg, pp. 82–96.

Fehle, J., Schmidt, T. and Wolff, C. (2021). Lexicon-based sentiment analysis in German: systematic evaluation of resources and preprocessing techniques. In *Proceedings of the 17th Conference on Natural Language Processing (KONVENS 2021)*, Düsseldorf, Germany, 6–9 September 2021, pp. 86–103.

Fischer, F., Börner, I., Göbel, M., *et al.* (2019). Programmable corpora: introducing DraCor, an infrastructure for the research on European drama. In *Book of Abstracts, Digital Humanities Conference 2019 (DH 2019)*, Utrecht, Netherlands: Zenodo. https://doi.org/10.5281/zenodo.4284002.

Gius, E., Meister, J., Petris, M., Meister, M., *et al.* (2020). CATMA (7.0.0). https://doi.org/10.5281/zenodo.4353618. https://zenodo.org/record/4353618#.YFYUq11KjfA. (accessed 1 April 2023)

Grimm, G. E. (2010). Affekt. In Barck, K., Fontius, M., Schlenstedt, D., S and Wolzettel, F. (eds), *Ästhetische Grundbegriffe*, Vol.. 1, Stuttgart : Metzler, pp. 16–49.

Grimm, J. and Grimm, W. (1811). *Deutsches Wörterbuch von Jacob Grimm und Wilhelm Grimm, digitalisierte Fassung im Wörterbuchnetz des Trier Center for Digital Humanities, Version 01/21*. https://woerterbuchnetz.de/?sigle=DWB.

Gururangan, S., Marasović, A., Swayamdipta, S., Lo, K., *et al.* (2020). Don't stop pretraining: adapt language models to domains and tasks. In *Proceedings of the 58th Annual Meeting of the Association for Computational Linguistics*, Online, July 2020, pp. 8342–8360. http://arxiv.org/abs/2004.10964.

Hug, M., Boenig, M., Bracke, Y., Fischer, F., Haaf, S. and Thomas, C. (2021). Über bereichernde anreicherung. Wechselseitige annotation von dramen als subkorpus der digitalen bibliothek zwischen Zeno.org, TGRep, GerDraCor und DTA. In *Im Zentrum Sprache*. Untersuchungen zur deutschen Sprache in Geschichte und Gegenwart.

Kakkonen, T. and Galić Kakkonen, G. (2011). SentiProfiler: creating comparable visual profiles of sentimental content in texts. *Proceedings of the Workshop on Language Technologies for Digital Humanities and Cultural Heritage*, Hissar, Bulgaria, September 2011, pp. 62–69.

Kellner, B. (2007). Affektenlehre. In Weimar, K. (ed), *Reallexikon der deutschen Literaturwissenschaft, 3 B vols*, vol. 1, Berlin, Germany: De Gruyter, pp. 23–25.

Kim, E. and Klinger, R. (2019a). A survey on sentiment and emotion analysis for computational literary studies. *Zeitschrift Für Digitale Geisteswissenschaften*, 4: 1–21.

Kim, E. and Klinger, R. (2019b). An analysis of emotion communication channels in fan-fiction: towards emotional storytelling. In *Proceedings of the Second Workshop on Storytelling*, Florence, Italy, August 2019, pp. 56–64.

Kim, E., Padó, S. and Klinger, R. (2017). Prototypical emotion developments in literary genres. In *Proceedings of the Joint SIGHUM Workshop on Computational Linguistics for Cultural Heritage, Social Sciences, Humanities and Literature*, Vancouver, Canada, August 2017, pp. 17–26.

Kraft, S. (2011). *Zum Ende der Komödie: Eine Theoriegeschichte des Happyends*. Göttingen, Germany: Wallstein.

Krämer, J. (1998). *Deutschsprachiges Musiktheater im späten 18. Jahrhundert: Typologie, Dramaturgie und Anthropologie einer populären Gattung*. Tübingen, Germany: Niemeyer

Krause, M. (1980). Trivialdramatik. In Glaser, H.-A. (ed), *Deutsche Literatur: Eine Sozialgeschichte/5: Zwischen Restauration und Revolution: Klassik, Romantik 1789–1815*. Hamburg, Germany: Reinbeck bei Hamburg, pp. 313–326.

Labusch, K., Neudecker, C. and Zellhöfer, D. (2019). BERT for named entity recognition in contemporary and historic German. In *Proceedings of the 15th Conference on Natural Language Processing (KONVENS 2019): Long Papers*, Erlangen, Germany, 9–11 October 2019.

Landis, J. R. and Koch, G. G. (1977). The measurement of observer agreement for categorical data. *Biometrics*, 33(1): 159–74.

Liu, B. (2015). *Sentiment Analysis: Mining Opinions, Sentiments, and Emotions*. New York, NY: Cambridge University Press.

Lukas, W. (2005). *Anthropologie und Theodizee: Studien zum Moraldiskurs im deutschsprachigen Drama der Aufklärung (ca. 1730 bis 1770)*. Göttingen, Germany: Vandenhoeck & Ruprecht.

Mäntylä, M. V., Graziotin, D. and Kuutila, M. (2018). The evolution of sentiment analysis—A review of research topics,

venues, and top cited papers. *Computer Science Review*, **27**: 16–32.

Meid, V. (2009). *Die deutsche Literatur im Zeitalter des Barock. Vom Späthumanismus zur Frühaufklärung 1570–1740*. München, Germany: C.H. Beck.

Meyer, R. (1986 ff.). *Bibliographia Dramatica et Dramaticorum: Kommentierte Bibliographie der im ehemaligen deutschen Reichsgebiet gedruckten und gespielten Dramen des 18. Jahrhunderts nebst deren Bearbeitungen und Übersetzungen und ihrer Rezeption bis in die Gegenwart*. 1. Abteilung: Werkausgaben, Sammlungen, Reihen. 2. Abteilung: Einzeltitel. 3 Bde. Tübingen, Germany: Niemeyer 1986 ff.

Meyer-Sickendiek, B. (2005). *Affektpoetik: Eine Kulturgeschichte literarischer Emotionen*. Würzburg: Königshausen & Neumann.

Mohammad, S. (2011, June). From once upon a time to happily ever after: tracking emotions in novels and fairy tales. In *Proceedings of the 5th ACL-HLT Workshop on Language Technology for Cultural Heritage, Social Sciences, and Humanities*, Portland, OR, pp. 105–14.

Mönch, C. (1993). *Abschrecken oder Mitleiden: Das deutsche Bürgerliche Trauerspiel im 18. Jahrhundert: Versuch einer Typologie*. Tübingen, Germany: Niemeyer.

Müller-Kampel, B. (2003). *Hanswurst, Bernardon, Kasperl: Spaßtheater im 18. Jahrhundert*. Paderborn, Germany: Schöningh.

Müller-Kampel, B. and Kuzmics, H. (2010). Kasperl-La roche: seine Kunst, Seine Komik und das leopoldstädter theater. *Zeitschrift Für Literatur Und Theatersoziologie (LiTheS). Sonderheft*, **1**.

Nalisnick, E. T. and Baird, H. S. (2013). Character-to-character sentiment analysis in Shakespeare's plays. In *Proceedings of the 51st Annual Meeting of the Association for Computational Linguistics (Volume 2: Short Papers)*, Sofia, Bulgaria, pp. 479–83.

Noe, A. (2007). Italienische spieltexte: aus unveröffentlichten handschriften. In Brauneck, M. and Noe, A. (eds), *Spieltexte Der Wanderbühne*. Berlin, Germany: de Gruyter.

Pereira, M. P. D. S. (2019). Mixed methodological digital humanities. *Debates in the Digital Humanities 2019*. Minneapolis, MN: University of Minnesota Press, pp. 405–12.

Pianzola, F., Rebora, S., and Lauer, G. (2020). Wattpad as a resource for literary studies. quantitative and qualitative examples of the importance of digital social reading and readers' comments in the margins. *PLoS One*, **15**(1): e0226708.

Plutchik, R. (1980). *Emotion, a Psychoevolutionary Synthesis*. Manhattan, NY: Harper & Row.

Ranke, W. (2009). *Theatermoral: moralische Argumentation und dramatische Kommunikation in der Tragödie der Aufklärung*. Würzburg, Germany: Königshausen & Neumann.

Reagan, A. J., Mitchell, L., Kiley, D., Danforth, C. M. and Dodds, P. S. (2016). The emotional arcs of stories are dominated by six basic shapes. *EPJ Data Science*, **5**: 31.

Reiter, N. (2020). Anleitung zur Erstellung von Annotationsrichtlinien. *Reflektierte algorithmische Textanalyse: Interdisziplinäre(s) Arbeiten in Der CRETA-Werkstatt*. Stuttgart, Germany: De Gruyter, pp. 193–202.

Rotermund, E. (1972). *Affekt und Artistik: Studien Zur Leidenschaftsdarstellung und zum Argumentationsverfahren bei Hofmann von Hofmannswaldau*. München, Germany: W. Fink.

Sauder, G. (1980). *Empfindsamkeit*, **3** vols. Stuttgart, Germany: Metzler.

Schings, H. J. (1971). Consolatio Tragoediae. Zur Theorie des barocken Trauerspiels. In Grimm, R. (ed), *Deutsche Dramentheorien. Beiträge zu einer historischen Poetik des Dramas in Deutschland*. Frankfurt, Germany: Athenäum Vlg, pp. 1–44.

Schings, H. J. (1980). *Der mitleidigste Mensch ist der beste Mensch: Poetik des Mitleids von Lessing bis Büchner*. München, Germany: Beck.

Meier, A. (1993). *Dramaturgie der Bewunderung. Untersuchungen zur politisch-klassizistischen Tragödie des 18. Jahrhunderts*. Frankfurt, Germany: Klostermann.

Schmidt, T. and Burghardt, M. (2018). An evaluation of lexicon-based sentiment analysis techniques for the plays of gotthold ephraim lessing. In *Proceedings of the Second Joint SIGHUM Workshop on Computational Linguistics for Cultural Heritage, Social Sciences, Humanities and Literature*, Santa Fe, New Mexico, August 2018, pp. 139–49.

Schmidt, T., Burghardt, M. and Dennerlein, K. (2018). Sentiment annotation of historic German plays: an empirical study on annotation behavior. In Kübler, S. and Zinsmeister, H. (eds), *Proceedings of the Workshop on Annotation in Digital Humanities 2018 (AnnDH 2018)*, Osaka, Japan, December 2016, pp. 47–52.

Schmidt, T., Burghardt, M., Dennerlein, K., *et al.* (2019a). Sentiment annotation for Lessing's plays: towards a language resource for sentiment analysis on German literary texts. In Declerck, T. and McCrae, J.P. (eds), *2nd Conference on Language, Data and Knowledge (LDK 2019)*. Leipzig, Germany: CEUR Workshop Proceedings, pp. 45–50.

Schmidt, T., Winterl, B., Maul, M., Schark, A., Vlad, A. and Wolff, C. (2019b). Inter-rater agreement and usability: a comparative evaluation of annotation tools for sentiment annotation. In Draude, C., Lange, M. and Sick, B. (eds), *Informatik 2019: 50 Jahre Gesellschaft Für Informatik – Informatik Für Gesellschaft (Workshop-Beiträge)*. Bonn, Germany: Gesellschaft Für Informatik e.V., pp. 121–33.

Schmidt, T., Dennerlein, K., and Wolff, C. (2021a). Towards a corpus of historical German plays with emotion annotations. In Gromann, D., *et al.* (eds), *3rd Conference on Language, Data and Knowledge (LDK 2021)*, Zaragoza, Spain, 1–3 September 2021, pp. 9:1–11.

Schmidt, T., Dennerlein, K., and Wolff, C. (2021b). Using deep learning for emotion analysis of 18th and 19th century German plays. In Burghardt, M., *et al.* (eds), Fabrikation von Erkenntnis: Experimente in den Digital Humanities, *Esch-Sur-Alzette*. Luxembourg: Melusina Press, pp. 1–32. 10.26298/melusina.8f8w-y749-udlf.

Schmidt, T., Dennerlein, K., and Wolff, C. (2021c). Emotion classification in German plays with transformer-based language models pretrained on historical and contemporary language. In *Proceedings of the 5th Joint SIGHUM Workshop on Computational Linguistics for Cultural Heritage, Social Sciences, Humanities and Literature*. Punta Cana, Dominican Republic, November 2021, pp. 67–79.

Schmidt, T., Dennerlein, K., and Wolff, C. (2022). Evaluation computergestützter Verfahren der Emotionsklassifikation für deutschsprachige Dramen um 1800. In *DHd 2022 Kulturen des Digitalen Gedächtnisses. 8. Tagung des Verbands 'Digital Humanities im Deutschsprachigen Raum' (DHd 2022)*, Potsdam, Germany: Zenodo, pp. 107–13.

Schonlau, A. (2017). *Emotionen im Dramentext: Eine methodische Grundlegung mit exemplarischer Analyse zu Neid und Intrige 1750–1800*. Berlin, Germany: De Gruyter.

Schulte-Sasse, J. (1980). Drama. In Grimminger, R. (ed), *Hansers Sozialgeschichte der deutschen Literatur vom 16. Jahrhundert bis zur Gegenwart/3: Deutsche Aufklärung bis zur Französischen Revolution: 1680 – 1789*. Munich, Germany: Hanser Verlag, pp. 423–99.

Schulz, G. M. (1988). *Tugend, Gewalt und Tod: Das Trauerspiel der Aufklärung und die Dramaturgie des Pathetischen und des Erhabenen*. Tübingen, Germany: Niemeyer.

Schulz, G. M. (2007). *Einführung in die deutsche Komödie*. Darmstadt: Wiss. Buchges.

Schweter, S. (2020). *Europeana BERT and ELECTRA Models*. 10.5281/zenodo.4275044. https://doi.org/10.5281/zenodo.4275044. (accessed 1 April 2023).

Schweter, S. and Baiter, J. (2019). Towards robust named entity recognition for historic German. In *Proceedings of the 4th Workshop on Representation Learning for NLP (RepL4NLP-2019)*. Florence, Italy: Association for Computational Linguistics, pp. 96–103.

Shmueli, B. and Ku, L. W. (2019). SocialNLP EmotionX 2019 Challenge Overview: Predicting Emotions in Spoken Dialogues and Chats. *ArXiv:1909.07734 [Cs]*. http://arxiv.org/abs/1909.07734 (accessed 1 April 2023).

Sprugnoli, R., Tonelli, S., Marchetti, A. and Moretti, G. (2015). Towards sentiment analysis for historical texts. *Digital Scholarship in the Humanities*, **31**: 762–72.

Steinmetz, H. (1966). *Komödie der Aufklärung*. Stuttgart, Germany: Metzler.

Weise, C. (1986). *Sämtliche Werke*. In Roloff, H. G. and Susen, G. H. (eds), Berlin, Germany: De Gruyter, pp. 231–390.

Wiegmann, H. (ed.) (1987). *Die ästhetische Leidenschaft: Texte zur Affektenlehre im 17. und 18. Jahrhundert*. Hildesheim, Germany: Olms.

Winko, S. (2003). *Kodierte Gefühle: Zu einer Poetik der Emotionen in lyrischen und poetologischen Texten um 1900*. Berlin, Germany: Erich Schmidt.

Winko, S. (2019). Literaturwissenschaftliche Emotionsforschung. In Kappelhoff, H. *et al.* (eds), *Emotionen. Ein interdisziplinäres Handbuch*. Stuttgart, Germany: Metzler, pp. 397–407.

Wolf, T., Debut,, L., Sanh, V., *et al.* (2020). Transformers: state-of-the-art natural language processing. In *Proceedings of the 2020 Conference on Empirical Methods in Natural Language Processing: System Demonstrations*, Online: Association for Computational Linguistics, pp. 38–45.

Wood, I., McCrae, J. P., Andryushechkin, V. and Buitelaar, P. (2018a). A comparison of emotion annotation approaches for text. *Information*, **9**(5): 117.

Wood, I., McCrae, J. P., Andryushechkin, V. and Buitelaar, P. (2018b). A comparison of emotion annotation schemes and a new annotated data set. In *Proceedings of the Eleventh International Conference on Language Resources and Evaluation (LREC 2018)*, Japan, 7–12 May 2018. https://www.aclweb.org/anthology/L18-1192 (accessed 1 April 2023).

Yang, K., Lee, D., Whang, T., Lee, S. and Lim, H. (2019). EmotionX-KU: BERT-max based contextual emotion classifier. *ArXiv:1906.11565 [Cs]*. http://arxiv.org/abs/1906.11565.

Yavuz, M. C. (2021). Analyses of character emotions in dramatic works by using EmoLex unigrams. In *Proceedings of the Seventh Italian Conference on Computational Linguistics, CLiC-It'20*, Bologna, Italy, 1–3 March 2021.

Zedler, J. H. (1732–1754). *Grosses Vollständiges Universal Lexicon Aller Wissenschaften Und Künste [. . .], Band 34*. Germany: Halle/Leipzig. https://www.zedler-lexikon.de/index.html?c=startseite&l=de (accessed 1 April 2023).

Zehe, A., Becker, M., Hettinger, L., Hotho, A., Reger, I. and Jannidis, F. (2016). Prediction of happy endings in German novels. In *Proceedings of the Workshop on Interactions between Data Mining and Natural Language Processing 2016 (DMNLP 2016)*, Riva del Garda, Italy, 23 September 2016, pp. 9–16.

Zeller, R. (2005). Tragödientheorie, Tragödienpraxis und Leidenschaften. In Steiger, J. A. (ed), *Passion, Affekt und Leidenschaft in der Frühen Neuzeit*. Wiesbaden, Germany: Harrassowitz, pp. 691–704.

Zeman, H. (1985). Die Alt-Wiener Volkskomödie des 18. und frühen 19. Jahrhunderts. In Plaschka, R. G. (ed) *Österreich im Europa der Aufklärung: Kontinuität und Zäsur in Europa zur Zeit Maria Theresias und Josephs II*, Bd. 2, Wien, Austria, 1980, pp. 717–741.