

From Once Upon a Time to Happily Ever After: Tracking Emotions in Novels and Fairy Tales

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Abstract

Today we have access to unprecedented amounts of literary texts. However, search still relies heavily on key words. In this paper, we show how sentiment analysis can be used in tandem with effective visualizations to quantify and track emotions in both individual books and across very large collections. We introduce the concept of emotion word density, and using the Brothers Grimm fairy tales as example, we show how collections of text can be organized for better search. Using the Google Books Corpus we show how to determine an entity's emotion associations from co-occurring words. Finally, we compare emotion words in fairy tales and novels, to show that fairy tales have a much wider range of emotion word densities than novels.

1 Introduction

Literary texts, such as novels, fairy tales, fables, romances, and epics have long been channels to convey emotions, both explicitly and implicitly. With widespread digitization of text, we now have easy access to unprecedented amounts of such literary texts. Project Gutenberg provides access to 34,000 books (Lebert, 2009).¹ Google is providing access to n-gram sequences and their frequencies from more than 5.2 million digitized books, as part of the *Google Books Corpus (GBC)* (Michel et al., 2011a).² However, techniques to automatically access and analyze these books still rely heavily on key

word searches alone. In this paper, we show how sentiment analysis can be used in tandem with effective visualizations to quantify and track emotions in both individual books and across very large collections. This serves many purposes, including:

1. *Search*: Allowing search based on emotions. For example, retrieving the darkest of the Brothers Grimm fairy tales, or finding snippets from the Sherlock Holmes series that build the highest sense of anticipation and suspense.
2. *Social Analysis*: Identifying how books have portrayed different people and entities over time. For example, what is the distribution of emotion words used in proximity to mentions of women, race, and homosexuals. (Similar to how Michel et al. (2011b) tracked fame by analyzing mentions in the Google Books Corpus.)
3. *Comparative analysis of literary works, genres, and writing styles*: For example, is the distribution of emotion words in fairy tales significantly different from that in novels? Do women authors use a different distribution of emotion words than their male counterparts? Did Hans C. Andersen use emotion words differently than Beatrix Potter?
4. *Summarization*: For example, automatically generating summaries that capture the different emotional states of the characters in a novel.
5. *Analyzing Persuasion Tactics*: Analyzing emotion words and their role in persuasion (Manix, 1992; Bales, 1997).

In this paper, we describe how we use a large word-emotion association lexicon (described in Section

¹Project Gutenberg: <http://www.gutenberg.org>

²GBC: <http://ngrams.googlelabs.com/datasets>

3.1) to create a simple emotion analyzer (Section 3.2). We present a number of visualizations that help track and analyze the use of emotion words in individual texts and across very large collections, which is especially useful in Applications 1, 2, and 3 described above (Section 4). We introduce the concept of emotion word density, and using the Brothers Grimm fairy tales as an example, we show how collections of text can be organized for better search (Section 5). Using the Google Books Corpus we show how to determine emotion associations portrayed in books towards different entities (Section 6). Finally, for the first time, we compare a collection of novels and a collection of fairy tales using an emotion lexicon to show that fairy tales have a much wider distribution of emotion word densities than novels.

The emotion analyzer recognizes words with positive polarity (expressing a favorable sentiment towards an entity), negative polarity (expressing an unfavorable sentiment towards an entity), and no polarity (neutral). It also associates words with joy, sadness, anger, fear, trust, disgust, surprise, anticipation, which are argued to be the eight basic and prototypical emotions (Plutchik, 1980).

This work is part of a broader project to provide an affect-based interface to Project Gutenberg. Given a search query, the goal is to provide users with relevant plots presented in this paper, as well as ability to search for text snippets from multiple texts that have high emotion word densities.

2 Related work

Over the last decade, there has been considerable work in sentiment analysis, especially in determining whether a term has a positive or negative polarity (Lehrer, 1974; Turney and Littman, 2003; Mohammad et al., 2009). There is also work in more sophisticated aspects of sentiment, for example, in detecting emotions such as anger, joy, sadness, fear, surprise, and disgust (Bellegarda, 2010; Mohammad and Turney, 2010; Alm et al., 2005; Alm et al., 2005). The technology is still developing and it can be unpredictable when dealing with short sentences, but it has been shown to be reliable when drawing conclusions from large amounts of text (Dodds and Danforth, 2010; Pang and Lee, 2008).

Automatic analysis of emotions in text has so far had to rely on small emotion lexicons. The WordNet Affect Lexicon (WAL) (Strapparava and Valitutti, 2004) has a few hundred words annotated with associations to a number of affect categories including the six Ekman emotions (joy, sadness, anger, fear, disgust, and surprise).³ General Inquirer (GI) (Stone et al., 1966) has 11,788 words labeled with 182 categories of word tags, including positive and negative polarity.⁴ We use the NRC Emotion Lexicon (Mohammad and Yang, 2011; Mohammad and Turney, 2010), a large set of human-provided word–emotion association ratings, in our experiments.⁵

Empirical assessment of emotions in literary texts has sometimes relied on human annotation of the texts, but this has restricted the number of texts analyzed. For example, Alm and Sproat (2005) annotated 22 Brothers Grimm fairy tales to show that fairy tales often began with a neutral sentence and ended with a happy sentence. Here we use out-of-context word–emotion associations and analyze individual texts to very large collections. We rely on information from many words to provide a strong enough signal to overcome individual errors due to out-of-context annotations.

3 Emotion Analysis

3.1 Emotion Lexicon

The NRC Emotion Lexicon was created by crowdsourcing to Amazon’s Mechanical Turk, and it is described in (Mohammad and Yang, 2011; Mohammad and Turney, 2010); we briefly summarize below.

The 1911 *Roget’s Thesaurus* was used as the source for target terms.⁶ Only those thesaurus words that occurred more than 120,000 times in the Google n-gram corpus were annotated for version 0.92 of the lexicon which we use for the experiments described in this paper.⁷

The *Roget’s Thesaurus* groups related words into about a thousand categories, which can be thought of

³WAL: <http://wndomains.fbk.eu/wnaffect.html>

⁴GI: <http://www.wjh.harvard.edu/~inquirer>

⁵Please send an e-mail to saif.mohammad@nrc-cnrc.gc.ca to obtain the latest version of the NRC Emotion Lexicon.

⁶Roget’s Thesaurus: www.gutenberg.org/ebooks/10681

⁷The Google N-gram Corpus is available through the Linguistic Data Consortium.

as coarse senses or concepts (Yarowsky, 1992). If a word is ambiguous, then it is listed in more than one category. Since a word may have different emotion associations when used in different senses, word-sense level annotations were obtained by first asking an automatically generated word-choice question pertaining to the target:

Q1. Which word is closest in meaning to *shark* (target)?

- *car* • *tree* • *fish* • *olive*

The near-synonym for Q1 is taken from the thesaurus, and the distractors are randomly chosen words. This question guides the annotator to the desired sense of the target word. It is followed by ten questions asking if the target is associated with positive sentiment, negative sentiment, anger, fear, joy, sadness, disgust, surprise, trust, and anticipation.

The questions were phrased exactly as described in Mohammad and Turney (2010).

If an annotator answers Q1 incorrectly, then information obtained from the remaining questions is discarded. Thus, even though there were no gold standard correct answers to the emotion association questions, likely incorrect annotations were filtered out. About 10% of the annotations were discarded because of an incorrect response to Q1.

Each term was annotated by 5 different people. For 74.4% of the instances, all five annotators agreed on whether a term is associated with a particular emotion or not. For 16.9% of the instances four out of five people agreed with each other. The information from multiple annotators for a particular term was combined by taking the majority vote. The lexicon has entries for about 24,200 word-sense pairs. The information from different senses of a word was combined by taking the union of all emotions associated with the different senses of the word. This resulted in a word-level emotion association lexicon for about 14,200 word types.

3.2 Text Analysis

Given a target text, the system determines which of the words exist in our emotion lexicon and calculates ratios such as the number of words associated with an emotion to the total number of emotion words in the text. This simple approach may not be reliable in determining if a particular sentence is expressing a certain emotion, but it is reliable in determining if a large piece of text has more emotional expressions

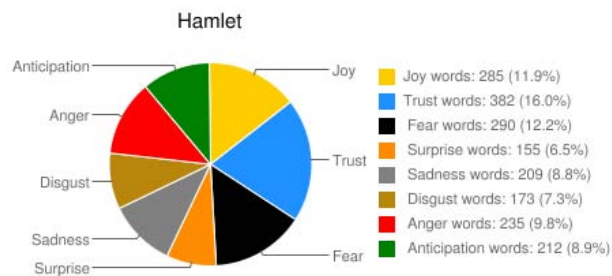


Figure 1: **Emotions pie chart** of Shakespeare's tragedy *Hamlet*. (Text from Project Gutenberg.)



Figure 2: **Emotions pie chart** of Shakespeare's comedy *As you like it*. (Text from Project Gutenberg.)

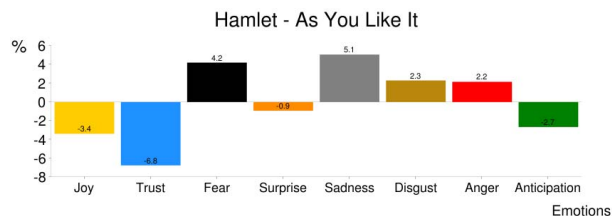


Figure 3: Difference in percentage scores for each of the eight basic emotions in *Hamlet* and *As you like it*.

compared to others in a corpus. Example applications include clustering literary texts based on the distributions of emotion words, analyzing gender-differences in email (Mohammad and Yang, 2011), and detecting spikes in anger words in close proximity to mentions of a target product in a twitter stream (Díaz and Ruz, 2002; Dubé and Maute, 1996).

4 Visualizations of Emotions

4.1 Distributions of Emotion Words

Figures 1 and 2 show the percentages of emotion words in Shakespeare's famous tragedy, *Hamlet*, and his comedy, *As you like it*, respectively. Figure 3 conveys the difference between the two novels even more explicitly by showing only the difference in percentage scores for each of the emotions. Emo-



Figure 4: *Hamlet - As You Like It*: relative-salience word cloud for trust words.



Figure 5: *Hamlet - As You Like It*: relative-salience word cloud for sadness words.

tions are represented by colours as per a study on word-colour associations (Mohammad, 2011).

Observe how one can clearly see that *Hamlet* has more fear, sadness, disgust, and anger, and less joy, trust, and anticipation. The bar graph is effective at conveying the extent to which an emotion is more prominent in one text than another, but it does not convey the source of these emotions. Therefore, we calculate the *relative salience* of an emotion word w across two target texts T_1 and T_2 :

$$\text{RelativeSalience}(w|T_1, T_2) = \frac{f_1}{N_1} - \frac{f_2}{N_2} \quad (1)$$

Where, f_1 and f_2 are the frequencies of w in T_1 and T_2 , respectively. N_1 and N_2 are the total number of word tokens in T_1 and T_2 . Figures 4 and 5 depict snippets of relative-salience word clouds of trust words and sadness words across *Hamlet* and *As You Like it*. Our emotion analyzer uses Google's freely available software to create word clouds.⁸

⁸Google word cloud: <http://visapi-gadgets.googlecode.com/svn/trunk/wordcloud/doc.html>

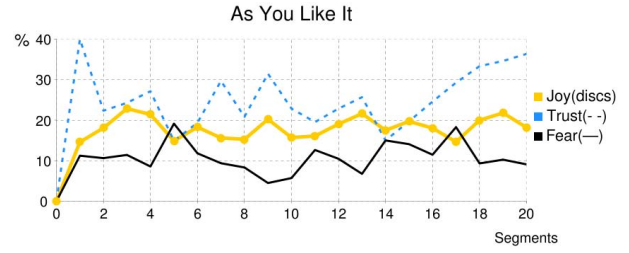


Figure 6: Timeline of the emotions in *As You Like It*.

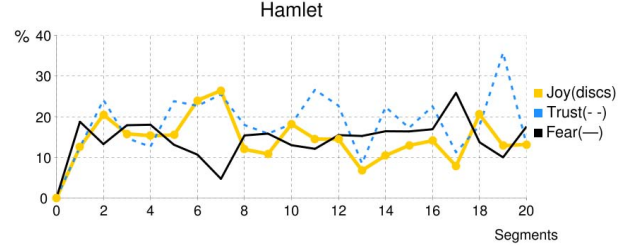


Figure 7: Timeline of the emotions in *Hamlet*.

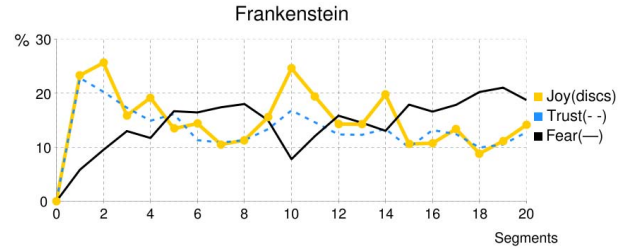


Figure 8: Timeline of the emotions in *Frankenstein*.

4.2 Flow of Emotions

Literary researchers as well as casual readers may be interested in noting how the use of emotion words has varied through the course of a book. Figure 6, 7, and 8 show the flow of joy, trust, and fear in *As You Like it* (comedy), *Hamlet* (tragedy), and *Frankenstein* (horror), respectively. As expected, the visualizations depict the novels to be progressively more dark than the previous ones in the list. Also that *Frankenstein* is much darker in the final chapters.

5 Emotion Word Density

Apart from determining the relative percentage of different words, the use of emotion words in a book can also be quantified by calculating the number of emotion words one is expected to see on reading every X words. We will refer to this metric as *emotion word density*. All emotion densities reported in this paper are for $X = 10,000$. The dotted line in Figure 9 shows the negative word density plot of 192 fairy tales collected by Brothers Grimm. The joy

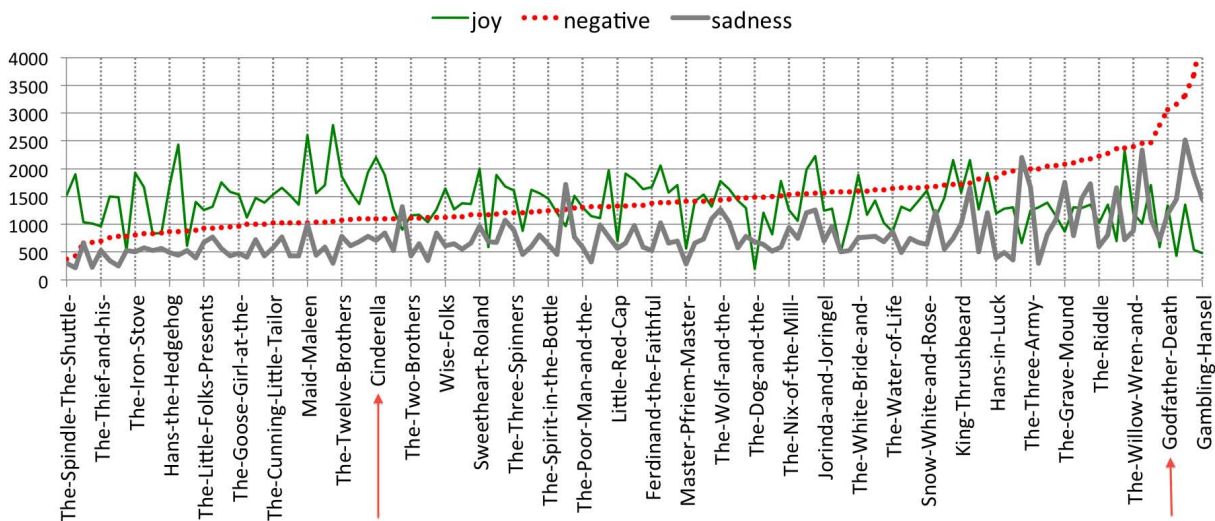


Figure 9: The Brothers Grimm fairy tales arranged in increasing order of negative word density (number of negative words in every 10,000 words). The plot is of 192 stories but the x-axis has labels for only a few due to lack of space. A user may select any two tales, say *Cinderella* and *Godfather Death* (follow arrows), to reveal Figure 10.

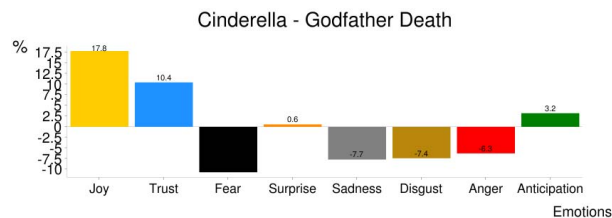


Figure 10: The difference in percentages of emotion words across *Cinderella* and *Godfather Death*.



Figure 11: *Cinderella - Godfather Death*: Relative salience word cloud of joy.

and sadness word densities are also shown—the thin and thick lines, respectively. A person interested in understanding the use of emotion words in the fairy tales collected by Brothers Grimm can further select any two fairy tales from the plot, to reveal a bar graph showing the difference in percentages of emotions in the two texts. Figure 10 shows the difference bar graph of *Cinderella* and *Godfather Death*. Figure 11 depicts the relative-salience word cloud of joy words across the two fairy tales. The relative-salience word cloud of fear included: *death*, *ill*, *be-ware*, *poverty*, *devil*, *astray*, *risk*, *illness*, *threaten-ing*, *horrified* and *revenge*.

6 Emotions Associated with Targets

Words found in proximity of target entities can be good indicators of emotions associated with the targets. Google has released n-gram frequency data from all the books they have scanned up to July 15, 2009.⁹ The data consists of 5-grams along with the number of times they were used in books published in every year from 1600 to 2009. We analyzed the 5-gram files (about 800GB of data) to quantify the emotions associated with different target entities. We ignored data from books published before 1800 as that period is less comprehensively covered by Google books. We chose to group the data into five-year bins, though other groupings are reasonable as well. Given a target entity of interest, the system identifies all 5-grams that contain the target word, identifies all the emotion words in those n-grams (other than the target word itself), and calculates percentages of emotion words.

Figure 12 shows the percentage of fear words in the n-grams of different countries. Observe, that there is a marked rise of fear words around World War I (1914–1918) for Germany, America, and China. There is a spike for China around 1900, likely due to the unrest leading up to the Boxer Rebellion (1898–1901).¹⁰ The 1810–1814 spike for

⁹Google books data: <http://ngrams.googlelabs.com/datasets>.

¹⁰http://en.wikipedia.org/wiki/Boxer_Rebellion

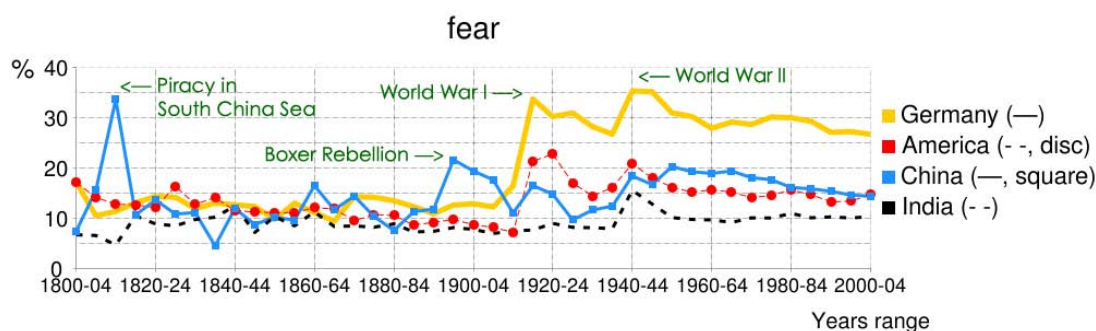


Figure 12: Percentage of **fear** words in close proximity to occurrences of *America*, *China*, *Germany*, and *India* in books from the year 1800 to 2004. Source: 5-gram data released by Google.

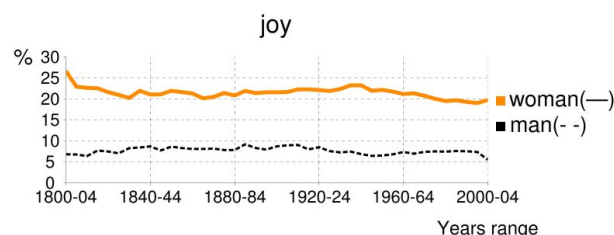


Figure 13: Percentage of **joy** words in close proximity to occurrences of *man* and *woman* in books.

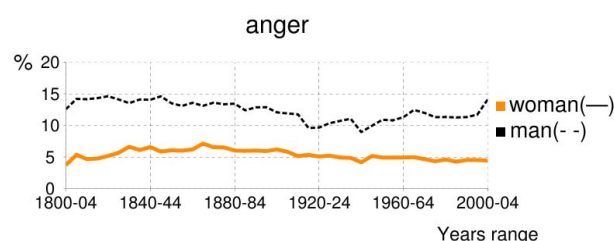


Figure 14: Percentage of **anger** words in close proximity to occurrences of *man* and *woman* in books.

China is probably correlated with descriptions of piracy in the South China Seas, since the era of the commoner-pirates of mid-Qing dynasty came to an end in 1810.¹¹ India does not see a spike during World War I, but has a spike in the 1940's probably reflecting heightened vigor in the independence struggle (Quit India Movement of 1942¹²) and growing involvement in World War II (1939–1945).¹³

Figures 13 shows two curves for the percentages of joy words in 5-grams that include *woman* and *man*, respectively. Figures 14 shows similar curves for anger words.

¹¹http://www.iias.nl/nl/36/IIAS_NL36_07.pdf

¹²http://en.wikipedia.org/wiki/Quit_India_Movement

¹³http://en.wikipedia.org/wiki/India_in_World_War_II

7 Emotion Words in Novels vs. Fairy Tales

Novels and fairy tales are two popular forms of literary prose. Both forms tell a story, but a fairy tale has certain distinct characteristics such as (a) archetypal characters (peasant, king) (b) clear identification of good and bad characters, (c) happy ending, (d) presence of magic and magical creatures, and (e) a clear moral (Jones, 2002). Fairy tales are extremely popular and appeal to audiences through emotions—they convey personal concerns, subliminal fears, wishes, and fantasies in an exaggerated manner (Kast, 1993; Jones, 2002; Orenstein, 2003). However, there have not been any large-scale empirical studies to compare affect in fairy tales and novels. Here for the first time, we compare the use of emotion-associated words in fairy tales and novels using a large lexicon.

Specifically, we are interested in determining whether: (1) fairy tales on average have a higher emotional density than novels, (2) different fairy tales focus on different emotions such that some fairy tales have high densities for certain emotion, whereas others have low emotional densities for those same emotions.

We used the Corpus of English Novels (CEN) and the Fairy Tale Corpus (FTC) for our experiments.¹⁴ The Corpus of English Novels is a collection of 292 novels written between 1881 and 1922 by 25 British and American novelists. It was compiled from Project Gutenberg at the Catholic University of Leuven by Hendrik de Smet. It consists of about 26 million words. The Fairy Tale Corpus (Lobo and Martins de Matos, 2010) has 453 stories, close to 1 million words, downloaded from Project Guten-

¹⁴CEN: <https://perswww.kuleuven.be/~u0044428/cen.htm>

FTC: https://www.l2f.inesc-id.pt/wiki/index.php/Fairy_tale_corpus

| | anger | | anticip. | | disgust | | fear | | joy | | sadness | | surprise | | trust | |
|-----|-------|----------|----------|----------|---------|----------|------|----------|------|----------|---------|----------|----------|----------|-------|----------|
| | mean | σ | mean | σ | mean | σ | mean | σ | mean | σ | mean | σ | mean | σ | mean | σ |
| CEN | 746 | 162 | 1230 | 126 | 591 | 135 | 975 | 225 | 1164 | 196 | 785 | 159 | 628 | 93 | 1473 | 190 |
| FTC | 749 | 393 | 1394 | 460 | 682 | 460 | 910 | 454 | 1417 | 467 | 814 | 443 | 680 | 325 | 1348 | 491 |

Table 1: Density of emotion words in novels and fairy tales: number of emotion words in every 10,000 words.

berg. Even though many fairy tales have a strong oral tradition, the stories in this collection were compiled, translated, or penned in the 19th century by the Brothers Grimm, Beatrix Potter, and Hans C. Andersen to name a few.

We calculated the polarity and emotion word density of each of the novels in CEN and each of the fairy tales in FTC. Table 1 lists the mean densities as well as standard deviation for each of the eight basic emotions in the two corpora. We find that the mean densities for anger and sadness across CEN and FTC are not significantly different. However, fairy tales have significantly higher anticipation, disgust, joy, and surprise densities when compared to novels ($p < 0.001$). On the other hand, they have significantly lower trust word density than novels. Further, the standard deviations for all eight emotions are significantly different across the two corpora ($p < 0.001$). The fairy tales, in general, have a much larger standard deviation than the novels. Thus for each of the 8 emotions, there are more fairy tales than novels having high emotion densities and there are more fairy tales than novels having low emotion densities.

Table 2 lists the mean densities as well as standard deviation for negative and positive polarity words in the two corpora. The table states, for example, that for every 10,000 words in the CEN, one can expect to see about 1670 negative words. We find that fairy tales, on average, have a significantly lower number of negative terms, and a significantly higher number of positive words ($p < 0.001$).

In order to obtain a better sense of the distribution of emotion densities, we generated histograms by counting all texts that had emotion densities between 0–99, 100–199, 200–399, and so on. A large standard deviation for fairy tales could be due to one of at least two reasons: (1) the histogram has a bimodal distribution—most of the fairy tales have extreme emotion densities (either much higher than that of the novels, or much smaller). (2) the histogram approaches a normal distribution such that

| | negative | | positive | |
|-----|----------|----------|----------|----------|
| | mean | σ | mean | σ |
| CEN | 1670 | 243 | 2602 | 278 |
| FTC | 1543 | 613 | 2808 | 726 |

Table 2: Density of polarity words in novels and fairy tales: number of polar words in every 10,000 words.

more fairy tales than novels have extreme emotion densities. Figures 15 through 20 show histograms comparing novels and fairy tales for positive and negative polarities, as well as for a few emotions. Observe that fairy tales do not have a bimodal distribution, and case (2) holds true.

8 Conclusions and Future Work

We presented an emotion analyzer that relies on the powerful word–emotion association lexicon. We presented a number of visualizations that help track and analyze the use of emotion words in individual texts and across very large collections. We introduced the concept of emotion word density, and using the Brothers Grimm fairy tales as an example, we showed how collections of text can be organized for better search. Using the Google Books Corpus we showed how to determine emotion associations portrayed in books towards different entities. Finally, for the first time, we compared a collection of novels and a collection of fairy tales using the emotion lexicon to show that fairy tales have a much wider distribution of emotion word densities than novels.

This work is part of a broader project to provide an affect-based interface to Project Gutenberg. Given a search query, the goal is to provide users with relevant plots presented in this paper. Further, they will be able to search for snippets from multiple texts that have strong emotion word densities.

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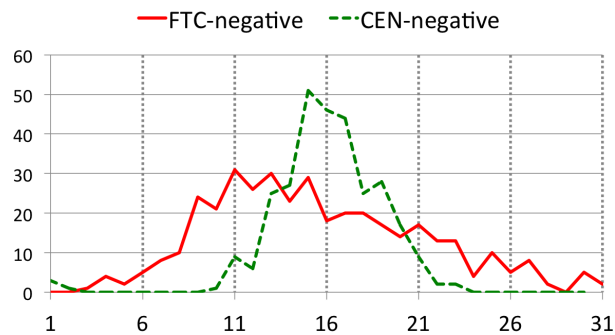


Figure 15: Histogram of texts with different negative word densities. On the x-axis: 1 refers to density between 0 and 100, 2 refers to 100 to 200, and so on.

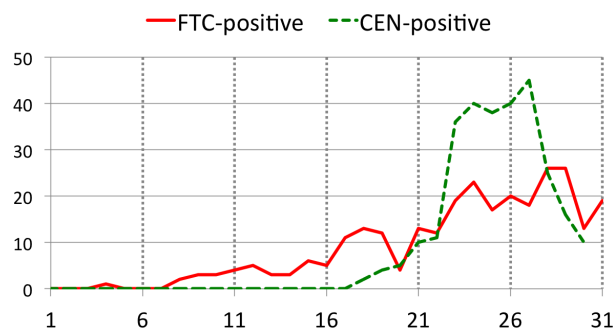


Figure 18: Histogram of texts with different positive word densities. On the x-axis: 1 refers to density between 0 and 100, 2 refers to 100 to 200, and so on.

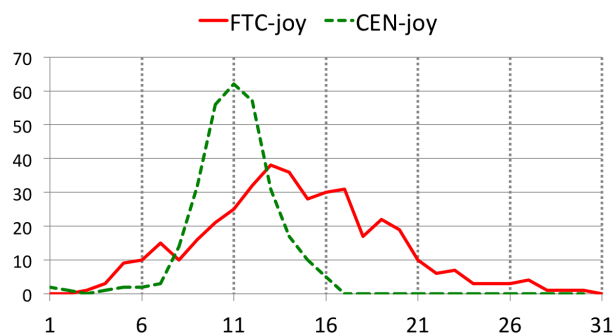


Figure 16: Histogram of texts with different joy word densities.

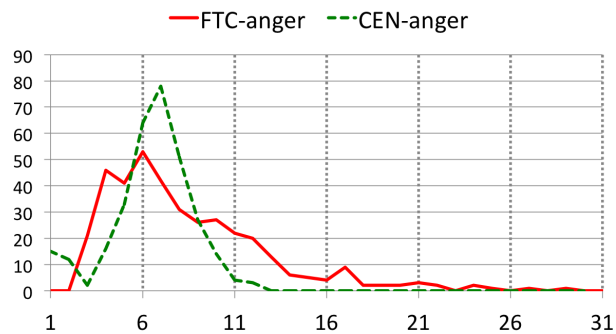


Figure 19: Histogram of texts with different anger word densities.

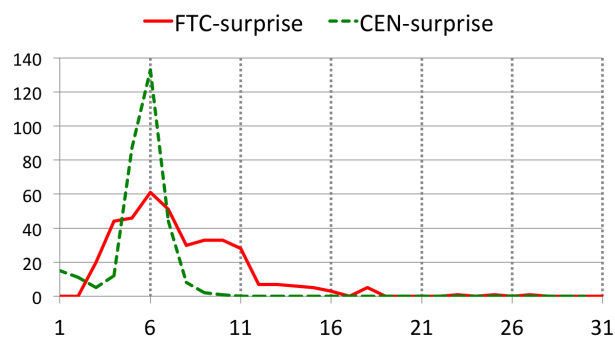


Figure 17: Histogram of texts with different surprise word densities.

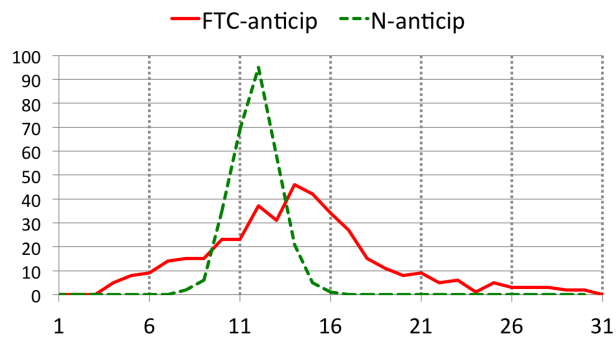


Figure 20: Histogram of texts with different anticipatory word densities.

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