

On the Unity of Literary Change. The Development of Emotions in German Poetry, Prose, and Drama between 1850 and 1920 as a Test Case

Leonard Konle^{1,*}, Merten Kröncke^{2,*}, Fotis Jannidis¹ and Simone Winko²

¹*Institut für Deutsche Philologie, Julius-Maximilians-Universität Würzburg, Germany*

²*Seminar für Deutsche Philologie, Georg-August-Universität Göttingen, Germany*

Abstract

In this study, we use the development of emotions in German-language poetry, drama, and prose from 1850 to 1920 to informally test three hypotheses about literature: (1) Literature is a unified field, and therefore genres develop similarly at the same time. (2) The development of literature is led by one genre while the others follow. (3) The three main genres have very different developments without any relation to each other. We look at the development of emotions in these genres in general, and then at more fine-grained levels: polarity, six groups of emotions, and the group of love emotions. In the end, our data cannot confirm any of these hypotheses, but do show a closer relationship between poetry and prose, while drama shows a very distinct development. Only in some specific cases, such as the representation of lust and of love, can we see a closer relationship between the genres in general.

Keywords

literary history, emotion analysis, genre, German literature

1. Introduction

The abstract term ‘literature’ is a relatively late invention in English and German, which conceptually bundles the very different histories of the individual major genres (prose, drama, poetry) and even the terms for some of the major genres are comparatively late abstractions, such as in the case of the German word for poetry (‘Lyrik’) which came into use around 1800. The undeniable productivity of the term ‘literature’ lies in the fact that commonalities are emphasized and marked as essential. The disadvantage is that any use of such an abstract notion may suggest a unified entity where there are rather heterogeneous sub-fields. Traditional literary studies and computational literary studies (CLS) tend to see themselves in opposing camps as far as the tendency to use such abstractions is concerned. On the one hand, even well-established genre terms are questioned in cultural studies as fictions([12]), while CLS uses (e.g. [19]) or investigates[5][17]) genre terms as fruitful categories. On the other hand, even in traditional literary studies, especially in German literary studies, there is a tendency to assume that ‘lit-

CHR 2024: Computational Humanities Research Conference, December 4–6, 2024, Aarhus, Denmark

*Equal contribution, Corresponding authors, see detailed contribution in Section 8.

✉ leonard.konle@uni-wuerzburg.de (L. Konle); merten.kroencke@uni-goettingen.de (M. Kröncke);

fotis.jannidis@uni-wuerzburg.de (F. Jannidis); fotis.jannidis@uni-wuerzburg.de (S. Winko)

🆔 0000-0001-5833-0414 (L. Konle); 0000-0003-2717-0598 (M. Kröncke); 0000-0001-6944-6113 (F. Jannidis);

0000-0002-1006-7925 (S. Winko)



© 2024 Copyright for this paper by its authors. Use permitted under Creative Commons License Attribution 4.0 International (CC BY 4.0).

erature' is more than a useful term. The widespread use of concepts like 'literary system'[26] or 'literary field'[4] is also an indicator for this assumption. In our opinion, such questions are not theoretical problems, but can only be answered by empirical, historical, corpus-based studies: What similarities do individual genres exhibit in a given period and how do their developments differ? The time span we are analyzing below is the years from 1850 to 1920, which are regarded in German literary history as the period of realism and early modernism. We will look at three genres - prose, drama, poetry - and their relationship to each other to test three hypotheses about literature:

1. Literature is a homogeneous field and all genres develop in similar fashion at the same time.
2. Literature consists of genres and in times of change one of this genres will take the lead, will change first and the others will follow.
3. Literature is an abstraction over the very distinct and mostly independent histories of specific genres.

The selection of genres that we include in the study is based on the classical triad and each of these major genres is represented by a specific subgenre. Our prose corpus, for example, only contains novels published in print, which excludes entertainment literature published in other formats as well as novellas, short stories and short prose. For pragmatic reason, we must be selective not only in the constitution of the corpus, but also in which of the numerous possible perspectives on the literary texts we take into consideration. Obvious candidates would be aspects like themes, formal structures or character types. Since contemporaries have already determined the change from realism to early modernism by, among other things, how and which emotions are thematized (e.g., [38, p. 736]; [9, p. 338f.]; [29, p. 274]), we will concentrate on this perspective in this study. In short, the objective of this study is to investigate the interrelationship between the genres of prose, drama, and poetry during the period spanning from 1850 to 1920 by examining the manner in which these genres thematize and express emotions. We will start our analysis with a closer look at the general frequency of emotions in the three genres from 1850 to 1920. In the next step we look separately at positive and negative emotions and then on six emotion groups: agitation, anger, fear, joy, love, sadness. Our last step is an analysis of the emotions grouped together in 'love': 'lust', 'affection', 'longing', and 'love_{sub}'. This drilling down into more and more fine-grained perspectives allows us at the one hand to understand what powers the relations we can perceive on the more abstract level, but it also allows to determine whether we can identify counter-histories which subvert the main trends.

2. Related Work

2.1. Literary studies

Our approach can be linked to various literary-historical studies and in part test their theses: We highlight some of the debates relevant to our study, focusing on scholarship concerned with 19th- and 20th-century German-language literature. We organize them according to the

three guiding hypotheses about the development of literature and genres with regard to the representation of emotions.

(1) The literary system develops as a whole, independently of the development of genres. Although the history of emotions in literature has not yet been well studied, some observations can be made how the literary representation of emotions has changed over time. According to Scheuer, a literary history of emotional representations would have to take into account the ‚increasing sentimentalization‘; since the Romantic period there have been literary tendencies of ‚exaggeration of feeling‘ („Gefühlsübersteigerung“, [36, p. 19]), even into the 20th century. According to this approach, these tendencies manifest themselves around 1900 in phenomena as diverse as the aestheticistic dissection of one’s own emotional state or in mixtures of sentimentality and brutality in naturalistic texts ([36, p. 19f.]). From this perspective, no distinction is made between specific genres.

(2) Literary developments are driven by ‚leading genres‘. In literary histories we often find the assumption that there are such phenomena as leading genres in different epochs. These are genres in which the literary innovations that are typical or representative of a period appear first and are particularly pronounced (cf. [14, p. 150]). Even if typicality or representativeness is measured in different ways – e.g. quantitatively via the number of publications, qualitatively via the programmatic or discursive relevance in a period – an asymmetrical interdependence between the genres is nevertheless assumed: The leading genre precedes, the others follow if they can. For realism, for example, it is claimed that prose is the leading genre, while drama and poetry are of lesser importance (cf. [3, p. 145f., 327f.]); for naturalism, it is stated that it began around 1885 in poetry (cf. [1]: 45; [39, p. 533]), then manifested itself in prose and finally, from 1889, significantly influenced drama (cf. [1, p. 45]). Poetry is also usually cited as the decisive genre for the symbolist counter-movement to naturalism (cf. [1, p. 47]; [39, p. 533]). Based on our corpus, it is possible to examine how or if the developments of the individual genres relate to each other, even if we only focus on one aspect of genre development, the emotions.

(3) Literary genres develop independently. The representation of emotions has been studied most frequently in poetry. This is due to the fact that it has often been suggested that among prose, drama, and poetry, poetry is most closely tied to emotion. The association of poetry with emotionality, often linked to the notion of poetry as a particularly ‚subjective‘ genre, was widespread in the 19th century and continued to have proponents in the 20th century (cf. [25, p. 56], [42, p. 119–125], [44, p. 25–28], [40, p. 79–81, 84]). For instance, viewing poetry as an expression or representation of emotions was part of the influential aesthetics of Hegel and Vischer ([15, p. 323, 419–421, 424]; [41, p. 1261, 1325]). In the 20th century, however, more scholars emphasized that emotionality is not a necessary feature of poetry, especially when considering poetry beyond the 19th century (cf. [25, p. 57], [42, p. 120]). The debates outlined so far often take place on a theoretical level and aim to determine characteristics of poetry in terms of a genre definition. Whether poetry empirically represents emotions more often than other genres is a related but distinct question. [24] found some evidence that German-language poetry from the second half of the 19th and early 20th centuries does indeed represent emotions more frequently than prose and drama. However, the corpus for that study was very small, containing only 5 prose texts and 5 dramas.

With regard to the emotional-historical development of poetry, it has been argued that modernist poetry represents emotions less often than realist poetry ([2, p. 319]). Other researchers

contend that modernist poetry continues to represent emotions frequently, albeit in a modified way ([42], [20, p. 376]). [22] showed that German-language poetry from around 1900 represents emotions slightly less frequently than poetry from earlier periods, although the difference increases when canonical authors are considered. The observed trends were mainly due to a decrease in positive emotions, which means that the proportion of negative emotions increased over time. It remains to be seen whether similar trends can be observed in prose and drama.

There is no generally recognized approach to exploring the relationship between genre and emotion in literary studies. Meyer-Sickendiek has proposed a conceptual approach to writing the history of literary genres as a history of emotions. He sees literary genres as ‚media‘ of basic emotions and assigns them each a leading emotion ([28, p. 35f.]), e.g. the emotion ‚grief‘ to the elegy, ‚surprise‘ to the novella and ‚longing‘ to the melodrama. His starting point are the Poetics. In this approach, the modification of the leading emotions by individual authors over time proves to be relevant to cultural history. In contrast, we take the literary texts as our starting point and analyse the emotions that are actually presented in the individual texts, with these texts being assigned to the three main genres.

2.2. Computational Literary studies

Sentiment Analysis and also the analysis of emotions has a comparatively long and rich history in Computational Literary Studies.[21] Emotions have also been used to distinguish genres and subgenres.[16] For the analysis of the development of poetry in German literature the studies mentioned in the last section are also important.

In methodological terms, our study is also comparable to Andrew Piper’s contribution on the concept of fiction, which also draws conclusions from the analysis of historical data for the theoretical discussion of central literary concepts.[30]

3. Resources

3.1. Corpus

Our poetry corpus¹ comprises texts from 20 anthologies from the period under study. The anthologies feature contemporary poetry. The collections from around 1900 additionally focus on ‚modern‘ poetry. Often, the anthologies aim to showcase the ‚best‘ texts of their time. For our corpus, we included all anthologized poems published between 1850 and 1920. For more details, see [43].

The drama corpus consists of all texts in the German Drama Corpus (GerDraCor) from the period under study.² In addition, we included all texts from Project Gutenberg edition 16 from the same time span, which were marked as drama and which were not already in our corpus.[34] The prose corpus contains novels from DTA³, TextGrid⁴ and Project Gutenberg.

¹Code and Data: <https://github.com/cophi-wue/Unity-of-Literary-Change.git>

²<https://dracor.org/ger>

³<https://www.deutschestextarchiv.de/>

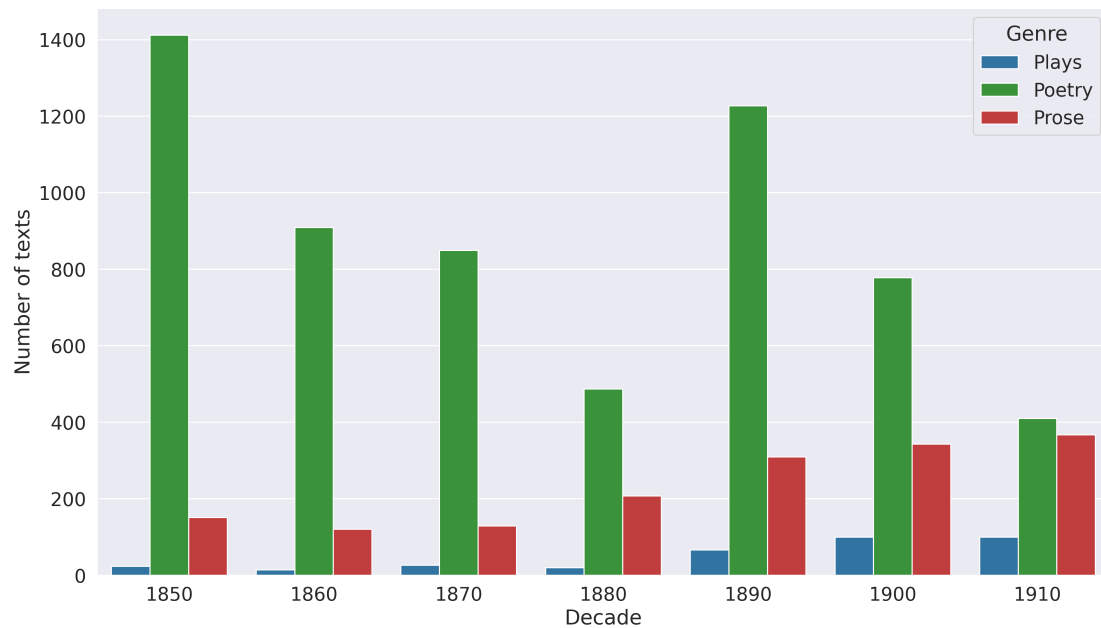
⁴<https://textgrid.de/>

Table 1

Amount of texts by genre.

Genre	Titles
Prose	1626
Plays	349
Poetry	4983

In order to examine developments over time, the corpus texts had to be dated. For the plays taken from Dracor, we use the dates provided by DraCor. The additional plays, the poems and the prose texts have been dated by us. While it was relatively easy to find dates for plays and prose, it was much more difficult for poetry, in part because many poems were written by authors who are little known today and whose works are not or only partially catalogued or digitized. From the poems with reliable dating, we have calculated that an author is on average 33 years old at the time of publication. For the poems that cannot be dated precisely, we estimate the first publication to be 33 years after the author's birth. In total, we were able to compile dates manually for 130 plays, 2821 poems and 1908 prose texts⁵.

**Figure 1:** Texts per decade by genre.

⁵Including those that fall outside our period of investigation (86).

3.2. Annotation

We annotated the representation of emotions in 1352 poems, 28 prose texts, and 23 plays. The goal was not to annotate readers' emotions, but rather the emotions represented in the text itself, e.g., whether a character is happy, sad, in love, etc. The annotators used a list of 40 discrete emotions (e.g., longing, lust, joy, surprise, envy, regret). The selection is based on existing emotion models (e.g. [7], [8]; [32], [31], [33]) and on the emotions that were regularly represented in our corpus. Because a substantial number of emotions were only infrequently annotated (e.g., disgust), we categorized the emotions after annotation into 6 major groups, inspired by the emotion hierarchy from Shaver et al. ([37]): agitation, anger, fear, love, joy, sadness. First, each text was annotated independently by two annotators, who then manually merged the annotations into a consensus annotation. Their agreement, measured with γ [27], is for Poetry 0.71, Prose 0.76 and Plays 0.74. Our annotation followed the model in [22] and [23].

Table 2

annotated units with emotion groups per genre.

Genre	Love	Joy	Anger	Sadness	Fear	Agitation
Prose	255	326	135	312	115	158
Plays	455	430	290	561	245	262
Poetry	1656	1874	345	1791	261	283

As we will analyze the emotion group ‚Love‘ in more detail later on, we also report the annotations of (selected) individual emotions that constitute this group: the individual emotion love in the narrower sense, e.g. in ‚I love you‘, but also longing, affection, and (sexual) lust. Therefore, we use the label ‚Love‘ to refer to the individual emotion love (love_{sub}), but also to the emotion group.

Table 3

Text spans annotated with love sub-emotions per genre.

Genre	love _{sub}	Longing	Affection	Lust
Prose	118	20	58	26
Plays	232	43	91	23
Poetry	1038	310	94	123

4. Methods

4.1. Machine Learning

In order to generate sufficient material for a statistical analysis of our entire corpus, we need to automate the annotation process. The task is redefined so that instead of annotating any kind of text span, one or more emotions are assigned to a predefined segment. The segments are chosen

Table 4

F1-Score of automatic annotation of emotion groups (5-fold cross-validation).

Genre	Love	Joy	Anger	Sadness	Fear	Agitation
Prose	.70	.81	.79	.80	.81	.78
Plays	.72	.83	.81	.81	.80	.76
Poetry	.73	.70	.82	.70	.83	.74

Table 5

F1-Score of automatic annotation of love sub-emotions (5-fold cross-validation).

Genre	Love _{sub}	Longing	Affection	Lust
Prose	.95	.75	.92	.89
Plays	.92	.72	.82	.86
Poetry	.81	.70	.65	.69

with respect to genre: stanza in poetry; lines in plays and paragraphs in novels. This reduces the complexity of the task from segmentation (identifying emotion-carrying text passages) and subsequent labelling (selecting one or more emotions) to a single multi-labelling process. As foundation model we choose SauerkrautLM-7B-HerO⁶. The LLM is created by merging two mistral-7B models and further training on a German dataset. This choice is based on the fact that this model is freely available and can be handled with the computational resources at our disposal. Among the German models that meet these criteria, it performs best in general benchmark⁷ at the time of this study. Larger free models (e.g. Llama-3-SauerkrautLM-70b-Instruct), as well as commercial services (e.g. gpt4), are ruled out due to the large amount of predictions which need to be generated for the novels in the corpus alone. We reduce the computational costs of finetuning the model by making use of QLoRA[6].

The model is quantised to 8bit and the rank of its learnable adaptation matrix is 4 with an alpha of 8. The training is performed over 30 epochs, the batchsize is 140 and the initial learningrate $3e^{-4}$. Imbalance in label distribution is countered by random under-sampling. The quality of the model is determined separately for each genre in a 5-fold cross-validation (see table 4).

The second task aims to further differentiate the emotion of love from Shaver’s model. The task is to find one or more sub-emotions in segments with love emotion that caused the categorisation in the love group. We restricted the sub-emotions to identify to love_{sub}, longing, affection and lust. Training is carried out as described for the first task. Table 5 shows the evaluation results. Predictions are only generated for segments, that were labeled with love by the first model.

⁶<https://huggingface.co/VAGOsolutions/SauerkrautLM-7b-HerO>

⁷<https://huggingface.co/datasets/VAGOsolutions/MT-Bench-TrueGerman>

4.2. Descriptive Statistics across literary genres

The data set generated is inherently complex, as the interplay of emotions, genres, and their evolution over time makes it difficult to provide a single comprehensive analysis that addresses all aspects equally.

Firstly, emotions differ in their frequency, and this variation also changes across different genres. Additionally, genres vary significantly in terms of the number of texts, the number of segments within those texts (e.g., novels typically have more paragraphs than poems have stanzas), and the length of these segments (paragraphs tend to be longer than speech acts or stanzas).

In the figures below, we opted to calculate the average per document rather than per segment within each genre. However, this approach has its limitations: treating a long novel and a short poem as single data points may place disproportionate weight on shorter texts. Moreover, genres with shorter texts exhibit more variability, as they are more likely to contain no or only one emotional instance. In contrast, genres with longer texts containing more segments are more likely to include a full range of emotions. Despite this, we chose to average by document, as it feels more intuitive and better suited to the subject matter than averaging by segments. The document-based average reflects the emotions encountered when picking up a random book and reading it, whereas averaging by segments would resemble reading a single page from a book, which is not a realistic representation.

This approach does not fully resolve the issue of varying emotion frequencies across genres. To visualize trends between genres more effectively, we applied z-transformations. Since these transformations express changes in terms of standard deviations from the mean within each genre, rather than relative or absolute frequencies, it allows us to compare values despite the differing characteristics of the genres.

The only exception arises when calculating emotion density. To provide a normalized value, we computed emotions per token. However, this measure is only a rough approximation, as not all tokens have the same likelihood of carrying emotion, due to the varying segment lengths. Smaller segments result in more frequent measurements per token, as we can only detect whether a segment contains an emotion or not.

4.3. Time Series Analysis

In order to calculate statistical correlations between time series, stationarity must first be checked. Stationarity here means that the time series shows almost no trend and constant variability over the period under investigation. This property determines which statistical methods are permissible.

If two time series are stationary, we test their correlation for the same period (lag = 0) using the Pearson correlation coefficient. We can map whether there are time-shifted dependencies (lag > 1) using cross-correlation and test for significance with the Granger Causality test [13]. If both time series are not stationary, neither method can be used. Instead, we check for cointegration with the Engle-Granger test [10].⁸ For both tests, we limit the maximum number of lags to 4 (corresponds to 12 years), as we consider a connection with a period further in the

⁸A table with all test results can be found in the repository.

past to be implausible in this context. In the case that one time series is stationary and the other is non-stationary, we do not perform tests because the underlying statistical processes that generate the time series are so different that we rule out a relationship.

To have enough support for each data point in the time series, we work with 3-year bins (1850-1852, 1853-1855, etc.). For our visualizations in figure 3 to figure 9 we additionally smooth the time series by applying a moving average over a window of 3 bins. This reduces the variance the data show, but makes it much easier to visually identify interesting changes.

5. Analysis

In the following sections, we analyze the representation of emotions in prose, drama, and poetry, progressing from the abstract to the specific. We begin by examining the overall frequency of emotions (5.1). Next, we distinguish between positive and negative emotions (5.2), followed by an analysis of the six emotion groups (love, joy, etc.) (5.3). Finally, we focus on the ‘Love’ emotion group, delving into its individual emotions, such as sexual lust and longing (5.4).

5.1. Emotionality

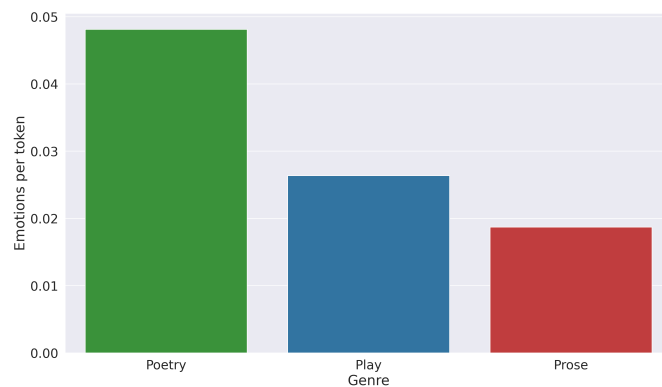


Figure 2: Emotion per token by genre.

First, we look at the ‘emotional density’ of the genres (figure 2). In terms of emotions per token, poetry represents emotions more often than drama and prose. This finding is consistent with the common notion that poetry is a particularly emotional genre. However, since a relevant proportion of poems do not represent emotions at all, emotionality is certainly not a necessary feature of poetry. Nevertheless, even at the beginning of the 20th Century, when the proportion of emotion in poetry has decreased substantially, it is still above the values in plays and prose.

Figures 3 and 4 show how the frequency of emotion representations changes over time. Figure 4 transforms the values from figure 3 into the number of standard deviations from the genre mean. This z-transformation allows for another meaningful comparison of trends across genres by placing them on a common scale.

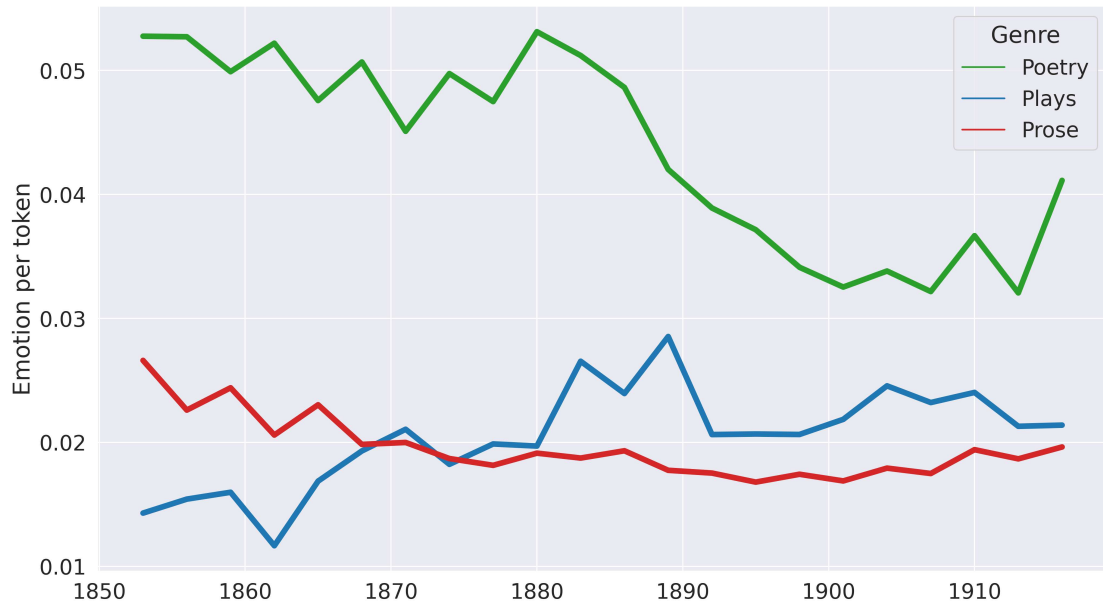


Figure 3: Emotion per token over time by genre.

As expected, there is a decline in the frequency of emotion in poetry during early modernism, although this trend does not continue into the 1910s. The amount of emotion per token in prose also declines over the long term, at least until the 1890s. The frequency of emotion representation in drama follows a markedly different pattern. It increases rather than decreases. When we statistically test whether the time series follow similar patterns, we see no significant result in any case.

5.2. Polarity

Our next step is to distinguish between positive and negative emotions (Figure 5). We consider the emotions in the ‘Love’ and ‘Joy’ groups to be positive, and the emotions in the ‘Sadness’, ‘Fear’ and ‘Anger’ groups to be negative. ‘Agitation’ is discarded.

For poetry and prose the amount of positive emotions decreases up to 1890, but only for poetry this process continues. Drama shows a different pattern, with positive emotions becoming more frequent over the long term. The genres also follow different trajectories for negative emotions. While there is a long-term increase in negative emotions in drama, there is a decrease in prose, which seems to stop around 1900. From about 1880, poetry follows a similar pattern to prose. Statistical testing shows that the only significant relationship exists between prose and drama at 1 lag for both positive and negative emotions. The result is due to the opposite tendencies of the two genres: while positive and negative emotions decrease in prose, they increase in drama.

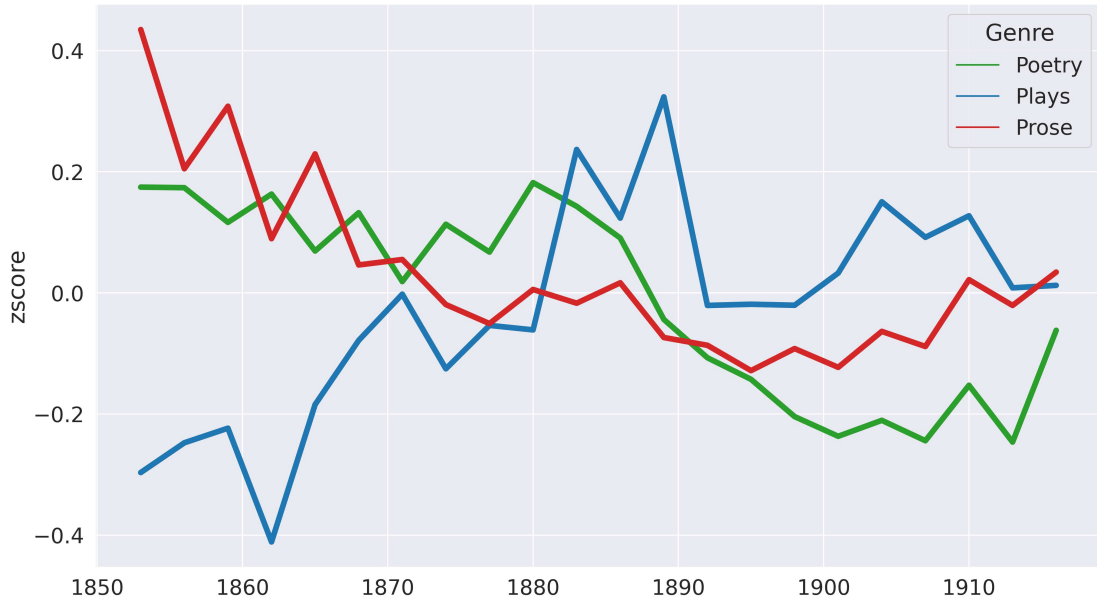


Figure 4: Emotion per token over time by genre. Values are normalised by z-Transformation.

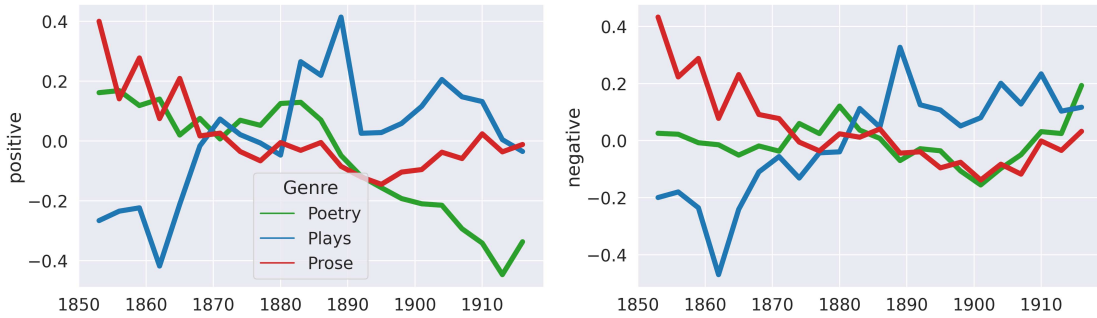


Figure 5: Polarity over time by genre. Values are normalised in every emotion and genre by z-Transformation. See repository for a plot containing errorbars.

5.3. Emotion Groups

We further increase the level of detail in our analysis and focus on the six emotion groups, which are based on the emotion hierarchy in [37]. In figure 6 which shows the emotional profiles of the genres we see that the genres differ markedly. Poetry often represents joy, love, and sadness, but has very low values for fear and a relatively low value for agitation. Prose has a similarly high value for joy, a lower but still high value for sadness, but reduced values for the other emotions. The drama especially represents agitation.

Examining the corresponding time series, we observe heterogeneous results (Figure 7). The development of emotions across different genres does not follow a uniform or straightforward

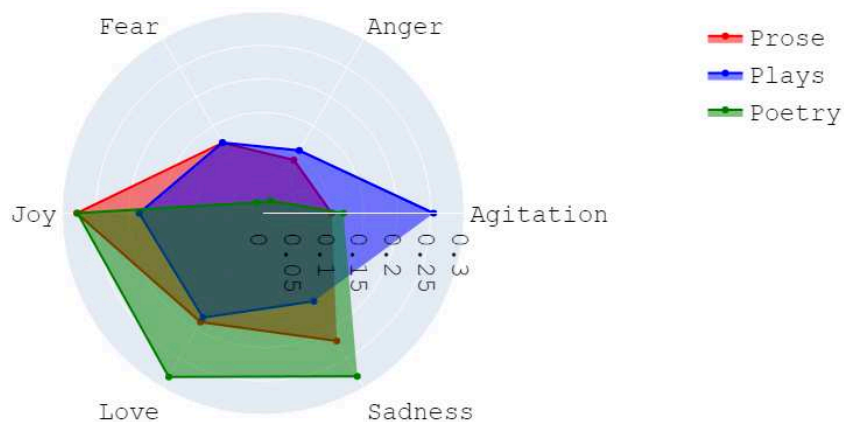


Figure 6: Emotion profile by genre.

pattern. There are some similarities, but only in limited cases. For example, both poetry and prose show a decrease in joy that stops around 1900 and a pattern of decline and increase in agitation from the 1880s onward, while their development with respect to other emotions is not very similar.

To further investigate whether emotion frequencies follow similar trajectories across genres, we plot their cross-correlation (Figure 8).⁹ The unlagged correlation of the poetry time series with the prose and drama time series is shown on the right side of the plots (lags = 0). High values at this point indicate that the frequency of a given emotion is increasing or decreasing simultaneously in poetry and prose, or poetry and drama. Additionally, we examine the correlation for different time lags by shifting the prose and drama time series by 1 to 4 lags (one lag equals three years), then recalculating the correlation. This approach reveals whether the time series follow similar patterns but with a delay. For instance, if there is a similar trend of increase and subsequent decline in a given emotion for both poetry and prose, but poetry begins this trajectory 1 or 2 lags earlier, the correlation without time shifts might be close to zero. However, with a shift of 1 or 2 lags, we might see that the correlation is quite high.

We see that anger in poetry and plays is not correlated at lag 0. But the correlation increases at lag -1. Which means that one time step after drama poetry shows a similar change of values. This fits with the observation in Figure 7 that there is an increase in anger after 1900 in all three genres, though it starts a few years earlier in drama. A similar pattern can be found for agitation.

The statistical tests show that for most combinations of two time series, their development

⁹We only compute cross-correlation for those time series which are stationary.

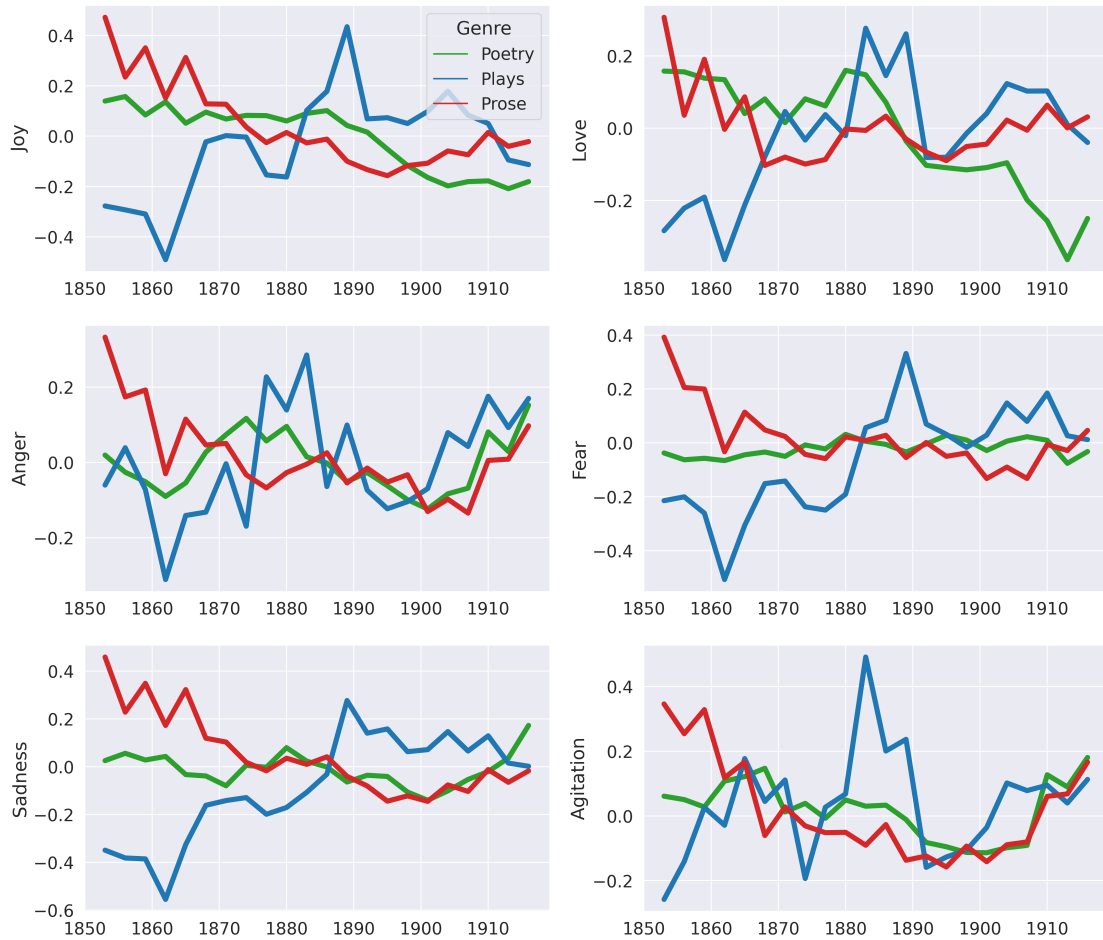


Figure 7: Emotion groups over time by genre. Values are normalised in every emotion and genre by z-Transformation. See repository for a plot containing errorbars.

is not significantly related. The exceptions are the relationships between prose and drama regarding joy and sadness with 1 to 3 lags. While both emotions decrease in prose, they tend to increase in drama.

5.4. Love

In this section, we take a closer look at the ‘Love’ emotion group and its individual emotions. Here, too, the results are heterogeneous. The plot on ‚lust’ shows a development that is consistent with literary-historical theses ([36, p. 20]; [35, p. 153f.], [11]). In modernism, the literary representation of sexuality increases in all genres, although, interestingly, this development seems to stop in the 1890s in poetry (but poetry also began this trend earlier) and in the 1910s in drama. We also see an increase in longing in all genres, at least until 1910. Representations of love_{sub} (e.g., in ‘I love you’) become less frequent over time in prose and poetry, but more

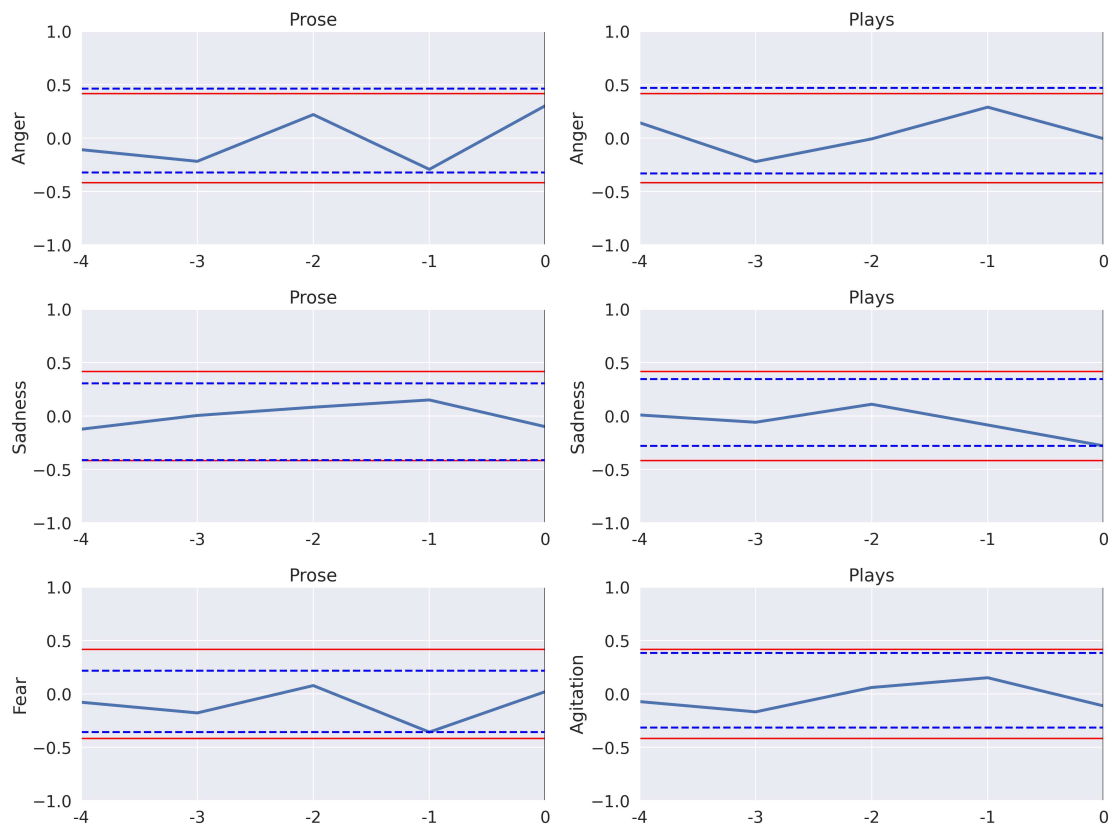


Figure 8: Cross correlation of poetry and lags of prose and plays in decades by emotion groups.

frequent (with strong fluctuations) in drama.

The cross-correlation, shown in Figure 10, reveals that there are some correlations between poetry and drama, but they are not very strong. In the case of affection, the correlation increases at -2 and -3 lags, but it must be borne in mind that affection is represented very rarely in poetry.

When we statistically test the relationships between time series, we see that there is a significant connection between play and prose in lust, and between different combinations of all three genres in $love_{sub}$. Among others, drama does not follow the decline of $love_{sub}$ in prose and drama.

6. Discussion

The data don't support the first hypothesis, that all genres move more or less in sync. The overall trends we observe in most of the data don't support the second hypothesis either, that the development of one genre is the model for the other genres that follow with some time lag. In individual cases, however, we see developments that seem to fit the idea of a leading genre.

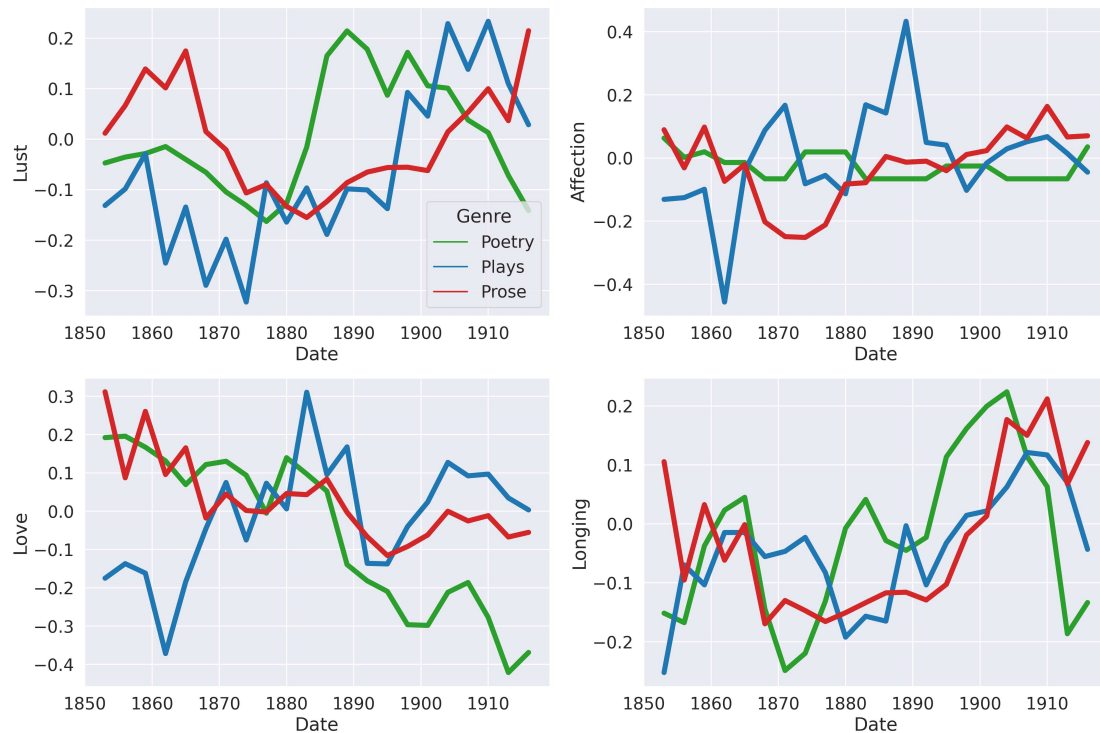


Figure 9: Sub-emotions of love over time by genre. Values are normalised in every emotion and genre by z-Transformation. See repository for a plot containing errorbars.

In particular, one of the most important innovations of modern literature, the representation of lust, is very pronounced in poetry and appears only with a time lag in drama and prose. But even the third hypothesis of a completely independent development of the genres can hardly be reconciled with the observations based on the data. Rather, we see that poetry and prose, especially after 1890, sometimes have a lot in common, but that drama almost always shows its own development. The fact that drama behaves differently from prose and poetry has been noted not only by our research group, but also in a study of word choice in 19th and early 20th century English literature ([18]). Whether these are signs of a more general 'special status of drama' may be a topic for future research. All in all, the data already allows us to be quite sceptical about the three hypotheses which express assumptions often found in literary studies.

On the other hand, our study has some shortcomings that may call into question the reliability of the results. The relatively small number of plays (only about 350 compared to about 1600 novels and about 5000 poems) may distort the results, especially the low numbers in the first decades, so increasing the number of plays in our corpus will be a high priority. Another problem is the proportion of subgenres, for example comedy in drama or elegy in poetry. At the moment we don't control our data for this variable. On the other hand, probably a change in the preference of a subgenre is already an indicator for a change in which emotions are preferred. So if we were to keep the proportions of the subgenres equal, we would dampen some

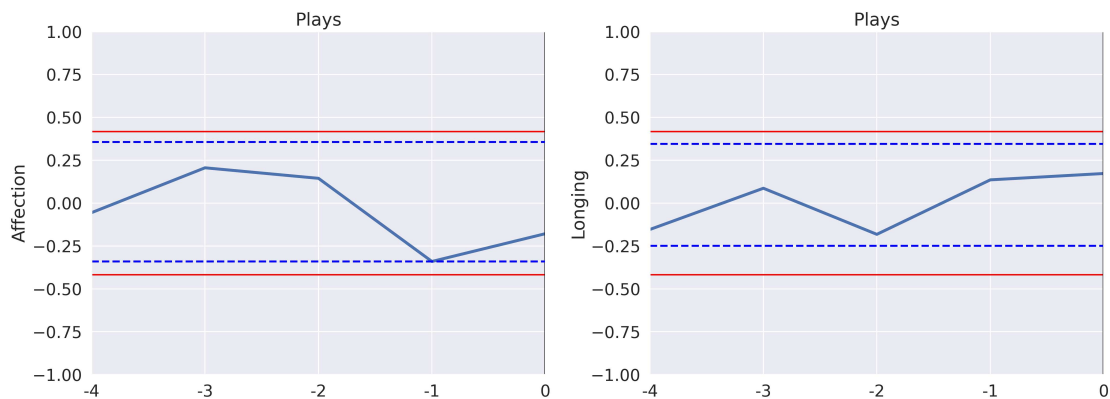


Figure 10: Cross correlation of poetry and lags of prose in decades by love sub-emotion.

of the fluctuations in the area of emotions.

We believe that the issue of making valid comparisons across significantly different segment lengths and numbers requires further empirical investigation. In future research, we aim to move away from using segments as a classification unit and instead focus on token-level classification. Previous efforts to train models within this framework have unfortunately been unsuccessful, but we are optimistic that progress can be made by utilizing larger language models and prompting.

Other future work will look into the reasons for the closer similarity between the development of prose and poetry and the more singular development of drama. Is it a question of the medium? Prose and poetry are distributed in print and typically meant to be read in solitude, while plays are performed on a stage? Or does the difference lie in the fact that poetry and prose have an intermediate communicative instance (the narrator or speaker), while drama manages without this instance? So far we have only looked at the relationship between one genre and another, but in the future we want to model the process by including all time series at once. This would allow us to determine the weight of temporary influences that genres have on each other. Finally, this could be a first step towards modeling the influence of external factors, such as ideological or socio-economic developments.

7. Acknowledgements

This work was funded by the Deutsche Forschungsgemeinschaft as part of the SPP 2207 Computational Literary Studies in the project: Literary Change. German Poetry between Realism and Early Modernism and Its Relation to Literary, Cultural and Social Developments.

8. Author Contributions

Leonard Konle: Software, Formal Analysis, Visualization, Writing – original draft

Merten Kröncke: Data Curation, Methodology, Writing – original draft

Simone Winko: Data Curation, Conceptualization, Supervision, Writing – original draft, Funding acquisition

Fotis Jannidis: Conceptualization, Supervision, Writing – original draft, Funding acquisition

References

- [1] P. Ajouri. *Literatur um 1900: Naturalismus, Fin de Siècle, Expressionismus*. Akademie Studienbücher Literaturwissenschaft. Berlin: Akad.-Verl, 2009. 253 pp.
- [2] M. Andreotti. *Die Struktur der modernen Literatur. Neue Wege in die Textanalyse. Einführung Epik und Lyrik*. 5th ed. Wien/Köln/Weimar: Haupt, 2014. 294 pp.
- [3] S. Becker. *Bürgerlicher Realismus: Literatur und Kultur im bürgerlichen Zeitalter 1848-1900*. Utb 2369. Tübingen: Francke, 2003. 359 pp.
- [4] P. Bourdieu. *Rules of Art: Genesis and Structure of the Literary Field*. Stanford: Stanford University Press, 1996.
- [5] J. Calvo Tello. *The novel in the Spanish silver age: a digital analysis of genre using machine learning*. Digital humanities research 4. Bielefeld: transcript, 2021.
- [6] T. Dettmers, A. Pagnoni, A. Holtzman, and L. Zettlemoyer. “QLoRA: Efficient Finetuning of Quantized LLMs”. In: *arXiv preprint arXiv:2305.14314* (2023).
- [7] P. Ekman. “An Argument for Basic Emotions”. In: *Cognition and Emotion* 6.3 (1992), pp. 169–200.
- [8] P. Ekman. “Basic Emotions”. In: *Handbook of Cognition and Emotion*. Ed. by T. Dalgleish and M. J. Power. Chichester, UK: John Wiley & Sons, Ltd, 1999, pp. 45–60.
- [9] E. Engel. *Geschichte der deutschen Literatur des Neunzehnten Jahrhunderts und der Gegenwart*. 5th ed. Wien/Leipzig: Freytag/Tempsky, 1913.
- [10] R. F. Engle and C. W. J. Granger. “Co-Integration and Error Correction: Representation, Estimation, and Testing”. In: *Econometrica* 55.2 (1987), pp. 251–276. URL: <http://www.jstor.org/stable/1913236>.
- [11] J. Flemming. “„Sexuelle Krise“ und „Neue Ethik“. Wahrnehmungen, Debatten und Perspektiven in der deutschen Gesellschaft der Jahrhundertwende”. In: *Liebe, Lust und Leid. Zur Gefühlskultur um 1900*. Ed. by H. Scheuer and M. Grisko. Kassel: kassel university press, 1999, pp. 27–55.
- [12] J. Frow. *Genre*. 2. edition. London New York: Routledge, 2014.
- [13] C. W. J. Granger. “Investigating Causal Relations by Econometric Models and Cross-spectral Methods”. In: *Econometrica* 37.3 (1969), pp. 424–438. URL: <http://www.jstor.org/stable/1912791>.
- [14] M. Gymnich. “Leitgattungen”. In: *Handbuch Gattungstheorie*. Ed. by R. Zymner. Stuttgart, Weimar: Springer, 2010, pp. 150–151.
- [15] G. Hegel. *Vorlesungen über die Ästhetik, Teil 3*. Ed. by H. Hotho and P. Marheineke. Vol. 10.3. Verlag von Duncker und Humblot, 1838.

- [16] U. Henny-Krahmer. “Exploration of sentiments and genre in Spanish American novels. In: . Hg. von Jonathan Girón Palau / Isabel Galina Russell. (DH 2018, Mexico City) Mexico City 2018, pp.” In: *Digital Humanities 2018: Puentes-Bridges. Book of Abstracts*. Ed. by J. Palau and I. G. Russell. Mexico City, 2018, pp. 399–403.
- [17] U. Henny-Krahmer. “Genre Analysis and Corpus Design: Nineteenth Century Spanish-American Novels (1830-1910)”. doctoralthesis. Universität Würzburg, 2023. DOI: 10.25972/opus-31999.
- [18] Y. Hu, M. Jiang, T. Underwood, and J. S. Downie. “Improving Digital Libraries’ Provision of Digital Humanities Datasets: A Case Study of HTRC Literature Dataset”. In: *Proceedings of the ACM/IEEE Joint Conference on Digital Libraries in 2020*. Virtual Event China: Acm, 2020, pp. 405–408. DOI: 10.1145/3383583.3398621. URL: <https://dl.acm.org/doi/10.1145/3383583.3398621>.
- [19] M. L. Jockers. *Macroanalysis: Digital Methods and Literary History*. Urbana, Chicago: University of Illinois Press, 2013.
- [20] C. Kanz. “Die literarische Moderne (1890–1920)”. In: *Deutsche Literaturgeschichte. Von den Anfängen bis zur Gegenwart*. 8th ed. Stuttgart/Weimar: Metzler, 2013, pp. 342–386.
- [21] E. Kim and R. Klinger. “A Survey on Sentiment and Emotion Analysis for Computational Literary Studies (Version 2)”. In: *Zeitschrift für digitale Geisteswissenschaften* (2021). DOI: 10.17175/2019_008_v2. URL: <https://zfdg.de/2019%5C%5F008>.
- [22] L. Konle, M. Kröncke, F. Jannidis, and S. Winko. “Emotions and Literary Periods”. In: *Digital Humanities Conference Abstracts*. Dh. Tokyo, 2022, pp. 278–281. URL: <https://dh2022.dhii.asia/dh2022bookofabsts.pdf>.
- [23] M. Kröncke, F. Jannidis, L. Konle, and S. Winko. *Annotationsrichtlinien Emotionsmarker und Emotionen*. 2022. URL: <https://doi.org/10.5281/zenodo.6020616>.
- [24] M. Kröncke, L. Konle, S. Winko, and F. Jannidis. “Modellierung von Gattungsunterschieden. Emotionen in Lyrik, Prosa und Drama”. In: *”DHD 2024”* (2024-02-21). In collab. with J. Weis, E. Bunout, T. Haider, P. Helling, M. Gerstmeier, T. Perschl, E. Huber, T. Haider, A. Debbeler, and N. Majka. DOI: 10.5281/zenodo.10698335.
- [25] D. Lamping. *Das lyrische Gedicht. Definitionen zu Theorie und Geschichte der Gattung*. 2nd ed. Göttingen: Vandenhoeck & Ruprecht, 2000.
- [26] N. Luhmann. *Art as a Social System*. Stanford: Stanford University Press, 2000.
- [27] Y. Mathet, A. Widlöcher, and J.-P. Métivier. “The Unified and Holistic Method Gamma (Σ) for Inter-Annotator Agreement Measure and Alignment”. In: *Computational Linguistics* 41 (3 2015), pp. 437–479. DOI: 10.1162/COLI_a_00227.
- [28] B. Meyer-Sickendiek. *Affektpoetik. Eine Kulturgeschichte literarischer Emotionen*. Würzburg: Königshausen & Neumann, 2005.
- [29] H. Naumann. *Die deutsche Dichtung der Gegenwart 1885–1923*. Stuttgart: Metzler, 1923.
- [30] A. Piper. “Fictionality”. In: *Journal of Cultural Analytics* 2.2 (2016). DOI: 10.22148/16.011. URL: <https://culturalanalytics.org/article/11067-fictionality>.

- [31] R. Plutchik. "A General Psychoevolutionary Theory of Emotion". In: *Theories of Emotion*. Elsevier, 1980, pp. 3–33.
- [32] R. Plutchik. "A psychoevolutionary theory of emotions". In: *Social Science Information* 21.4 (1980), pp. 529–553.
- [33] R. Plutchik. "The Nature of Emotions". In: *Social Science Information* 89.4 (2001), pp. 344–350.
- [34] *Gutenberg-DE Edition* 16. 2024. URL: <https://www.projekt-gutenberg.org/>.
- [35] W. Riedel. „*Homo natura*“. *Literarische Anthropologie um 1900*. Berlin: Königshausen & Neumann, 1996.
- [36] H. Scheuer. "Liebe, Lust und Leid. Zur Gefühlskultur um 1900. Eine Einführung". In: *Liebe, Lust und Leid. Zur Gefühlskultur um 1900*. Ed. by H. Scheuer and M. Grisko. Kassel: Kassel University Press, 1999, pp. 13–26.
- [37] P. Shaver, J. Schwartz, D. Kirson, and C. O'Connor. "Emotion Knowledge: Further Exploration of a Prototype Approach". In: *Journal of Personality and Social Psychology* 52 (6 1987), pp. 1061–1086.
- [38] A. Soergel. *Dichtung und Dichter der Zeit. Eine Schilderung der deutschen Literatur der letzten Jahrzehnte*. Leipzig: Voigtländer, 1911.
- [39] P. Sprengel. *Geschichte der deutschsprachigen Literatur 1870-1900. Von der Reichsgründung bis zur Jahrhundertwende*. München: C. H. Beck, 1998.
- [40] P. Trilcke. "Lyrik im neunzehnten Jahrhundert. Ein kommentiertes Datenreferat zu populären Poetiken". In: *Grundfragen der Lyrikologie 2. Begriffe, Methoden und Analysedimensionen*. Ed. by C. Hillebrandt, S. Klimek, R. Müller, and R. Zymner. Berlin/Boston: de Gruyter, 2021, pp. 67–92.
- [41] F. Vischer. *Asthetik oder Wissenschaft des Schönen. Zum Gebrauche für Vorlesungen. Vol. 3.2.5: Die Dichtkunst*. Mäcken, 1857.
- [42] S. Winko. *Kodierte Gefühle. Zu einer Poetik der Emotionen in lyrischen und poetologischen Texten um 1900*. Berlin: Erich Schmidt, 2003.
- [43] S. Winko, L. Konle, M. Kröncke, and F. Jannidis. *Lyrikanthologien 1850-1910*. 2022. URL: <https://doi.org/10.5281/zenodo.6053951>.
- [44] R. Zymner. "Theorien der Lyrik seit dem 18. Jahrhundert". In: *Handbuch Lyrik. Theorie, Analyse, Geschichte*. Ed. by D. Lamping. 2nd ed. Stuttgart: Metzler, 2016, pp. 23–36.