Mining Emotions from the Finnish War Letter Collection, 1939–1944

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Abstract

Our paper analyses emotional language used by Finnish soldiers and civilians in their private communication during World War II. The dataset consists of 7,000 handwritten letters converted into a machine-readable corpus with rich metadata. The dataset offers a unique opportunity to make a statistical analysis of people's emotional responses to the war. We engage in key questions of the cultural history of war, such as the connection between soldiers' emotional language and violence: did soldiers' emotional language become more laconic in the course of the war?

While computational approaches to mining emotions have been common in fields like computer science and linguistics, they have not gained wider popularity in historical research. Pioneering attempts have been based on individual emotion words carefully chosen by an historian, or on readily available, more generic emotion lexicons. Compared to machine-learning solutions, lexicon-based approaches require less computational effort and are more transparent to interpret. Our methodology combines the ready-made word list FEIL with contextual knowledge of historians. FEIL gives around 7,000 Finnish words an emotion category and intensity ratings. First, the emotion lexicon was filtered based on high intensity. Then the domain expert manually removed words not particularly emotionally intensive in the context of war letters. The expert also annotated the list of the most frequent words in the war letter collection and handpicked emotionally intensive words not included in FEIL. Our final list covered 298 emotion words. We quantified changes in their use over time.

In contrast to earlier research, our analysis indicates that soldiers' and civilians' emotionality did not significantly differ during World War II. Soldiers' use of emotion words saw a decline in the last stages of the war, but overall their letters were almost as emotional as the civilians' letters. We did indeed identify some changes in the individual emotion words used by the soldiers in their letters: patriotic words in particular decreased in the course of the war. In addition to empirical findings, our paper sheds light on the problem of universal emotion lexicons in historical research: linguistic, cultural and temporal differences between present-day lexicons and historical datasets can lead to biased interpretations. Thus, our paper contributes not only to the history of emotions but also to emotion mining, which is historically sensitive.

Keywords

emotion mining, text mining, digital history, history of emotions, war letters

1. Introduction

In 2014, Peter Stearns published the first article in the history of emotions to use computational methods and large digital datasets. Stearns, utilizing simple word frequency counts in machine-readable data to analyse emotional changes related to children's obedience in the nineteenth century, was optimistic about computational advances in the field in the near future: "Even in this first attempt, I hope that the potential excitement of this new methodology will inspire additional work." [1] Almost ten years later, it is safe to say that the history of emotions has not witnessed any kind of "digital turn". The reasons for this may be multiple, including the shortage of computational skills among emotion historians, the absence of historically-aware methods in emotion mining research and the general difficulty of transforming nuanced concepts such as "emotions" into simple computations. However, it is noteworthy that in closely related fields, such as the history of concepts, computational approaches have become increasingly common during the last ten years [2]. Using Finnish war letters as a concrete case study, our article sheds new light on the possibilities of computational study of historical emotions.

Pioneering attempts to study the historical expression of emotions computationally have been based either on individual emotion words chosen by an historian [3], or on generic emotion lexicons readily available to historians [4]. The methods used by computer scientists for mining emotions can be roughly divided into lexicon-based and machine-learning approaches. Emotion lexicons list a set of emotions words, and can be constructed either manually or automatically from large corpora. Supervised machine learning depends on annotated training data: when the machine has "learned" enough human labelled examples of emotions in the text, it can predict emotions in the unseen textual datasets. The main benefit of machine-learning approaches lies in their flexibility: these models are not dependent on explicit words pre-defined by humans but can also use other features of language (e.g. syntactic information and word order) to classify emotions, or to determine whether a text contains emotions or not [5]. Compared to machine learning, lexicon-based approaches require less computational effort and are more transparent for historians to interpret [6].

In this article, we introduce a simple emotion lexicon constructed by two historians to better understand the emotionality of correspondence during World War II in Finland. We have three goals: (1) to study empirically how the emotional language changes in the private communication of Finnish soldiers and civilians in the period 1939–1944, (2) to pinpoint the prospects and pitfalls of emotion lexicons for historians, and (3) to present some preliminary observations on the relation between the history of emotions and computational approaches in general. Thus, our article contributes not only to the history of emotions but also to emotion mining, which is historically sensitive.

2. Data

Our dataset consists of 7,000 handwritten letters converted into a machine-readable corpus with rich metadata. The letters were written by ordinary Finnish people during World War II and stored in the Tampere University Folklife Archives through a public gathering in the 1970s. It has now been possible for a few years to convert handwritten messages into machine-readable text thanks to vast advances in Transkribus [7]. We have, however, digitized our dataset through a different path. The 7,000 letters used in this analysis were typed out in the 1980s by the archive workers and we digitized the letters from these papers using Adobe Acrobat OCR software. The quality of OCR in the dataset is around 94.4% (1,962,827 recognized tokens and 115,509 unrecognized tokens in all letters) [8]. In addition, we have manually compiled extensive information about the times and places in which the letters were written and about the senders, recipients and their personal relationships, which has been annotated as metadata [9].

These letters afford us an extraordinarily extensive view of the emotional lives of wartime people. Unlike in peacetime, when letters were mostly written by members of elites, in wartime they were scribbled by literally everyone. The war separated people and communities when the men left for battle, which compelled people, even those with little experience of writing, to turn to letters to keep in touch with their loved ones. This resulted in massive writing in Finland as well as elsewhere in the fighting world. The Finnish Army Field Post carried 1.1 billion deliveries in the period 1939–1945, which makes

this period the most intense time of private letter writing in Finnish history [10]. The prospect that wartime letters offer for historians has been obvious for several decades, as cultural historians have read them extensively hands-on to explore the lives of ordinary people in wartime [11]. The digitization of the letters opens up intriguing new opportunities to amplify the experiential and emotions histories of the period [12].

3. Method

During the last two decades computer scientists and linguists have created several lexicons for the computational mining of emotions. The lexicons often include thousands of words used in textual datasets to detect different emotions and their intensity. As noted by several creators of these lexicons, general resources have their limitations when in-depth knowledge on a specific domain is sought. In these instances, it is beneficial to create lexicons composed specifically to access the data of interest [13]. We as historians take the view that this insight is particularly important when examining sources written decades or even centuries ago. The fundamental premise in the history of emotions is that emotions are culturally constructed and change over time, and that our research is intended to reveal these time and place bound differences [14].

When designing the methodology for mining emotions from the war letters, we first explored the readily available resources. Specifically, we experimented with the FEIL and SELF emotion lexicons [15], which are based on the NRC Emotion Lexicon and Intensity Lexicon originally compiled in English [16]. The FEIL and SELF lexicons are currently the only available emotion lexicons for Finnish. Both lexicons classify words into eight emotion categories according to Robert Plutchik's core emotion theory. The main difference is that FEIL gives each word an emotional intensity value ranging from 0 to 1, while SELF rates words according to their negativity or positivity. From the perspective of the history of emotions, universal and stable emotion categories are extremely problematic because the entire field is based on the assumption that emotions change over time and vary across cultures. William Reddy, the pioneer in the history of emotions, suggested in the 1990s that verbal expressions of feelings directly change, build and intensify emotions [17]. The strong link between emotion concepts and emotions has also recently been highlighted in social neuroscience, most notably in the work of Lisa Feldman Barrett [18]. On the other hand, the categorization of words based on their emotional negativity and positivity, which can be useful in many real-life tasks, such as sorting out customer feedback, seemed too reductive to serve as a basis for any in-depth historical interpretations. Hence we did not exploit emotion categories or positive and negative values in our own research design.

Our aim was to study changes in the emotionality of war letters during World War II by combining an emotion word lexicon with word frequency count analysis. The FEIL lexicon seemed useful for this task, but the problem was that it contains many ordinary, emotionally low-intensive words such as "tree" (*puu*, indicating joy, 0.09 intensity value), "elbow" (*kyynärpää*, anger, 0.117) and "to swim" (*uida*, fear, 0.125). Thus, we first decided to use in our analysis only the high-intensity words in the lexicon (intensity score >0.6 according to the FEIL lexicon). The filtered list included 1,650 emotion words. The list gave provided a starting point for our lexicon, but as this was created for present-day needs, we found many ways to improve it for our historical data. The first obvious problem was related to the words describing war and its conduct. In general emotion lexicons like FEIL, words like "war" (*sota*, fear, 0.94), "gun" (*ase*, fear, 0.73) and "bomb" (*pommi*, anger, 0.77) receive very high intensity scores due to their apparent connection to catastrophic events. However, in the context of war, we take it for granted that there will be many mentions of war-related words. What we hope to find out is the emotional language used to refer to these events. This is one of the most prominent questions in the cultural history of war. Many scholars have argued that soldiers described their frontline experiences surprisingly laconically, even their most disturbing violent experiences, without any "big" emotional words [19]. The context of our data also needs to be taken into account in the case of more positive war-related words like *loma* ("holiday", "military leave"). As our letters were primarily written between close family members separated by the war, the prospect of soldiers' getting to home on leave was one of their most pervasive topics. We are less concerned with how frequently military leaves were

discussed in our sources than with the quantity and quality of emotion words occasioned by the idea of forthcoming leaves.

The second problem we identified was the words appearing to have too high intensity scores. The filtered list included very commonly used words like "to gain" (*saada*, anticipation, 0.66), "good" (*hyvä*, trust, 0.62) and "to start" (*alkaa*, anticipation, 0.75). The presence of these entirely unremarkable words in FEIL is partly due its categorization into eight basic emotions. For example, "gain" and "start" reportedly indicate "anticipation". Our analysis, however, is not intended to divide our sources into eight emotion categories but to find words that reliably indicate emotionality in the context of war, namely how living through the war was felt among the ordinary people. We are particularly interested in words signalling strong emotions such as fear, sadness, anger and, at times joy, words that may occur infrequently in writing but have a significant emotional meaning.

Third, it was also apparent that many emotionally loaded words that were frequent in our data and common in general were completely absent from the FEIL lexicon. One of the reasons for their absence was in the translation process. FEIL is based on the NRC Emotion Lexicon and translated into Finnish automatically by Google Translate [20]. There are important verbs such as "to love" (*rakastaa*), "to fear" (*pelätä*) and "to suffer" (*kärsiä*) that occur in the original NRC but have been lost in translation: English words have only been translated into Finnish nouns but not to corresponding Finnish verbs (e.g. "love" has been translated into the noun *rakkaus* but not into the verb *rakastaa*). There were moreover a few instances where the emotional intensity value did not reach our threshold (0.6) because the emotional connotation of the original English word, which had determined the intensity rating of word, was apparently much lower than that of the Finnish translation. These words included, for example, "badness" (*pahuus*), "despairing" (*epätoivoinen*) and "restless" (*levoton*).

Altogether, our greatest concern was, however, that there were simply a lot of words missing from the list which were important for expressing emotions in the war letters. One reason for this was that the FEIL lexicon is not meant to be a comprehensive list of emotion words; although consisting of thousands of words, it is still a sample which omits a lot of particularly less-used vocabulary [21]. However, we could also clearly see that the problem was in the linguistic, cultural and temporal differences between the lexicon and our data. The NRC lexicon, the basis of the FEIL lexicon, was built on the American culture of the 2000s, and hence did not include vast range of vocabulary that was emotionally important in the Finnish culture of the 1940s. In order to overcome these limitations, we created a new lexicon for our needs in two steps. First, a specialist on the Finnish war letters reviewed the filtered FEIL lexicon words (intensity score >0.6) occurring a minimum of ten times in our letter dataset and manually filtered words not having the high level of emotionality sought in our examination. Second, the domain expert went through a list of words occurring at least ten times in our letter data and handpicked emotionally intensive words not included in the original FEIL.

After making the changes mentioned above, our final list of emotion words had changed dramatically from its starting point: of the 394 words having an intensity value higher than 0.6 in the FEIL list and which occurred a minimum of ten times in the war letters, only 115 remained in the final list. On the other hand, the final list increased by 183 new words from the manual examination of the letter data. Thus, nearly two thirds of the words in our list are based on the historian's domain expertise. There are some notable differences between the lists. First, the number of nouns decreased in our list, while adjectives and verbs became more common. This shift possibly reflects our goal: to study *how* rather than *what* events were described. The majority of the nouns removed were those directly describing war and its conduct. Second, the words added were on average more rarely used than those removed. This observation could support our initial assumption regarding the relation between word frequency and emotionality: words used frequently in everyday lives seldom carry such emotional intensity as many of those rarer emotion words reserved for exceptional circumstances. The "rarity" of our added words also reflects the linguistic differences in emotional vocabulary between English and Finnish. Many of the added Finnish words carry strong emotional connotations in Finnish but do not have a simple translation in English. Cultural differences in emotional expressions are likewise apparent in the fact that we found from the letter data 55 words not included in the FEIL lexicon that refer explicitly to an emotion or experiencing an emotion in Finnish. Our lexicon is openly available online for further research [22].

4. Results

Next, we test our newly constructed lexicon on the computational analysis of the war letters. For the sake of comparison, we also conduct an identical analysis using the FEIL lexicon. We discuss the effects of our lexical modifications on the empirical results and connect our numerical findings to existing research on the emotional history of war. Our letter data offers a unique opportunity to conduct a statistical analysis of people's emotional responses to the war. We wanted to engage in one of the key questions of the cultural history of war: did the war crush the intensive "big words" bandied about at its outbreak and make soldiers laconic and unsentimental in their conduct during the continued violence? This question also involves the assumed differences between soldiers' and civilians' experiences of the war. According to the classical notion by Paul Fussell on the British culture of World War I, the war specifically changed the language of men in the trenches due to their encounters with traumatic experiences of violence. The people at home unaware of the crushing reality of warfare continued to describe it in traditional emotional terms [23].
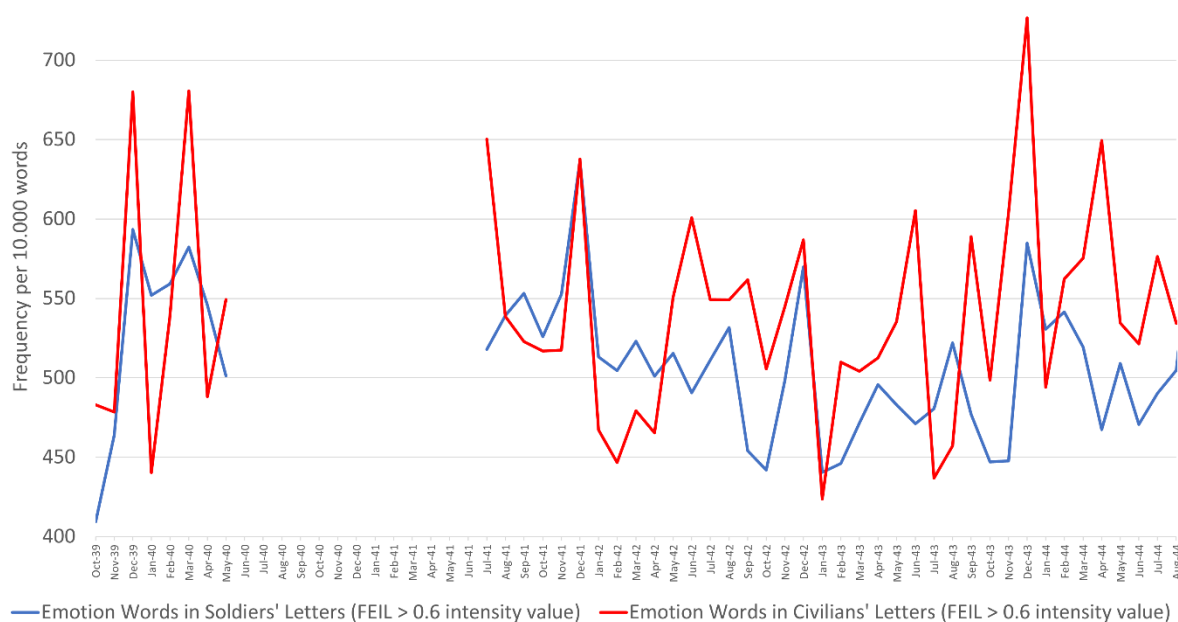

Figure 1: Emotion words in the Finnish War Letter Collection, October 1939–August 1944, based on the Finnish Emotion Intensity Lexicon.

To analyse these assumptions empirically, we quantified the monthly frequency of emotion words in the soldiers' and civilians' letters during the war years 1939–1944. Our analysis does not cover the period June 1940–June 1941 because hostilities ceased at this period due to the so-called Interim Peace between Finland and the Soviet Union, which meant that soldiers returned home and did not send great numbers of letters. Figure 1 shows the results based on the filtered FEIL lexicon (>0.6 intensity score). The results seem to offer some support for the notion that the emotionality of soldiers was lower than that of civilians. Although variation is quite strong especially in the civilians' line chart – a sign of limitations in our data that we soon discuss – the civilians on average use emotion words more frequently than the soldiers in 31 months of the total 46 months analysed. The difference is most notable in the latter part of the war, when there is a clear upward trend in the civilians' line, whereas the emotional words used by soldiers simultaneously show a slight decrease.

On the other hand, Figure 2, based on our updated lexicon, partly challenges this finding. In this chart, soldiers are equally or even more emotional writers until around the spring of 1943, when civilians surpass them. Thus, the greatest difference between our lexicon and FEIL is related to the total distribution of emotion words between civilians and soldiers: while the grand peak in civilians' emotion words in November and December 1943 can be found in both charts, in Figure 2 soldiers use emotion

words more frequently than civilians in 22 individual months out of 46. Our main result, and one that challenges the theory of unemotional soldiers, is that, according to our lexicon, soldiers are equally or even more emotional than civilians from the beginning of the war until around spring 1943.
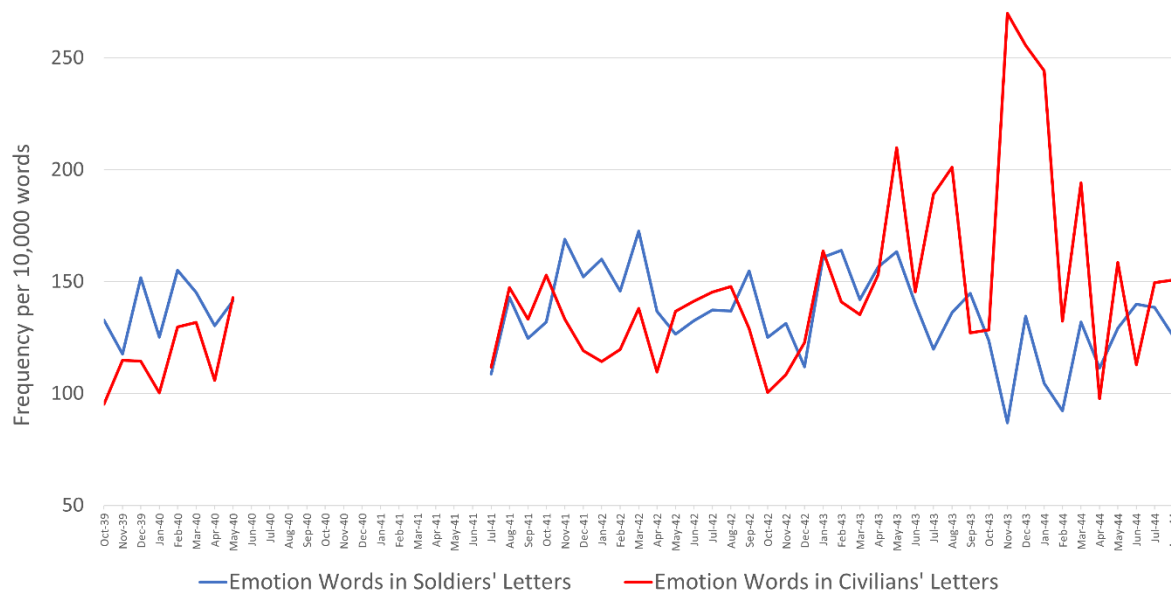

Figure 2: Emotion words in the Finnish War Letter Collection, October 1939–August 1944, based on the Finnish War Letter Emotion Lexicon.

Why does our lexicon portray soldiers as more emotional than does the FEIL lexicon? The explanation is likely that our lexicon contains more emotionally intensive, "manly" words than FEIL. As discussed before, even the high-intensity words (>0.6) in the FEIL lexicon include a great number of frequently used words that we did not consider especially emotional. We removed these and manually selected new ones from the letter data, causing the lexicon to include less used but emotionally more intensive vocabulary. It is probable that soldiers, and men in general, were in relative terms more prone to use our new words than were the women who were the writers of 93% of civilians' letters (1,971/2,124). Unlike the more commonly used, weaker emotion words removed from the FEIL lexicon, these extremely emotionally intensive words do not necessarily make men appear weak – the prime reason why men are typically thought to be unemotional – but may even exaggerate their manliness. For example, men have been shown to use words expressing anger, such as expletives, more than women [24].

Overall, the differences between soldiers' and civilians' emotionality are not as great in our data as we expected in light of earlier research. A probable reason for this is the context of our analysis, namely letter writing. The theory of a decline in emotional language among soldiers put forward in the classical accounts of the cultural history of war, claimed that the change took place specifically at the front among soldiers. Our letters, however, are for the most part communication between the battle front and the home front. It is likely that the Finnish soldiers likewise spoke very differently at the front than in their letters because people adjust their emotional behaviour according to different communication contexts. In this respect, it is natural that soldiers' and civilians' emotionality did not drastically differ in the war letters.

Despite the relative similarity of soldiers' and civilians' emotionality, it should be noted that a slight decreasing trend in soldiers' emotionality emerges in the latter part of the war. What is interesting in this change is that the normalized variation over time (standard deviation / mean) is greater according to our lexicon than in the FEIL lexicon [25]. This is likewise a result of the "densification" of our lexicon. As the FEIL lexicon includes words used regularly in the course of daily lives whatever the situation, the changes in their use are subtle. Our lexicon contains stronger words reserved for serious emotional events and, thus, portrays more clearly the occasions when people speak "emotionally", in manners that are outside the practices of daily behavior. Furthermore, we stress that relying solely on

the overall frequency of emotional vocabulary, as we did in this analysis, has obvious limitations in the study of wartime changes in emotionality. For example, on scrutinizing the changes in the use of individual words, we could identify lexical shifts within the emotional language used by the soldiers in their letters. Comparing the emotional words in the first eight months of the war against those in the last eight months (Table 1), shows that emotional words connected to patriotic discourse such as "fatherland" (*isänmaa*), "victory" (*voitto*), and "to sacrifice" (*uhrata*) seem to disappear almost completely (used less than once in 10,000 words) from soldiers' letters during the war. In addition, several words used in personal emotional communication such as "longing / sad" (*ikävä*), "worry" (*huoli*), "to miss" (*kaivata*) decrease significantly, but unlike patriotic words, they are not in danger of total extinction.

Table 1
Top 15 emotion words used less frequently in soldiers' letters during the last eight months of the war compared to the first eight months.

Word	Translation	Hits per 10,000 words Oct 1939 – May 1940	Hits per 10,000 words Jan 1944 – Aug 1944	Absolute difference
IKÄVÄ	longing, sad	12.7	4.7	-8.0
HUOLI	worry	5.6	1.4	-4.2
ISÄNMAA	fatherland	4.4	0.4	-4.0
ILOINEN	happy, glad	5.0	1.6	-3.4
ILO	joy	4.6	2.2	-2.4
KAIVATA	to miss, to long for	3.8	1.6	-2.2
HARTAASTI	sincerely	2.3	0.3	-2.0
RAKKAUS	love	2.3	0.4	-1.9
SURRA	to mourn, to grieve	2.1	0.6	-1.5
ONNELLINEN	happy	2.5	1.1	-1.4
KOHTALO	destiny	3.2	1.9	-1.3
VOITTO	victory	1.8	0.5	-1.3
PELÄTÄ	to be afraid of	2.2	1.0	-1.2
UHRATA	to sacrifice	1.2	0.1	-1.1
SIUNAUS	blessing	1.7	0.6	-1.1

Our brief experiments using a manually constructed lexicon revealed some limitations in our data. More detailed analysis of the grand peak in Figures 1 and 2 served to reveal the most important area for further research. The main reason for civilians' increased use of emotion words at the end of 1943 lies not in the dramatic change in the general mood of the Finnish civilians but in the increased emotionality of two different couples. More specifically, this peak is caused by two female civilians writing to their loved ones, one girlfriend (Hilkka, surname unknown) and one wife (Orvokki Höglund), both of whom simultaneously use extremely emotional language in their letters from November 1943 until January 1944 [26]. The peak illustrates a problem in the current composition of our war letter dataset: the smaller number of civilians' letters means that their letter data is more sensitive to the impact of individual outliers. The simple observation leads to two important insights. First, since our war letter corpus currently contains fewer letters from civilians than from soldiers, we need more letters from civilians to obtain more reliable results. In fact, we are currently digitizing more war letters with Transkribus, and special attention needs to be paid to the balanced overall structure of the corpus. Second, it seems that the most important distinction in war letter writing is not necessarily that between civilians and soldiers. Rather, the quality of relationships seems to play a crucial role: a letter between lovers, or from a worried mother to a son, or between brothers-in-arms in the trenches could have a very different profile in terms of emotional vocabulary. This contextual variation disappears when we divide our war letter collection into the simple categories of "letters by soldiers" and "letters by civilians". In this study, we could not measure the impact of relationship on the use of emotion words – for example, if the soldiers hid their negative emotions in their letters to family –, but since the exact nature of the relationship is described in our metadata, we will exploit this information in the near future.

5. Conclusions

Our small but direct contribution to the emotional history of war is that, based on a simple computational analysis, soldiers' and civilians' emotionality does not appear to be very different in letters during World War II. Soldiers' use of emotion words saw a decline in the final stages of the war, but overall their letters were almost as emotional as the civilians' letters. We could identify some changes when we analysed individual words: occurrences of patriotic emotion words decreased and almost vanished in the course of the war. In addition, even our brief analysis seems to suggest that soldiers and civilians expressed their emotions differently to different people, meaning that every argument on historical emotions must take into account their contextual variation. There is no universal soldier nor civilian behaving in a similar fashion in each communication situation.

This insight inspires us to reflect on the role of lexicons in the history of emotions. One of the core ideas in the field is that the ways in which people express their emotions through language change over time. The importance of contextual factors seems to favour manually compiled lexicons. In this paper, we used a short but carefully constructed list to measure the numbers of emotional expressions in private communication in time of war. Our modifications changed the results in a few notable ways: our list put greater value on soldiers' (male) emotionality and made the shifts in emotionality over time slightly clearer. Although the modified lexicon had benefits for our research interests, we also note that the results based on the FEIL lexicon were not essentially worse: they merely reflect a different type of emotionality, one that highlights more everyday expressions of emotions in the present-day context. We do not know the ground truth against which to compare our results, but in general, we are confident that extracting emotions from historical sources requires that historians use their expertise on the cultures of the past to prepare more accurate semantic resources for mining.

In historical research, understanding one's methodology thoroughly from building resources to data analysis and to interpretation is crucial. As our case study shows, there were many aspects in our results that could be explained only through in-depth knowledge of our lexicons. This itself is a prime reason for historians to modify their lexicons: creating one's own lexicon renders mastery over tools imperative. Of course, depending on the ultimate goal, universal emotion lexicons have their advantages. For example, to maximize recall (the number of emotional expressions found in historical datasets), large-scale lexicons might outperform manual lists in the quantity of findings but at the expense of quality. The primary goal in historical research is rarely to find all the instances connected to the historical phenomenon under investigation. More often, we are interested in how the phenomenon changes over time.

Finally, we should concede the limitations of our paper. First, we used our war emotion lexicon only to count relative frequencies over time, leaving more sophisticated methods, such as comparing the semantic similarities and differences between soldiers' and civilians' emotion words, to future research. Second, we did not intervene in the world of machine-learning methods, which are currently the state-of-the-art in sentiment analysis and emotion detection tasks. Context matters: hence attaching fixed values to emotion words in emotion lexicons is problematic. An emotion word such as "dear" carries more weight in the middle of the text than in a form of address. Similarly, when a person who does not usually swear uses an expletive, the emotional intensity should be higher than in the case of a habitual swearer. Machine-learning models could at least theoretically be taught to understand the context in which the word is used. The main problem with machine-learning approaches for historians of emotions is their mathematical complexity and, thus, lack of transparency: it is difficult to make solid historical interpretations without understanding the inner workings of machine-learning algorithms. Note that, in contrast to the historical interpretation of emotions, transparency is not a problem when the task at hand is purely practical: when the machine reads handwritten war letters and tries to predict correct words, it is not necessary for an historian to understand *why* the results are correct, if only the words are read correctly.

In his pioneering article, Peter Stearns compared introducing computational data mining for historians of emotions to trying to teach old dogs new tricks [27], but for the evolution of any scholarly field learning and adaptation are indispensable, however laborious.. The reality a decade after the article is that scientists with a strong background in statistical analysis but no expertise in the history of emotions are presenting widely-publicized studies of emotions in the past [28], studies that could be

easily enriched by knowing the basics of the history of emotions. The question is this: do historians want to leave the computational study of historical emotions to other fields to handle? For us, it seems more sensible that historians contribute to developing methods that understand historical sources and their contextual underpinnings.

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