

# Automatic Detection of Enjambment in German Readout Poetry

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## Abstract

One of the most important patterns in ancient as well as modern poetry is the enjambment, the continuation of a sentence beyond the end of a line, couplet, or stanza. The paper reports first activities towards the development of a digital tool to analyze the accentuation of poetic enjambments in readout poetry. The aim in this contribution is to recognize two forms of enjambment (emphasized and unemphasized) in poems using audio and text data. We use data from *lyrikline* which is a major online portal for spoken poetry whereas poems are read aloud by the original authors. We identified by hermeneutical means based on literary analysis a total of 69 poems being characteristic for the use of enjambments in modern and postmodern German poetry and train classifiers to differentiate the emphasized/unemphasized categorization. A remarkable result of our automated analyses (and to our knowledge the first data-driven analysis of this kind) is the identification of a cultural difference in the accentuation of enjambments: statistically speaking, poets from the former GDR tend to emphasize the enjambment, whereas poets from the FRG do not. We use features derived from speech-to-text alignment and statistical parsing information such as pause lengths, number of lines with verbs, and number of lines with punctuation. The best classification results, calculated by the F-measure, for the both types of enjambment (emphasized/unemphasized) is 0.69.

**Index Terms:** modern and postmodern poetry, free verse prosody, emphasized and unemphasized enjambment

## 1. Introduction

An enjambment carries over the sense or the grammatical structure from one verse line or couplet to the next without a punctuated pause. In an enjambed line (or ‘run-on-line’), the completion of a clause, phrase or sentence is delayed over to the following line so that the line ending is not emphasized like it is in an ‘end-stopped line’. In readout poetry, this delay of meaning create a tension when the poet make a pause before completing the sentence of his poem by reading the next line.

There are three different effects when poets read poems based on enjambments. Poets can a) ignore the gap to the run-on-line by reading the poem fluently. b) emphasize the gap to the run-on-line in case of a so-called “soft enjambment”, which does not really affect the flow of the stanza and makes the poem still sound natural. In this case, the gap occurs between each singular colon (word group) of the poem, e.g. the noun phrase and the verbal phrase. Another option is to c) emphasize the so-called “hard enjambments” that really interrupts the flow of the poem and its reading. This occurs when the enjambment runs across stanzas; separates articles or adjectives from their nouns, or splits a word across a line [1][2][3]. In modern and postmodern poetry, these techniques were developed during the so-called *free verse poetry* by modern and postmodern poets like

the Imagists [4][5][6], the Black Mountain poets [7][8], who all had an enormous impact on modern German poets before and after the second world war in 1945 [4][9][10][11][12].

The detection of enjambment is usually based on text data, for example, the automatic detection of enjambment and its type on Spanish poems [13], in which the authors defined three kinds of enjambment: lexical (breaks up a word), phrase-bounded (phrase gets split), and cross-clause enjambment (between a relative pronoun and its antecedent). They used natural language processing (NLP) tools such as Part-of-Speech (PoS) tagger, constituency, and dependency parser. They derived 30 rules based on PoS sequences for the automatic detection of enjambment on Spanish poems.

In this paper, we will prove that these gaps that split the enjambment from the previous line in printed verse are also available in vocal performance. We claim that just as white spaces break up the series of black marks on the paper into smaller perceptual units whose end may or may not coincide with the end of syntactic units, oral performances may break up the text into versification units, and even indicate conflicts of versification and syntactic units. Our analysis is a first step towards an automatic classification of rhythmical patterns based on traditional machine learning or deep learning techniques.

The paper is organized as follows: The database is presented in the Section 2. Section 3 reviews the philological method and digital tools used in the analysis as well as the features used in the classification algorithms. The experimental results are described in Section 4. Finally, conclusions and future works are presented in Section 5.

## 2. Database

The automatic recognition of rhythmical patterns in modern and postmodern poetry is the aim of the project *Rhythmicalizer* ([www.rhythmicalizer.net](http://www.rhythmicalizer.net)). We use the database of our partner *lyrikline* ([www.lyrikline.org](http://www.lyrikline.org)), which contains speech and text data of modern and contemporary poetry, giving us access to hundreds of hours of author-spoken poetry. The data used in the project is a large collection of modern and postmodern readout poetry taken from *lyrikline*. The *lyrikline* hosts contemporary international poetry as audio files (read by the authors themselves) and texts (original versions & translations). Users can listen to the poet and read the poems both in their original languages and various translations. The digital material covers more than 10, 800 poems from more than 1, 200 international poets from more than 70 different languages. Nearly 80% of the *lyrikline*-poems are postmetrical poems. In the project, we will use all the poems in English and German (more than 3, 600 poems). The total number of poets writing in German and English is 215 and 154, respectively.

In this study, the philological scholar of our project (second author) collected only the German poems from the *lyrikline*-

website and limited the data set to poems by 32 poets. This selection is about 15% of all the German speaking poets (including 12 poets from German Democratic Republic (GDR - East Germany), 17 poets from Federal Republic of Germany (FRG - West Germany), and 3 poets from Austria). Each of these authors read at least one and at most nine poems, so we analyzed a total of 69 poems (33 with emphasized enjambments and 36 with unemphasized enjambments). The minimal and maximal number of lines in poems is 8 and 137, respectively. The length of audio files is between 20 and 347 seconds.

### 3. Method

The method is based on the interplay of hermeneutical and computational approaches. For this reason, we made use of a statistical method developed to analyze the modern *free verse poetry*. This method evaluates the relation between grammatical and metrical units in poetry. The automatic detection of enjambments is based on feature extraction and classification.

#### 3.1. Grammetrical Ranking

To classify the poetic enjambment systematically, we make use of the theory of the grammetrical ranking. The term grammetrics, coined by Donald Wesling, is a hybridization of grammar and metrics: the key hypothesis is that the interplay of sentence-structure and line-structure can be accounted for more economically by simultaneous than by successive analysis [14]. In poetry as a kind of versified language, the singular sentence interacts with verse periods (syllable, foot, part-line, line, rhymed pair or stanza, whole poem), a process for which Wesling finds ‘scissoring’ an apt metaphor: Grammetrics assumes that meter and grammar can be scissored by each other, that the cutting places can be graphed with some precision: “One blade of the shears is the meter, the other is the grammar. When they work against each other, they divide the poem. It is their purpose and necessity to work against each other” [14] pp. 67.

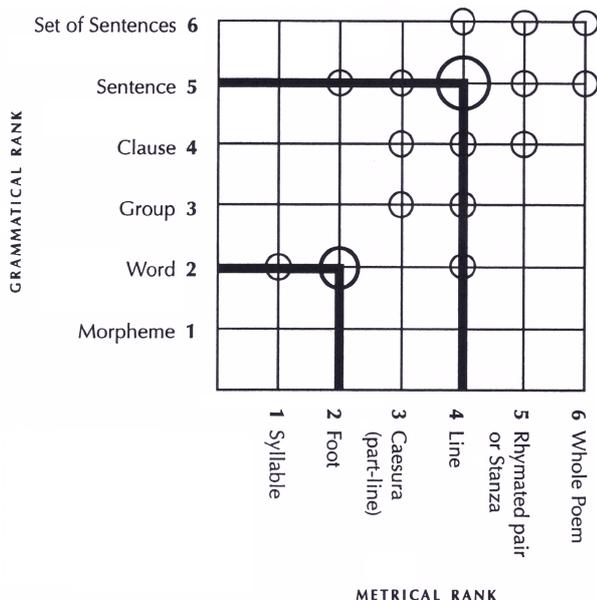


Figure 1: The vertical axis is the grammatical rank; the horizontal axis is the metrical rank. Intersection points help to identify the poem, for instance, the line arrangement [14].

In Wesling's scheme (see Figure 1), the vertical axis designates the grammatical rank and the horizontal axis the metric rank. Intersections of the two axes are represented by circles in which the axes meet; small circles for small coordinate points, large circles for large ones. Of all possible intersections on the grid, only 16 points are encircled, because normally only these 16 points are filled in poems. The 16 shear points can be represented in two clusters defined by their centers at the main coordinates of word foot and sentence line (large circles). Actually, these are not only scissor points, but also techniques such as caesura or enjambment. We recognize this enjambment by the fact that it marks one or more units below the sentence level (5) on the grammatical rank, and the line level (4) on the metrical rank. So we know about poets like Walt Whitman using end-stopped-lines including main and subordinate clauses. With regards to the grammetrical ranking, these *longline* poems used in Whitman's “Leaves of grass” have a (6) or a (5) on the vertical axis and a (4) on the horizontal axis. This poetic pattern already occurs in the Psalms in the King James Bible, and was taken over by Alan Ginsberg in “Howl”. A further example is the *cadence*, a sentence-based prosodic repetition, also connected to an end-stopped-line, now using a sentence in each line. In the grammetrical ranking, the *cadence* has a (5) on the vertical axis and a (4) on the horizontal axis. This poetic pattern was coined by the American Imagists Ezra Pound and Amy Lowell.

#### 3.2. Enjambment Analysis using Grammetrical Ranking

The American poet Walt Whitman was an end-stopped line-writer, he never broke up his lines and avoided the enjambment. Whereas his poetry is mainly concentrated on the first cluster (metrical rank = 4; grammatical rank  $\geq 5$ ); an enjambment normally has a (3) on the metrical rank and a (3) (word group/colon) on the grammatical rank. Some enjambments even have a (1) (morpheme) on the grammatical rank. This means that modern poetry developed two different types of enjambments:

1. **The soft enjambment** breaks up a sentence into one or more generally coherent clauses, e.g. the noun phrase and the verbal phrase. In the grammetrical ranking, the *soft enjambment* has a (4) or a (3) on the vertical axis and a (4) on the horizontal axis. A special case of this pattern is the *variable foot*, a colon-based ‘run-on-line’ which was developed by William Carlos Williams in his later poems. For each line, Williams used the colon that is the level below the clause. For this reason, the enjambment can also be regarded as a certain kind of postmetrical prosodic element [15][10][16].
2. **The hard enjambments** really interrupts the flow of the poem and its reading. This occurs when the enjambment separates article and noun, atonic pronoun and following word, determinative adjective and noun, qualifying adjective and noun, or even splits a word across a line. In the grammetrical ranking, the *hard enjambment* has a (2) or (1) on the vertical axis and a (4) on the horizontal axis. It is often used in the later poems of Paul Celan or the early poems of Thomas Kling.

Regarding the fact that our project is focused on readout poetry from the portal *lyrikline*, we also discovered a further and somehow new difference: Poets emphasizing their enjambments and poets not emphasizing their enjambments:

1. **The unemphasized enjambment** is used by *lyrikline*-poets like Nicolas Born, Richard Anders, Ernst Jandl, Hans Magnus Enzensberger, and Harald Hartung: while reading, these

poets do not strengthen the gap between two lines or do not hesitate to read the second part of the phrase that completes the sentence.

2. **The emphasized enjambment** was mainly coined in the former GDR and goes back to Bertolt Brechts essay “On Rhymeless Verse with Irregular Rhythms” [17]. Our paper shows that the *emphasized enjambment* mainly occurs in poems from authors of the former GDR like Karl Mickel or Kerstin Hensel. These GDR-poets were deeply influenced by Brechts idea of a “gestic” intonation, i.e. a technique requiring a discontinuous and irregular rhythm.

### 3.3. Processing Tools

The first step required is to create a text-speech alignment for the written poems and spoken recordings in order to enable the analysis of acoustic features. In a next step, poems will be processed using a statistical parser in order to add syntactic features. Focusing on the rhythmical patterns mentioned in Section 3.2, we used the following tools for the analysis and feature extraction tasks:

- **Text-Speech Aligner:** we use the text-speech aligner published by [18] which uses a variation of the SailAlign algorithm [19] implemented using Sphinx-4 [20]. The alignments are stored in a format that guarantees the original text to remain unchanged (which is important to be able to combine them with syntactic and other annotations).
- **Parser:** The Stanford parser [21] is used to parse the written text of poems. The parser used the Stuttgart-Tübingen-TagSet (STTS) table [22]. The main problem in poem parsing is the absence of punctuation in some cases, writing with special characters, or the writing of the whole text in lowercase or some words in uppercase. This cause errors in the parsing process. Each sentence of a poem is structured as a parse tree, which is an ordered, rooted tree that represents the syntactic structure according to some context-free grammar. Within each line, there is one root node, containing of two (or more) branch nodes, the nominal phrase and the verbal phrase.

### 3.4. Computational Analysis of Enjambment

Our method employs analysis based on computational speech processing in combination with manual philological analysis. The analysis is based on automatically extracted features that are potentially useful to describe and localize enjambments in *free verse poetry*. We parsed each line of a poem separately and expected that each sentence should contain one finite verb, beside other possible non-finite verbs. So whenever a full sentence containing one finite verb is spread over two or more lines, then there is an enjambment.

The Stanford parser uses a number of abbreviations to identify different parts of a speech. We focused on the following verbs: finite verbs (VVFİN), imperative verbs (VVİMP), auxiliary verbs (VAFİN), auxiliary imperative verbs (VAİMP), and finite modal verbs (VMFİN). We located finite verbs in a poem lines using the PoS-Tagging of the parser. In a second step, we examined whether in the following poem line the finite verb is missing: If this was the case, then we probably had an enjambment. The punctuation marks play an important role in the detection of enjambment, cause the complete sentences in lines can be identified by the sentence ending punctuations (. ? ! ; :), and the clauses by the comma. Therefore, all punctuation marks are detected in every poetic line.

For the distinction between *emphasized enjambment* and *unemphasized enjambment*, we had to measure the pauses between each of these “enjambments”. We compared the average length of pause between all individual words in the same poetic line (P1) with the pause between the words of the enjambment at the end of lines (P2): If P2 was greater than P1, then the poem is structured by *emphasized enjambments*. A statistical analysis is implemented to pause length. The pause length between words and at the end of lines in the *emphasized enjambment* is 1.8 msec and 13 msec, respectively. In the *unemphasized enjambment*, the pause length between words and at the end of lines is 1.7 msec and 9.6 msec, respectively.

Figure 2 shows an example of the automatic analysis of the rhythmical pattern *emphasized enjambment* for the first two lines (“Als ich bei ihm war rückte er” \ “Den Tisch fort und das Bett...”) (english: When I was with him, he moved \ the table away and the bed...) from the poem “ALS ICH BEI IHM WAR” (english: WHEN I WAS WITH HIM) from the poet Kerstin Hensel. From top to bottom one can see: speech signal, intensity (dB), word alignment, end of line alignment, parser information (PoS-tagging), and time. There is a pause between the end of the first line and the start of the second line (the pause length between the words “er” and “Den” is 0.5 sec). The figure shows that there are two finite verbs in the first line (“war”: VAFİN and “rückte”: VVFİN), but no finite verb in the second line of the poem. This indicates that the sentence is not finished in the first line but ‘runs on’ into the second line. Figure 3 shows the analysis of the first two lines (“Gib her, ein Blättchen, Tabak, den Filter, nie” \ “hört die Nachkriegszeit auf. Der Tau, die Kälte am Morgen, ...”) (english: Give me a leaflet, tobacco, the filter, the \ post-war era never ends. The dew, the cold in the morning, ...) from the poem “Im Rheinland. An der Oder” (english: In the Rhineland. At the Oder) of the Jürgen Becker. It is a good example for the *unemphasized enjambment*: There is no pause between the end of the first line and the start of the second line, which means no gap between the words “nie” and “hört”, although the sentence runs over from one line to the next.

For the automatic classification of both types of enjambment (emphasized & unemphasized), we need to extract the corresponding features and to build models for every class. The main extracted features are based on pause length and parser information. Three feature vectors or sets are used:

- **Pause:** the feature vector consists of two pause features: pause length between the words in each individual line and the pause length at the end of each line.
- **Parser:** three features from the parser are used: number of lines (lines with text), number of lines with finite verbs, and number of lines with punctuation marks.
- **Pause & Parser:** the current feature vector includes the five features used in the previous feature vectors: pause length between words in each individual line, pause length at the end of each line, number of lines, number of lines with finite verbs, and number of lines with punctuation.

A series of classifiers are selected in order to determine the best suited classifier for the evaluation. The following machine learning algorithms with default values using the Weka data mining toolkit [23] are applied for the recognition of *emphasized enjambment* and *unemphasized enjambment*:

- **IBk:** the Instance-Based (IB) classifier with a number of (k) neighbors is the K-nearest neighbours (KNN) classifier using the euclidean distance and 1-nearest neighbour [24].

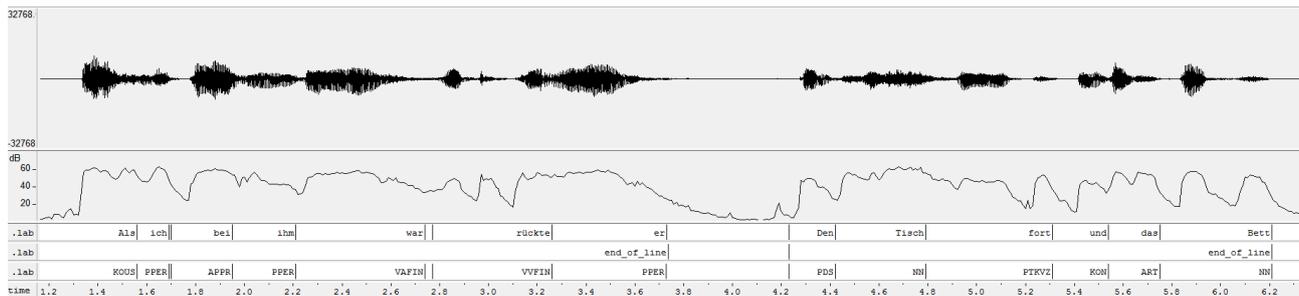


Figure 2: Analysis of the first two lines in the poem “ALS ICH BEI IHM WAR” as an example for the “emphasized enjambment”.

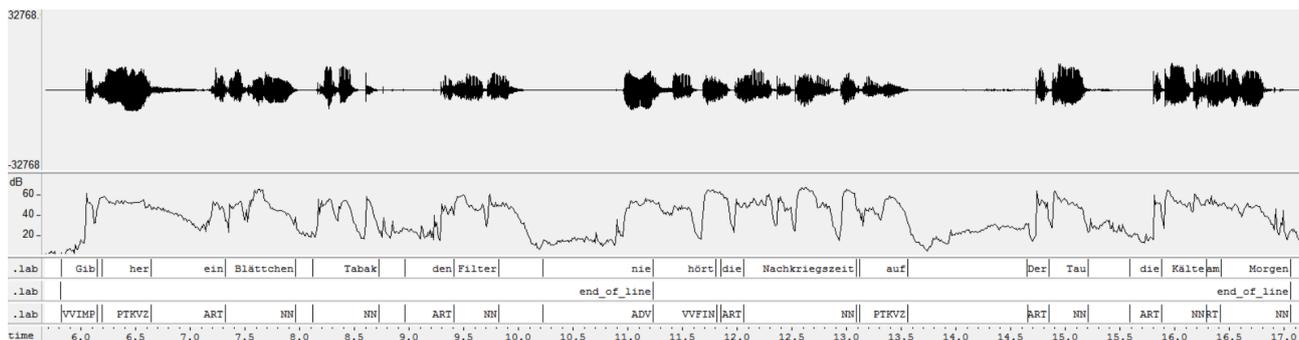


Figure 3: Analysis of the first two lines in the poem “Im Rheinland. An der Oder” as an example for the “unemphasized enjambment”.

- **LogitBoost**: The classifier performs additive logistic regression [25].
- **RandomForest**: a forest of random trees [26].

## 4. Results

We focused on poems readout in German, taken from 32 poets (12 from the former GDR, 17 from FRG, and 3 from Austria). We have a total of 69 poems: 33 using emphasized enjambments and 36 using unemphasized enjambments. 14 poets emphasize their enjambments (2 using also unemphasized enjambments), 9 of them came from the former GDR, 4 from FRG, and 1 from Austria. On the other hand, 20 poets do not emphasize their enjambments (again 2 also using emphasized enjambments), 4 of them came from the former GDR, 14 from FRG, and 2 from Austria. This means that 75% of the poets from the GDR emphasize their enjambments, which is far more compared to their ‘West German’ colleagues (23.5%).

The classification performance is measured using the F-measure which is the harmonic mean between precision and recall. Table 1 shows the classification results in a 10 fold cross-validation by applying three feature sets on three classifiers. It can be seen that the feature set (Pause) yielded better results than the other feature set (Parser) and (Pause & Parser). The best performance in the experiment is achieved by the IBk and LogitBoost classifier using the pause features with a F-measure of 0.69.

## 5. Conclusion and Future Work

We presented the first experiments on the classification of emphasized & unemphasized enjambment within the project *Rhythmicalizer* for the identification of *free verse prosody*. The database taken from our partner *lyrikline* contains a collection

Table 1: Experimental results obtained on the cross-validation by applying different feature sets and several classifiers.

Classifier \ Features	Pause	Parser	Pause & Parser
IBk	0.69	0.49	0.67
LogitBoost	0.69	0.60	0.54
RandomForest	0.64	0.50	0.63

of modern and postmodern readout poetry (text and audio data). In this corpus, we focused on poets using enjambments and differed between poems emphasizing and those not emphasizing the enjambment. We investigated different kinds of features based on text and audio data by using several classifiers. The best results are obtained by using the pause information with the KNN classifier.

We expect to get more examples for experiments during the next two years when analyzing the whole *lyrikline*-dataset. We also want to extend the automatic enjambment recognition with regards to the difference between soft and hard enjambments. In the long run, we will try to develop a software tool identifying all rhythmical patterns of the so-called *free verse prosody*. These further patterns are described in [27].

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