Estimating the Emotion of Disgust in Greek Parliament Records

Anonymous ACL submission

Abstract

We present an analysis of the sentiment in Greek political speech, by focusing on the most frequently occurring emotion in electoral data, the emotion of 'disgust'. We show that emotion classification is generally tough, but high accuracy can be achieved for that particular emotion. Using our best-performing model to classify political records of the Greek Parliament Corpus from 1989 to 2020, we studied the points in time when this emotion was frequently occurring and we ranked the Greek political parties based on their estimated score. We then devised an algorithm to investigate the emotional context shift of words that describe specific conditions and that can be used to stigmatise. Given that early detection of such word usage is essential for policy-making, we report two words we found being increasingly used in a negative emotional context, and one that is likely to be carrying stigma, in the studied parliamentary records. We release our data and code.

1 Introduction

Detecting the emotion of a text involves its classification based on specific emotion categories. The emotion categories are often defined by a psychological model (Oberländer and Klinger, 2018) and the field is considered a branch of sentiment analysis (Acheampong et al., 2020). Classifying a text as negative or positive may be a simpler task, but this coarse level of aggregation is not useful in tasks that require a subtle understanding of emotion expression (Demszky et al., 2020). As described by Seyeditabari et al. (2018), for example, although 'fear' and 'anger' express a negative sentiment, the former leans towards a pessimistic view (passive) while the latter with a more optimistic one that can lead to action. This has made the detection of emotions preferred over sentiment analysis for a variety of tasks (Bagozzi et al., 1999; Brave and Nass, 2002; Kabir and Madria, 2021), including political science (Ahmad et al., 2020).

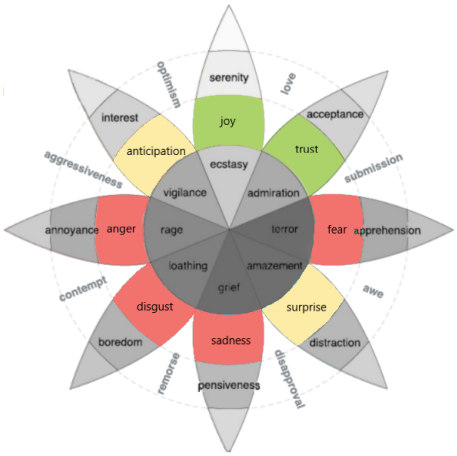

Figure 1: Plutchik's Wheel of emotions colored based on our sentiment aggregation. Green colour corresponds to positive sentiment, red to negative sentiment, and yellow to emotions that we didn't include in the aggregation.

Most studies in emotion detection concern resource-rich languages while only a few concern under-represented languages (Ahmad et al., 2020). We developed and publicly release a Greek dataset for emotion classification, by using the eight primary emotions (Figure 1) from Plutchik's Wheel (Plutchik, 1980). Following similar studies for resource-lean languages (Ranasinghe and Zampieri, 2021; Das et al., 2021; Alexandridis et al., 2021), we used this dataset to fine-tune and assess multilingual and monolingual Large Language Models (LLMs) for emotion classification. Although these benchmarks achieve low to average results for most of the studied emotions, the performance for DISGUST is much higher and comparable to the performance of sentiment and subjectivity classification when we aggregate the emotions accordingly. This finding allowed us to proceed to the primary research goal of this study, which is described next.

We annotated the records of the Greek Parliament Corpus (Dritsa et al., 2022) from 1989 to 2020, using our best-performing classifier, for the

emotion of DISGUST, which is the most frequently occurring emotion in electoral data (Mohammad et al., 2015). Disgust is defined as a marked aversion aroused by something highly distasteful, [1] and one can distinguish moral from physical disgust (Chapman and Anderson, 2012). In this work, we consider disgust as a strong emotional reaction of aversion triggered by a repulsive or offensive speech, often accompanied by feelings of discomfort and a desire to distance oneself from the source of the feeling. Based on our classifier's predictions, we studied the points in time when this emotion occurred most frequently. Also, we ranked the Greek political parties based on their detected score. Then, we investigated the emotional context shift, focusing on words that describe specific conditions and which can be used to stigmatise (e.g., handicapped, crazy, disabled). Our analysis shows that the words we targeted are being increasingly used in an emotional context related to DISGUST in the studied parliamentary records.

This study presents a new dataset of 3,194 Greek tweets classified for emotion, plus 7,753 used for augmentation. Despite its limited size, this is a publicly available dataset for emotion detection that can facilitate the development (e.g., by controlled crowd sourcing) of larger datasets. We fine-tune and assess LLMs on our resources, presenting the results per emotion (and by aggregating at the sentiment and subjectivity level), showing that the classification of DISGUST is promising. Based on this result, we devised an algorithm that can capture the evolution of this emotion given a selected target term, as in euphemism trendmill (Felt and Riloff, 2020) but applied to political speech, where a word associated with negative reactions can influence political attitudes (Utych, 2018).

2 Related work

Emotion classification is an NLP task with various use cases (Oberländer and Klinger, 2018; Acheampong et al., 2020; Demszky et al., 2020; Seyeditabari et al., 2018; Sailunaz et al., 2018; Gaind, 2019).[2] Early enough, Transformers (Vaswani et al., 2017) were employed for the task Kant et al. (2018), showing the benefits of transfer learning (Mohammad et al., 2018). Unfortunately, although datasets exist in English (Desai et al., 2020), there is a lack in other, especially resource-lean languages. Ahmad et al. (2020) detected emotion in Hindi by transferring learning from English, capturing relevant information through the shared embedding space of the two languages. A similar path was followed by Tela et al. (2020), who fine-tuned the English XLNet (Yang et al., 2019) on (10k samples of) the Tigrinya language. The same strategy has been assessed for other NLP tasks, such as name entity recognition and topic classification (Hedderich et al., 2020),[3] while in the related task of offensive language detection, Ranasinghe and Zampieri (2020) experimented with transfer learning across three languages (not Greek), showing the benefits of the multilingual BERT-based XLM-R (Conneau et al., 2019). XLM-R outperforms various machine/deep learning and Transformer-based approaches in emotion classification Das et al. (2021) while Kumar and Kumar (2021) showed that in zero-shot transfer learning from English to Indian it compares favourably to the state-of-the-art.

Emotion detection for the Greek language

A few published studies have focused on sentiment analysis in Greek (Markopoulos et al., 2015; Athanasiou and Maragoudakis, 2017; Tsakalidis et al., 2018), yet limited published work concerns emotion detection, probably due to the lack of publicly available resources. Fortunate exceptions include the work of Krommyda et al. (2020) and the work of Palogiannidi et al. (2016). The former study suggested the use of emojis in order to assign emotions to a text, but they didn't share their dataset, and this approach is expected to work only with emoji-rich corpora. The latter study created an affective lexicon, which can lead to efficient solutions, but is not useful to fine-tune pre-trained algorithms, such as the ones discussed above. Alexandridis et al. (2021) was the first to experiment with two BERT-based models, trained on a Greek emotion dataset, which is not publicly available. Upon communication with one of the authors, part of their data is included in our dataset. Another exception is the work of Kalamatianos et al. (2015), who was the first to publish an emo-

[1] https://www.merriam-webster.com/dictionary/disgust

[2] An earlier review of the field can be found in the work of Mohammad (2016).

[3] We also point the interested reader to the work of Pires et al. (2019), who indicated that transfer is possible to languages in different scripts (yet, better performance is achieved when the languages are typologically similar) and to that of Lauscher et al. (2020), who studied the effectiveness of cross-lingual transfer for distant languages through multilingual Transformers.

tion dataset in Greek but their study comes with two major limitations. First, inter-annotator agreement was not reported using a chance-corrected measure, making the results less reliable. Second, the lack of emotion (neutral category) is disregarded, but this is the major class in domains such as politics, making the results of their inter-annotator agreement even less reliable. We release our dataset to promote further research in the field.[4]

Emotion and Political NLP

Existing sentiment and emotion analysis research in political contexts lacks emphasis on Greek political NLP (Papantoniou and Tzitzikas, 2020), particularly in estimating the emotion of disgust. Sentiment and emotion analysis has been applied to parliamentary speeches (Valentim and Widmann, 2023), party manifestos (Koljonen et al., 2022; Crabtree et al., 2020) and to predict political affiliation (Hjorth et al., 2015) or emotive rhetoric (Kosmidis et al., 2019). These studies do not directly address Greek parliamentary records and they are based on simplistic lexicon-based models, which makes it difficult to distinguish when a word is used neutrally or emotively (Koljonen et al., 2022). Our work is different, because we employ emotion classification to detect alarmingly negative usage of words that can be used to stigmatise. This is similar to the detection of euphemism and dysphemism (Felt and Riloff, 2020), but applied to political speech, where a word associated with negative reactions can influence political attitudes (Utych, 2018).

3 Dataset development

This section presents our new dataset, comprising tweets annotated regarding the emotion of the author.[5] We discuss this dataset in subsets used in our experiments, first focusing on the evaluation subset (PALO.ES), then training (PALO.GR), and last regarding secondary sources, such as data for augmentation (ART) and data used to fine-tune LLMs first in English with neutral tweets.[6]

[4] anonymised.link

[5] We did not opt for sentences extracted from political records, because these are less frequently emotional, as opposed to tweets. Our primary motivation for excluding this source was the optimisation of the annotation process, avoiding the annotation of non-target texts.

[6] This only served to adjust to a setting where the majority of tweets is characterised by lack of emotion.

Class	Emotions
ANGER	anger, annoyance, rage
ANTICIPATION	anticipation, interest, vigilance
DISGUST	disgust, disinterest, dislike, loathing
FEAR	fear, apprehension, anxiety, terror
JOY	joy, serenity, ecstasy
SADNESS	sadness, pensiveness, grief
SURPRISE	surprise, distraction, amazement
TRUST	trust, acceptance, liking, admiration
OTHER	sarcasm, irony, or other emotion
NONE	no emotion

Table 1: Emotion classes and their respective emotions.

3.1 PALO.ES

This subset comprises Greek tweets provided by *Palo Services*,[7] each annotated by two professional annotators employed by the company. Each tweet was annotated regarding ten emotion classes, presented in Table 1.[8] As a first step, we shared a small sample of one hundred tweets to estimate inter-annotator agreement, providing no specific instructions. Cohen's Kappa was found to be as low as 0.29. The agreement increased, however, with the following two additional annotation rounds.

The first annotation round was performed by providing the annotators with the guidelines suggested by Mohammad et al. (2018), asking two questions per tweet. The first question was: *Which of the following options best describes the emotional state of the tweeter?*, seeking for the primary emotion of the respective tweet. The second question was: *Which of the following options further describes the emotional state of the tweeter? Select all that apply.*, now allowing more than one emotions to be assigned. Tweets were provided to the annotators as examples per emotion (Appendix A, Table 6). Cohen's Kappa improved to 0.36 for the primary emotions while Fleiss Kappa (Fleiss and Cohen, 1973) was found to be 0.26 for the multi-label annotation setting, which is still low.

The second round followed a manual investigation of the annotations, which revealed that disagreement was often on tweets comprising news or announcements. Attempting to alleviate a possible misunderstanding, we updated the annotation guidelines so that the annotators were guided to classify tweets with news or announcements to the NONE class (more details in Appendix A, Table 7).

The final annotation experiment was performed by following the updated guideline and by provid-

[7] http://www.paloservices.com/

[8] Annotated samples are provided in Appendix A.

	ANGER	ANTIC.	DISGUST	FEAR	JOY	SADNESS	SURPRISE	TRUST	NONE	TOTAL
SE.EN	**37.0**	**14.3**	**37.8**	**17.6**	**37.2**	**29.4**	5.1	5.2	2.8	7,724
SE+	33.6	12.9	34.3	16.0	33.8	26.7	4.6	4.7	11.9	8,519
ART	12.9	12.9	12.9	12.9	12.9	12.9	**10.9**	11.7	12.9	7,753
PALO.GR	9.8	9.8	24.2	0.7	16.2	1.5	6.2	**21.6**	46.2	2,408
PALO.ES	10.8	2.8	31.7	0.5	1.8	0.6	1.4	2.2	**60.6**	786

Table 2: The relative frequency per emotion (columns 1-8), or their absence (column 9), along with the total number of tweets (last column) per dataset. In bold are the highest values per class.

ing both annotators with the same batch of 999 tweets and filtering out tweets that the annotators disagreed on. Cohen's Kappa improved to 0.51 (+15) and Fleiss Kappa improved to 0.44 (+18). We kept 786 out of 999 tweets that annotators agreed on at least one emotion, rejecting 146 tweets with no agreement and 68 tweets labelled with the emotion OTHER. Due to its size and guaranteed quality, we employ PALO.ES only for evaluation purposes. We note that although the established agreement is high enough for such a subjective task,[9] we chose to use our models only on specific emotions that we trust (see Section 5).

3.2 The PALO.GR training subset

PALO.GR follows the same annotation process as PALO.ES, but each professional annotator was now given 1,000 different tweets. Out of the 2,000 annotated tweets, we excluded 135 (6.8%) that were labelled as OTHER, leaving 1,865 tweets in total. In order to augment the under-represented positive emotion classes (e.g., JOY, SURPRISE, TRUST), we provided our annotators with 543 more tweets, which had been classified as positive by the company. This led to a total of 2,408 tweets.

3.3 Employing secondary sources

Augmentation was facilitated with Greek tweets retrieved for several emotions (we will refer to this sample as ART).[10] To do so, we used target words that could have been selected by users under specific emotional states. For example, in order to collect tweets related to JOY, we searched for tweets that contain words such as *'χαίρομαι'* (*'I am happy'*). The exact words used to retrieve tweets per emotion are presented in Appendix A (Table 8).

Using an existing English dataset can assist as a prior step, by fine-tuning multilingual LLMs in emotion detection in English, before moving to a resource-lean language, such as Greek. Mohammad et al. (2018) introduced such a dataset for the '1st SemEval E-c Task', a multi-dimensional emotion detection dataset,[11] which can be used to fine-tune (multilingual or monolingual) LLMs in emotion classification in English. We will refer to this dataset as SE.EN. The task of the challenge was defined as: *"Given a tweet, classify it as 'neutral or no emotion' or as one, or more, of eleven given emotions that best represent the mental state of the tweeter"*. The dataset comprised 7,724 tweets with binary labels for each of the eight categories of Plutchik (1980): ANGER, FEAR, SADNESS, DISGUST, SURPRISE, ANTICIPATION, TRUST, and JOY, which were expanded with OPTIMISM, PESSIMISM, LOVE, and with NONE for the neutral tweets. These categories are not mutually exclusive, i.e., a tweet may belong to one or more categories (Appendix A).

Better representing the neutral class was done in a final step of this dataset development process. There were 218 (2.8%) neutral SE.EN (training and development) tweets, which means that it is assumed that most often tweets do comprise emotions. Although this may be simply due to the sampling of the data, we find that this assumption is weak. Depending on the domain, most often it is the lack of emotion that characterises a tweet, since it often comprises news, updates or announcements. Based on this observation, and in order to better represent the neutral class, we enriched SE.EN with 795 neutral tweets that were taken from the timeline of the British newspaper *'The Telegraph'*,[12] provided by the online community Kaggle.[13] We dub this extended dataset SE+.[14]

3.4 The class distribution

The class support of all the datasets is presented in Table 2. SE+ has the highest total support and the highest percentage of the categories ANGER, ANTICIPATION, DISGUST, FEAR, JOY and SADNESS com-

[9] Low levels of inter-annotator agreement is a well-known problem in emotion/sentiment/subjectivity studies, where lower agreement scores are reported (Tsakalidis et al., 2018).

[10] We used: https://www.tweepy.org/.

[11] https://competitions.codalab.org/competitions/17751

[12] https://www.telegraph.co.uk/

[13] https://www.kaggle.com/

[14] Preliminary experiments with the dataset of Demszky et al. (2020) showed that it wasn't beneficial.

pared to the other datasets. The distribution of the support for the ART dataset is evenly spread. For the PALO.GR and PALO.ES datasets we observe a high percentage for the category DISGUST and especially for the category NONE. By adding more neutral tweets to SE.EN, the support for NONE increased from 2.8% to 11.9%, almost reaching ART (12.9%).

4 Emotion classification benchmark

We preprocessed the tweets of all the datasets by removing all URLs and usernames (e.g., *@Papadopoulos*), while tokenisation was undertaken with respect to each model's properties. We trained our systems in order to classify the tweet into one or more of the eight former emotion categories of Table 3, excluding NONE. The score for the NONE class was calculated as the complementary of the maximum probability of the other eight categories. In other words, if the maximum emotion score was lower than 0.5, the NONE class was assigned.

From emotions to subjectivity and sentiment

In order to study not only the emotions but also the sentiment of the tweets, we aggregated ANGER, FEAR, SADNESS, DISGUST into a 'NEGATIVE' sentiment category (in red in Fig. 1). TRUST and JOY were aggregated into a 'POSITIVE' category (in green in Fig. 1). The rest were considered as belonging to a 'NEUTRAL' category. ANTICIPATION and SURPRISE (in yellow in Fig. 1) were not considered neither as POSITIVE nor as NEGATIVE, because we find that the sentiment they express is ambiguous. To model subjectivity, we used the NONE emotion class, linking low NONE scores to the subjective and high to the objective class (i.e., a low score indicates the presence of at least one emotion).

Selected evaluation measure

For evaluation, we report the Area Under Precision-Recall Curves (AUPRC) per emotion, sentiment and subjectivity category, chosen based on the highly imbalanced nature of our dataset.[15]

4.1 Machine and deep learning benchmarks

We used six Transformer-based models, using one LLM pre-trained on multiple languages and one that was pre-trained on Greek. We used Random Forests as a baseline (RF:PALO).[16]

XLM-R (Conneau et al., 2019) is a Transformer-based multilingual LLM which leads to state-of-the-art performance on several NLP tasks, especially for resource-lean languages. For our task, we added a fully-connected layer on top of the pre-trained XLM-R model. We fed the pre-trained model with vectors that represent the tokenised sentences, and subsequently, the pre-trained model fed the dense layer with its output, i.e., the context-aware embedding (length of 768) of the [CLS] token of each sentence (Appendix B, Fig. 5). The number of nodes in the output layer is the same as the number of classes (eight). We fine-tuned the multilingual XLM-R first on the English SE+ and then we further fine-tuned it on the Greek ART and PALO.GR datasets, yielding two models: X:ART and X:PALO respectively. We also experimented with merged ART and PALO.GR, yielding X:ART+PALO. To assess the benefits of using an English dataset as a prior step, we fine-tuned XLM-R directly on PALO.GR, without any fine-tuning on SE+, which yielded X:NOPE. and tried zero-shot learning by training the model only on SE+, yielding to X:ZERO. **GreekBERT** was introduced by Koutsikakis et al. (2020) and it is a monolingual Transformer-based LLM for the modern Greek language. We fine-tuned GreekBERT on PALO.GR, which led to the BERT:PALO model.[17] Further experimental details are shared in the Appendix (B).

4.2 Experimental Results

We used as the high quality PALO.ES dataset as our evaluation set and we present the results in emotion, sentiment, and subjectivity classification.

Emotion classification

Table 3 presents the AUPRC (average across three restarts) of all seven models, per class and overall, for the task of emotion classification. The standard error of the mean is also calculated and shared in Appendix B (Table 10). X:ART+PALO was the best overall, achieving the best performance in ANGER, FEAR, SADNESS and NONE. X:PALO followed closely, with best performance in ANTICIPATION, JOY, SURPRISE, TRUST and (shared) in NONE.

Sentiment and subjectivity classification

Table 4 presents the AUPRC for the task of sentiment and subjectivity detection. X:ART+PALO, X:PALO and BERT:PALO perform equally high in subjectivity (0.98). These models were also top per-

[15] AUPRC captures the tradeoff between precision and recall for different thresholds.

[16] We used TFIDF and default parameters of: https://scikit-learn.org/stable/.

[17] We used: https://huggingface.co/.

	ANGER	ANTIC.	DISGUST	FEAR	JOY	SADNESS	SURPRISE	TRUST	NONE	AVG
X:ZERO	0.38	0.12	0.82	0.03	0.49	0.10	0.07	0.18	0.92	0.35
X:ART	0.33	0.13	0.68	0.07	0.31	0.07	0.05	0.10	0.89	0.29
X:ART+PALO	**0.51**	0.43	0.94	**0.15**	0.50	**0.19**	0.06	0.25	**0.99**	**0.45**
X:PALO	0.46	**0.50**	0.93	0.09	**0.54**	0.04	**0.09**	**0.28**	**0.99**	0.44
X:NOPE	0.43	0.19	0.90	0.03	0.48	0.03	0.03	0.20	0.98	0.37
BERT:PALO	0.49	0.31	**0.95**	0.03	0.45	0.03	0.03	0.24	0.98	0.39
RF:PALO	0.34	0.14	0.81	0.05	0.13	0.02	0.03	0.10	0.93	0.28

Table 3: Emotion classification AUPRC per emotion and macro-averaged across all emotions (last column). The average across three restarts is shown per model per column.

	Sentiment				Subjectivity		
	neg	**pos**	**neu**	**AVG**	**subj**	**obj**	**AVG**
X:ZERO	0.84	0.40	0.93	0.72	0.80	0.93	0.86
X:ART	0.69	0.18	0.90	0.59	0.72	0.90	0.81
X:ART+PALO	0.95	0.41	**0.99**	0.78	**0.97**	**0.99**	**0.98**
X:PALO	0.95	**0.43**	**0.99**	**0.79**	0.96	**0.99**	**0.98**
X:NOPE	0.93	0.39	**0.99**	0.77	0.95	**0.99**	0.97
BERT:PALO	**0.96**	0.39	**0.99**	0.78	**0.97**	**0.99**	**0.98**
RF:PALO	0.84	0.17	0.95	0.65	0.87	0.95	0.91

Table 4: AUPRC in sentiment and subjectivity classification, using our seven emotion classifiers (the average across three restarts is shown). The two macro average scores are shown on the right of each task.

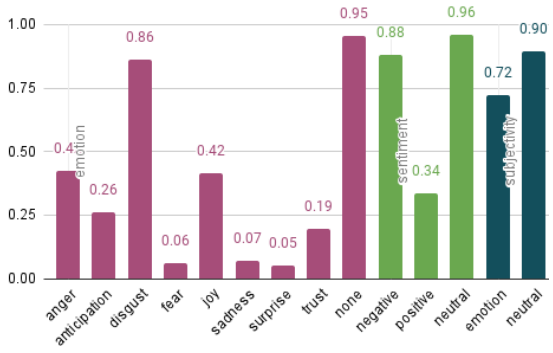

Figure 2: Average AUPRC score of all seven systems in emotion (in purple), sentiment (light green), subjectivity (dark blue) classification.

forming for the neutral sentiment and the objective class, along with the X:NOPE model, which did not use fine-tuning in English as a prior step. This means that using an English dataset as a prior fine-tuning step assisted in the detection of the subjective emotions. Specifically, X:PALO was the best for positive and BERT:PALO for negative ones.

Zero-shot classification

Considering its zero-shot learning, X:ZERO achieved considerably high scores in DISGUST and NONE (0.82 and 0.92 respectively), also scoring high in JOY. More generally for POSITIVE emotions, it scored only three percentage points lower from the best performing X:PALO. X:ZERO also outperformed X:ART, which had the worst results. The low performance of X:ART indicates that retrieving data based on keywords may not be the right way to build a training dataset, when the evaluation dataset is sampled otherwise. On the other hand, combined with other datasets it can lead to improvements, as for example X:ART+PALO that outperforms both X:ART and X:PALO for the emotion classification task, and especially for subjective emotions.

Emotion classification averaged across systems

Figure 2 presents the average AUPRC score (across systems) per emotion, sentiment and subjectivity class, allowing us to compare the different emotions and emotion groups for the average performance. We observe that our dataset provides adequate training material for DISGUST and for the lack of any emotion (NONE). The former probably explains also the high score for the NEGATIVE sentiment while the latter for the NEUTRAL.

5 Detecting emotions in political speech

We mechanically annotated and studied the emotion in the textual records of the Greek Parliament. We focused on DISGUST, which is the emotion that our classifiers capture best (see Figure 2). We opted for detecting a single emotion, instead of sentiment or subjectivity, because the latter could be linked to multiple emotions and hence providing us with an inaccurate conclusions. For example, as we noted in the introduction, 'fear' and 'anger' are both negative, but the pessimistic view of the former differs from the optimistic view of the latter (Seyeditabari et al., 2018). Such subtle differences, however, should not be ignored in our socio-political study (Ahmad et al., 2020), where we: (a) explore the emotion evolution in political speech, (b) utilise its presence to compare political parties, (c) explore the context of terms used to stigmatise people (Rose et al., 2007).

The Greek Parliament Corpus,[18] which we

[18] https://zenodo.org/record/7005201

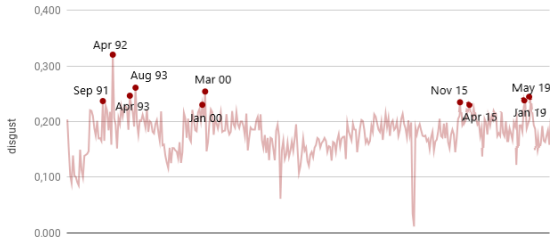

Figure 3: Average predicted DISGUST score per month for the records of the Greek Parliament Corpus. The ten highest values are shown with red bullets.

used to undertake this study, comprises 1,280,918 speeches of Greek Parliament members from 1989 to 2020[19], which were split into 9,096,021 sentences (with average word length of 19) for the purposes of our research. Preliminary experiments with our top three emotion classifiers, X:PALO, BERT:PALO, X:ART+PALO, showed that the first performs best (Appendix C) and was, therefore, selected for the application we discuss next.

5.1 Emotion evolution in political speech

Figure 3 illustrates the detected DISGUST emotion, monthly averaged, with the 10 highest values (i.e., months) highlighted. A probability score was computed for each sentence of the records, by employing the DISGUST emotion head of our X:PALO model. Then, we macro-averaged the computed scores per month. The highest DISGUST score was observed between 1991 and 1993 (September 1991, April 1992, April 1993, August 1993), in 2000 (January 2000, March 2000), in 2015 (November 2015, April 2015) and in 2019 (January 2019, May 2019). By investigating the main events of these months, we found that there is at least one event per month that could potentially explain these high scores (more information about the selected events and examples of text can be found in Table 12 and Table 13 in Appendix C).

5.2 Political parties and 'disgust'

By computing the average DISGUST score per party,[20] we were able to compare all political parties, as depicted in Table 5. We observe that the two highest scores correspond to far-right political parties. The *Democratic Social Movement* and the *Communist Party of Greece* follow closely. On the lower end of the diagram are the *Opposition* and the *Parliament*. Both categories include speeches that the parliament stenographer could not assign to a specific member, but rather used a generic reference, e.g., 'A member (from the Official Opposition)' or 'Many members'. *Opposition* refers to such cases for members of the political party that came second during the national elections of each parliamentary period. *Parliament* refers to speeches delivered by many members at the same time. Both are characterised by lack of any emotion, which can be explained by the boilerplate sentences that they use in their speeches. For example, the most common sentence of the *Parliament* is 'Μάλιστα, μάλιστα' (translated as: *'Affirmative, affirmative'*). Correspondingly, a common sentence of *Opposition* is the 'Κατά πλειοψηφία' (translated as: *'By majority.'*). However, the DISGUST of *Opposition* is higher than that of *Parliament*, as the former also includes sentences that could express DISGUST, such as: 'Αίσχος, αίσχος' (translated as: *'Disgrace, disgrace'*).

5.3 Emotional context shift

Studying language evolution can reflect changes in the political and social sphere (Montariol et al., 2021), changes whose importance increases when they regard language used to stigmatise people. Rose et al. (2007) presented 250 labels used to stigmatise people with medical illness in school. Motivated by the correlation that was recently found between the negative sentiment and stigmatising language (Jilka et al., 2022; Delanys et al., 2022), we (a) explore the frequency of some of these terms in the parliamentary records, and (b) utilise emotion classification to investigate the evolution of the negative context they appear in over time. Static word embeddings (in multiple spaces) can be used to capture semantic shift and word usage change (Levy et al., 2015; Gonen et al., 2020), and contextual embeddings can be used to detect generally context shifts (Kellert and Zaman, 2022). We propose that *emotional* context shifts also apply and that emotion classifiers can unlock these shifts' use to complement the study of language evolution.

Target We focus on terms that have been used to stigmatise, which set a major barrier to help-seeking people and especially to ones with a mental illness (Rose et al., 2007). This fact set our focus on three such terms, which (a) were frequently occurring according to the study of Rose et al. (2007), and (b) were present in our Greek parliamentary corpus; i.e., *'crazy'* (Brewis and Wutich, 2019), *'handicapped'* (Jahoda et al., 1988), and *'disability'* (Veroni, 2019). We note, however, that

[19] The proceedings for 1995 are not publicly available.

[20] We computed one score per sentence and macro-averaged across all the sentences of the respective party.

Political Party	Score
(fr) Golden Dawn	33%
(fr) Greek Solution	28.6%
(l) Democratic Social Movement	28.3%
(fl) Communist Party of Greece	26.4%
(l) Alternative Ecologists	25.2%
(r) Political Spring	24.6%
(-) Independent (out of party)	24.5%
(-) Independent Democratic MPs	23.8%
(c) Union of Centrists	23.5%
(c) Democratic Alliance	21.6%
(l) Coalition of the Radical Left	21.5%
(l) Coalition of the Left, of Movements and Ecology	20.7%
(l) European Realistic Disobedience Front	20.7%
(r) Independent Greeks	20.6%
(r) New Democracy	19.6%
(fr) Patriotic Alliance	19.2%
(c) The River	19%
(l) Popular Unity	19%
(cl) Movement for Change	18.5%
(cl) Panhellenic Socialist Movement	17.4%
(l) Democratic Left	17.2%
(cr) Democratic Renewal	15.3%
(-) Extra Parliamentary	14%
(fr) Popular Orthodox Rally	13.3%
(-) Opposition	6.3%
(-) Parliament	0.3%

Table 5: Average DISGUST score per political party. The color intensity reflects the score. Political positions of the parties are denoted in a parenthesis, where 'f' corresponds to 'far', 'r' to 'right', 'c' to 'center', 'l' to 'left' and '-' to unspecified position.

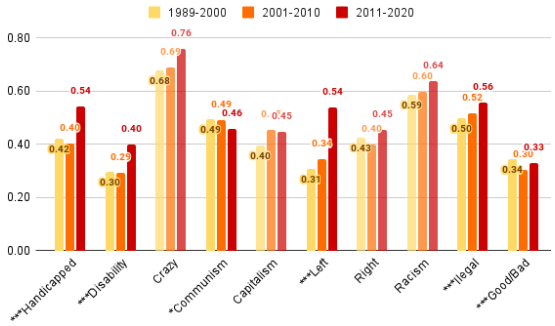

Figure 4: Average DISGUST score computed on random samples per term (horizontally) per decade (in red the most recent). Faded colors and one asterisk indicate to a p-value that was greater than 0.05. Three asterisks indicate to p-value < 0.01, and two asterisks to 0.001 < p-value < 0.05.

stigmatising language exists beyond this domain, e.g., including terms related to obesity (Pont et al., 2017), which we plan to investigate in future work. Initially, we retrieved sentences containing each of the terms from the Greek parliament corpus.[21] We then sliced our corpus as in (Gonen et al., 2020), focusing on three periods: from 1989 to 2000, from 2001 to 2010, and from 2011 to 2020. From each decade we sampled 100 sentences per target word, each of which was scored with X:PALO regarding the DISGUST emotion, in order to report the average DISGUST score per decade. The target words describe specific conditions, whose stigmatised use can be captured by an increased score over time (the algorithm is in the Appendix C). The statistical significance of the differences between slices is computed with bootstrapping.[22]

Control groups were created with the words 'bad' and 'good', repeating the same methodology, as well as with words related to politics whose usage could also be linked to stigma. One group comprised 'racism' and 'illegal immigrant' while the other comprised the words 'communism', 'capitalism', 'left' and 'right'. The support of all the selected words is shared in Appendix C (Table 6).[23]

The results show that there was a statistically significant shift after 2011 for 'handicapped' and 'disability' (Fig. 4, Appendix C).[24] An exploration of texts comprising those terms (Appendix C, Tables 16 and 15) revealed voices disgusted by the situation of specific social groups. The term 'crazy', on the other hand, has been used to stigmatise (Appendix C, Table 17).

6 Conclusion

We presented a new dataset of Greek tweets labelled for emotion. Our benchmark showed that LLMs are strong performers for the task of detecting the emotion of disgust, the most frequent emotion in electoral data. Focusing on the political domain, we utilised our best performing emotion classifier to identify points in time when this emotion was frequent and to sort the political parties. Furthermore, we introduced a method to assess a word's emotional context shift, which showed that the words 'handicapped' and 'disabled' are increasingly used in a negative emotional context, and that the word 'crazy' is likely to be carrying stigma in Greek political speech.

A more thorough analysis of the stigma for the latter word, an exploration of more potentially stigmatised words, and the application of our method to more languages are directions for future work.

[21] Each term corresponds to a group of derivative terms, including for example inflected word forms.

[22] p-values computed by re-executing one thousand times Algorithm 1 (Appendix C), re-sampling texts per slice.

[23] We disregarded low-support terms such as 'spastic', 'psychopath', 'gay', 'fascism', 'feminism'.

[24] A st. significant negative shift is observed also for the terms 'left' and 'illegal immigrant'.

Limitations

While we are using state-of-the-art LLMs, the selected models are not designed to handle lengthy text input, which could be more useful in political speeches. Experimentation with models such as the Longformer (Beltagy et al., 2020) could extend the current study. Furthermore, our emotion classification disregarded irony or sarcasm, which can occur frequently in a political corpus. Extending our classification schema or employing irony and sarcasm classifiers could provide complementary dimensions to the 'disgust' emotion that was investigated with this study. Finally, in this study we explore the emotion evolution of a word's context by employing emotion classification. Emotion distribution shifts are very likely in political corpora over time, but this also means that the performance of the emotion classifiers might be affected. Investigating the out-of-distribution generalisation ability of the emotion classifiers could verify their robustness towards this direction.

Ethics Statement

With this study we used a classified emotion as the means to detect stigmatised words. As was shown by Jilka et al. (2022) and Delanys et al. (2022), negative sentiment is correlated with stigmatising language regarding medical terms while medical or neutral use of the same terms is related more to neutral emotions. However, any detected terms with our suggested (emotional context shift) approach should only be considered as suggestions to be studied by human experts. By no means should our presented approach be considered as a solid method to detect stigmatised words. Even if the emotion classification was made by humans, not systems, still any suggested stigmatised terms should be assessed in a broader context, inside and outside the domain in question.

Another ethical consideration stems from the current lack of text classifiers to incorporate successfully the conversational context. Much like toxic language detection (Pavlopoulos et al., 2020), the inferred emotion of any text should be in the context of the whole speech and perhaps daily parliamentary records. The robustness of the existing classifiers, as well as the development of ones aware of conversational context, could be made possible by undertaking an adequate annotation experiment of the studied political proceedings.

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Appendix

A Annotation

Examples for all the classes of the PALO.ES dataset are shown in Table 9. The examples shown to the annotators of our dataset (PALO.ES and PALO.GR), addressing the question: *Which of the following options best describes the emotional state of the tweeter?*, are shown in Table 6. The guidelines were updated with the note and the example of Table 7, for the final annotation of PALO.ES and PALO.GR parts. The words used to retrieve tweets per emotion for the development of ART are shown in Table 8. We note that not all words referring to a specific emotion lead to the retrieval of tweets comprising that emotion. For example, searching for 'χαρά' ('happiness'; aiming for tweets classified to JOY), we receive emotionless tweets, such as 'Η χαρά είναι ένα συναίσθημα που πρέπει να εκφράζεται στον ίδιο βαθμό όπως και τα υπόλοιπα' ('Happiness is an emotion that must be expressed to the same degree as the rest.').

anger (also includes annoyance, rage) e.g *"Εν τω μεταξύ όλοι δίνουν παράδειγμα την Παπαστράτος. Τα ξενοδοχεία πως δουλεύουν ρε μπετόστοκοι; Είδατε Κυριακή κλειστό ξενοδοχείο; Σκατά έχουν για μυαλό ρε μλκ τι να πω... #syriza_xeftiles #ΞΑΝΑΕΡΧΕΤΑΙ"*
anticipation (also includes interest, vigilance) e.g :*"Ελπίζω να καταφέρει να ανεβάσει ποιοτικά το νετφλιξ αν υπάρχει τέτοιο ενδεχόμενο"*
disgust (also includes disinterest, dislike, loathing) e.g:*"Παιδιά μια συμβουλή μακρυά από FORTHNET χαλαρα ότι από απαίσιο κυκλοφορεί σε Ιντερνετ"*
fear (also includes apprehension, anxiety, terror) e.g: *"Φοβάμαι πως η επόμενη φάση της πανδημίας στη χώρα άρχισε νωρίτερα από ότι υπολογίζαμε. Το φθινόπωρο τα πράγματα είναι σχεδόν σίγουρο ότι θα εξελιχθούν σε ένα νέο (χειρότερο) κύμα ή την διόγκωση του τωρινού, ακριβώς για τους λόγους που γράφεις."*
joy (also includes serenity, ecstasy) e.g:*"Αυτός που μου δίνει τους κωδικούς πλήρωσε ΕΠΙΤΕΛΟΥΣ το Νετφλιξ. Θα πάθω εγκεφαλικό απ τη χαρά μου."*
sadness (also includes pensiveness, grief) e.g:*"Με λύπη μου σας λέω , ότι αν είστε συνδρομητής @COSMOTE κ έχετε τεχνική βλάβη , ούτε άκρη θα βρείτε Σάββατο Κυριακο κ για την αποκατάσταση της, μπορεί να περιμένετε μια βδομάδα!!!!"*
surprise (also includes distraction, amazement) e.g:*"Υπέροχη νέα εφαρμογή Cosmote TV επιτέλους έχει και το E!"*
trust (also includes acceptance, liking, admiration) e.g:*"@SpyrosLAP: Αυτό είναι πολύ καλό. Ώρα του Υπ Παιδείας να πάρει τη χώρα μπροστά #Cyprus #Cyta @AnastasiadesCY #ΜΕΝΟΥΜΕΣΠΙΤΙ #StayAtHome"*
other (sarcasm,irony,or other emotion) e.g: *"ΟΤΕ ακούς; Τηλεφωνώ στο 13888 από την Παρασκευή, αλλά άκρα του τάφου σιωπή. Τί έπαθε ο γίγαντας των τηλεπικοινωνιών μας; @COSMOTE".*
none e.g:*"Αυτές είναι οι νέες σειρές και οι νέες ταινίες που έρχονται στο Netflix μέσα στο Δεκέμβριο! https://t.co/pxIpmDyZx1"*

Table 6: The options and the corresponding examples from the guidelines during the annotation for the development of our dataset.

NOTE	*If the tweet involves news/announcement, it should be classified in the 'none' class, assuming that the author does not have the emotion expressed by the news*
EXAMPLE	'ΑΠΟΚΛΕΙΣΤΙΚΟ: Επίκαιρη Επερώτηση για NOVA και αθέμιτο ανταγωνισμό Μαρινάκη… καταθέτει ο ΣΥΡΙΖΑ! 'URL' μέσω του χρήστη @user' ("EXCLUSIVE: Topical Question for NOVA and unfair competition Marinaki" SYRIZA testifies! 'URL' via @user')

Table 7: Note and example added to the annotation guidelines during the development of the PALO.ES dataset.

Words	Category
'αίσχος'(disgrace), 'έλεος'(mercy), 'ήμαρτον'(drat), 'αι σιχτιρ'(get lost), 'γαμώ'(fuck),'νιώθω εξοργισμένος'(I feel angry), 'νιώθω οργή' (I feel anger), 'βλάκα'(fool),'ηλίθιος'(stupid), 'σιχαμα'(abomination)	anger, disgust
'περιμένω'(wait), 'αναμένω'(expect), 'προσμένω'(look forward)	anticipation
'φοβάμαι'(I am afraid), 'τρομάζω'(scare), 'τρομακτικό'(scary), 'τρέμω'(tremble), 'σκιάζομαι'(afraid)	fear
'χαίρομαι'(I am glad), 'είμαι χαρούμενος'(I am happy), 'πολύ χάρηκα' (I was very happy), 'αχ ναιιι'(oh yeahhh),'ναιιι'(yesss), 'τέλειοο'(perfect), 'εκστασιασμένος'(ecstatic)	joy
'λυπάμαι'(I am sorry), 'στεναχωριέμαι'(feel sad), 'θλίβομαι'(grieve), 'θλίψη'(sadness), 'απογοήτευση'(disappointment)	sadness
'εκπλήσσομαι'(I am surprised), 'έκπληξη'(surprise)	surprise
'εμπιστοσύνη'(trust), 'εμπιστεύομαι'(I trust)	trust
'ανακοίνωση'(announcement), 'είδηση'(news)	none

Table 8: Words used to retrieve tweets per emotion for the development of ART.

B Experimental details

GreekBERT and XLM-R (Figure 5) were trained for 30 epochs with early stopping, patience of 3 epochs, batch size 16, learning rate 1e-5 for XLM-R and 5e-5 for GreekBERT, monitoring the validation loss, maximum length of 109 for XLM-R and 85 for GreekBERT. The selection of the hyperparameters occurred after manual tuning and the use of a GPU was necessary for the experiments.

C Emotion detection in political speech

Model selection

We manually evaluated our 3 best performing emotion detectors, viz. X:PALO, BERT:PALO, X:ART+PALO, on a sample of 173 sentences, that were randomly selected from the Greek Parliament Corpus, and annotated for sentiment classification (neutral, positive, negative and mixed) by three postgraduate students. The pairwise Cohen's

anger, disgust
”Δεν ντρέπεστε να γδέρνετε έτσι τον κόσμο με την ΔΕΗ? Όσα σας λείπουν μας στείλατε να πληρώσουμε? Απαράδεκτοι...Και πάλι ντροπή σας.” (Aren’t you ashamed to rip off the world like this with the PPC [Public Power Corporation]? You send to us to pay what you lack? Unacceptable.. Shame on you again.)
anticipation
Τεράστιο το ενδιαφέρον για το κορυφαίο τουρνουά τένις! #tennis #Wimbledon (Huge interest in the top tennis tournament! #tennis #Wimbledon)
disgust
Μπορεί η σωστή λέξη να είναι κατάντια. Μπορεί η σωστότερη να είναι παρακμή. Η 1η φορά θα είναι που μια ομάδα παίρνει την κάτω βόλτα; ή η τελευταία; Οπώς κ να το πούμε όμως έχει αυτουργούς #arispao (Comedown might be the right word. Decadence may be more correct. Will it be the 1st time a team gets the bottom ride? or the last one? No matter how we say it, it has perpetrators #arispao)
fear
Μακάρι αλλά που...εμένα σύντομα θα μου το κόψουν αν δε βαλω κάρτα. (I wish, but... I will soon be cut off if I don’t get a card.)
joy
Η #nrg βρέθηκε στην κορυφή της λίστας των ταχύτερα αναπτυσσόμενων επιχειρήσεων στην Ελλάδα, για το 2018! Συγχαρητήρια σε όλη την ομάδα, συνεχίζουμε δυναμικά! (#nrg topped the list of the fastest growing businesses in Greece for 2018! Congratulations to the whole team, keep going strong!)
sadness
Τι καλά που ήταν πριν τα κινητά. Πόσα δάκρυα, λαχταρες, αγάπες, επείγοντα ή όχι γίνονταν μέσα στον θάλαμο. Προσωπικά θυμάμαι στον ΟΤΕ πολλα παρόμοια. Πλέον μάλλον είναι πολιτιστικό μνημείο της Αγγλίας αν και ακόμα λειτουργεί κανονικά. (How nice was before cell phones. How many tears, longings, loves, urgent or not, took place inside the chamber. I personally remember many similar things at OTE. Now it is probably a cultural monument of England although it still functions normally.)
surprise
Πως γκένεν αυτό; Πλήρωνε δηλαδή η ΔΕΗ τα Δ.Τ. του πελάτη της; Αυτό και αν είναι σκάνδαλο! (How did this happen? In other words, PPC paid the D.T. of her client? What a scandal!)
trust
Ο ΠΑΟΚ δύσκολα θα χάσει euro γιατί έχει και τη σιγουριά του open. (PAOK will hardly lose Euro because they also have the confidence of the open).
none
ΔΕΗ: Σε ισχύ τα νέα τιμολόγια – Αναλυτικά οι τιμές | - 24 ώρες Τοπικές ειδήσεις Δυτ Μακεδονίας (PPC: The new tariffs are in effect - Detailed prices | -24 hours Local news of Western Macedonia)

Table 9: Examples from the PALO.ES with their English translations for each emotion.

kappa was found to be 0.55 while for all the tweets at least 2 out of three annotators agreed. X:PALO was found to perform slightly better in this sample, hence it was preferred over X:ART+PALO (one percentage unit higher in AUPRC in DISGUST; see Table 3) for this study.

Events potentially responsible for ‘disgust’

Table 12 presents events that potentially rationalise the highest DISGUST scores in the respective months. These are September of 1991,[25] April of 1992,[26] April of 1993,[27] August of 1993,[28] January of 2000,[29] March of 2000,[30] November of 2015,[31] April of 2015,[32] January of 2019,[33] and May of 2019.[34]

[25] https://www.newscenter.gr/politiki/970602/\kontogiannopoylos-katalipseis-paideia

[26] https://en.wikipedia.org/wiki/Macedonia_naming_disput

[27] https://www.esiweb.org/macedonias-dispute-greece

[28] https://www.tovima.gr/2008/11/25/archive/pws-epese-o-mitsotakis/

[29] https://m.naftemporiki.gr/story/1844644/politikooikonomika-orosima-10-dekaetion

[30] https://en.wikipedia.org/wiki/2000_Greek_legislative_election

[31] https://www.ertnews.gr/eidiseis/ellada/prosfigiki-krisi-ke-periferiakes-exelixis-sto-epikentro-tis-episkepsis-tsipra-stin-tourkia/

[32] https://www.theguardian.com/business/live/2015/apr/08/\shell-makes-47bn-move-for-bg-group-live-updates

[33] https://www.euronews.com/2019/01/24/explained-the-controversial-name-dispute-between-greece-and-fyr-macedonia

[34] https://www.lifo.gr/now/greece/i-stigmi-poy-o-tsipras-anakoinose-proores-ekloges-thlipsi-stin-koymoyndoyroy-kai-sto

	Emotion									
	anger	**antic.**	**disgust**	**fear**	**joy**	sadness	surprise	**trust**	**none**	**AVG**
X:ZERO	0.38 (0.02)	0.12 (0.01)	0.82 (0.02)	0.03 (0.00)	0.49 (0.04)	0.10 (0.02)	0.07 (0.01)	0.18 (0.03)	0.92 (0.01)	0.35
X:ART	0.33 (0.01)	0.13 (0.01)	0.68 (0.03)	0.07 (0.01)	0.31 (0.04)	0.07 (0.01)	0.05 (0.01)	0.10 (0.01)	0.89 (0.01)	0.29
X:ART+PALO	**0.51** (0.00)	0.43 (0.00)	0.94 (0.00)	**0.15 (0.01)**	0.50 (0.04)	**0.19 (0.04)**	0.06 (0.01)	0.25 (0.01)	**0.99 (0.00)**	**0.45**
X:PALO	0.46 (0.01)	**0.50 (0.00)**	0.93 (0.00)	0.09 (0.01)	**0.54 (0.03)**	0.04 (0.01)	**0.09 (0.02)**	**0.28 (0.02)**	**0.99 (0.00)**	0.44
X:NOPE	0.43 (0.00)	0.19 (0.01)	0.90 (0.00)	0.03 (0.01)	0.48 (0.07)	0.03 (0.01)	0.03 (0.01)	0.20 (0.13)	0.98 (0.00)	0.37
BERT:PALO	0.49 (0.02)	0.31 (0.09)	**0.95 (0.00)**	0.03 (0.02)	0.45 (0.09)	0.03 (0.01)	0.03 (0.01)	0.24 (0.03)	0.98 (0.00)	0.39
RF:PALO	0.34 (0.01)	0.14 (0.02)	0.81 (0.01)	0.05 (0.03)	0.13 (0.02)	0.02 (0.00)	0.03 (0.01)	0.10 (0.01)	0.93 (0.00)	0.28

Table 10: AUPRC (average across three repetitions) of emotion classifiers with the standard error of the mean (SEM) in the brackets

	Sentiment				**Subjectivity**		
	neg	**pos**	**neu**	**AVG**	**subj**	**obj**	**AVG**
X:ZERO	0.84 (0.01)	0.40 (0.02)	0.93 (0.01)	0.72	0.80 (0.02)	0.93 (0.01	0.86
X:ART	0.69 (0.03)	0.18 (0.03)	0.90 (0.01)	0.59	0.72 (0.03)	0.90 (0.01)	0.81
X:ART+PALO	0.95 (0.00)	0.41 (0.00)	**0.99** (0.00)	0.78	**0.97** (0.00)	**0.99** (0.00)	**0.98**
X:PALO	0.95 (0.00)	**0.43** (0.02)	**0.99** (0.00)	**0.79**	0.96 (0.00)	**0.99** (0.00)	**0.98**
X:NOPE	0.93 (0.00)	0.39 (0.02)	**0.99 (0.00)**	0.77	0.95 (0.01)	**0.99** (0.01)	0.97
BERT:PALO	**0.96** (0.00)	0.39 (0.06)	**0.99** (0.00)	0.78	**0.97** (0.00)	**0.99** (0.00)	**0.98**
RF:PALO	0.84 (0.01)	0.17 (0.01)	0.95 (0.00)	0.65	0.87 (0.01)	0.95 (0.00)	0.91

Table 11: AUPRC (average across three runs) of sentiment and subjectivity classifiers with the standard error of the mean (SEM) in the brackets.

Date	**Event**
1991, Sep	Bill of the Minister of Education Vassilis Kontogiannopoulos brought reactions.
1992, Apr	Meeting of political leaders; Macedonian issue.
1993, Apr	FYROM officially becomes a member of the UN.
1993, Aug	Disputes leading to the fall of the government.
2000, Jan	Finalization of the drachma exchange rate against the euro.
2000, Mar	Elections New Democracy succeeds Panhellenic Socialist Movement.
2015, Nov	The Greek Prime Minister visits the Turkish Prime Minister.
2015, Apr	The Greek Prime Minister visits the Russian Prime Minister.
2019, Jan	Macedonian Issue.
2019, May	Loss in European elections leads to a call for early parliamentary elections.

Table 12: The months with the higher values of DISGUST, potentially rationalised by the shown events.

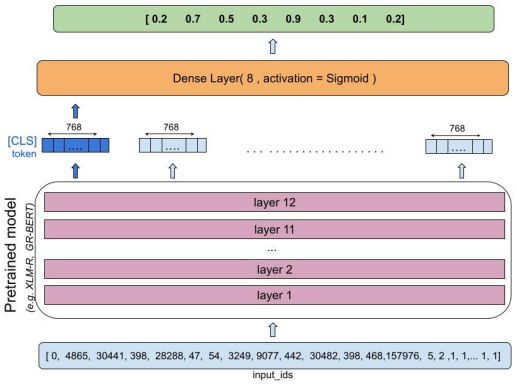

Figure 5: The architecture of XLM-R and GreekBERT for the emotion classification task.

Emotional context shift

The support of the selected terms is shown in Figure 6, where we can see that the usage of half of them (i.e., 'capitalism', 'left', 'right', 'racism', 'illegal immigrant') is increased in the last decade.

As shown in Fig. 6, for some words there are not enough data to validate our findings, especially for the earliest time period (prior to 2001). Hence, we compute and share the p-values (Table 14), by focusing on 2011 as a time limit and by using the Mann-Whitney U-test.[35] We used two periods,

[35]We used https://docs.scipy.org/doc/scipy/reference/generated/scipy.stats.mannwhitneyu.html, setting "less" as the alternative hypothesis and sampling randomly

one before and one after 2011. Experiments with bootstraping and three slices (before 2001, after 2011, and in between) brought similar findings regarding before/after 2011 but inconclusive regarding 2001.

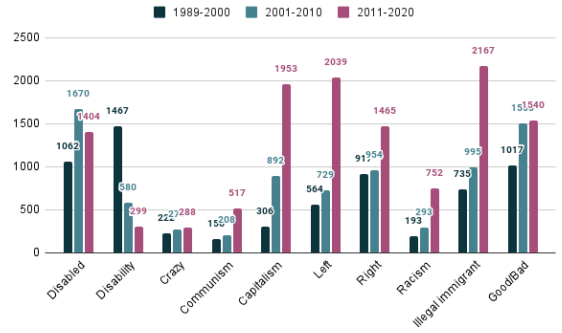

Figure 6: Support of the target words per decade.

Algorithm 1 describes the procedure to compute the evolution of the emotion of a targeted word's (w) context in a sliced corpus C. Each slice c is sentence-tokenised and each sentence s is scored based on a model M.

Algorithm 1: Emotion Context Shift

Data: Target word w;
Number of slices S;
$C : \{c^j, c^j : \{t^1, ..., t^{|c^j|}\}, j \in S\}$
Result: $E^w : \{e(c^1), ..., e(c^S)\}, 0 \leq e \leq 1$

foreach j **in** $\{0, ..., S\}$ **do**
  $e(c^j), i \leftarrow 0, 0$
  foreach *text* **in** c^j **do**
    if w **in** *text* **then**
      $e(c^j) \leftarrow e(c^j) + \textit{classifier}(\textit{text})$
      $i \leftarrow i + 1$
  $e(c^j) \leftarrow \frac{e(c^j)}{i}$
return $\{e(c^1), ..., e(c^S)\}$ /* Contextual emotion evolution of w. */

from the largest period.

September 1991
Πως, λοιπόν, να έχουμε εμπιστοσύνη ότι δε θα εφαρμοστούν και πάλι σε κάποια στιγμή μεσούσης- για να θυμηθούμε την καθαρεύουσα- της σχολικής και εκπαιδευτικής χρονικής διάρκειας, κάποια μέτρα πάλι σαν και αυτά του κ. Κοντογιαννόπουλου που δεν έφεραν απλώς κρίση, έφεραν έκρηξη. (How can we trust that new measures will not again be applied in medio anno - to remember our literally language - of the school year measures like those brought by Mr. Kontogiannopoulos that induced not just a crisis, but an explosion.)
April 1992
Φτάσαμε στο γεγονός η κυβέρνηση της Βουλγαρίας και ο φίλος του κυρίου Πρωθυπουργού ο κ. Ζέλεφ να αναγνωρίσει τα Σκόπια πριν καλά-καλά υπάρξουν. (We have reached the point where the government of Bulgaria and the friend of our Prime Minister Mr Zhelev recognized Skopje before they even existed.)
April 1993
Νομίζω ότι αυτό στη σημερινή συγκυρία είναι απαράδεκτο, αν θέλουμε όλοι εμείς που φλυαρούμε για τη Μακεδονία να εννοούμε τελικά ότι εκεί υπάρχει ένα καινούργιο ζήτημα που πρέπει να αντιμετωπίσουμε με νέες προτεραιότητες και νέες ιεραρχήσεις (I think that in the current situation this is unacceptable, if all of us who babble about Macedonia want to finally convey/mean that there is a new issue that needs to be addressed with new priorities and new hierarchies.)
August 1993
Για να δείτε, πόσο μακριά από την πραγματικότητα, ακόμη και σήμερα και όχι μόνο τα 8 χρόνια που βρισκόσαστε στην κυβέρνηση, είσθε, ξεκομμένοι από την πραγματικότητα την ευρωπαϊκή, τη διεθνή και παραπληροφορείτε τον Ελληνικό Λαό. (This is for you to see, how far from reality you are, even today and not only for the 8 years that you were in power; cut off from the European and the international reality and misinforming the Greek people.)
January 2000
Και νομίζω ότι αυτή η προκήρυξη τελικά οδήγησε στο να γίνει άλλη μια προσπάθεια διαρθρωτικής αλλαγής στην οικονομία μας, τελείως ανεπιτυχής και να βάλει τη σφραγίδα στην Κυβέρνηση της αποτυχίας, στην Κυβέρνηση που δεν έχει μέλλον τουλάχιστον για τη μετά ONE εποχή. (And I think that this announcement ultimately led to another completely unsuccessful attempt at structural change in our economy, and gave the seal of failure to the Government; the Government that has no future at least in the post-EMU era.)
March 2000
Δηλαδή κάθε φορά θα κάνουμε εκλογές με άθλιες νομοθεσίες και θα υποσχόμαστε ότι μετά τις εκλογές θα τα ξαναδούμε; Μα, το θέμα είναι με ποιους όρους διεξάγουμε τις εκλογές τώρα. (In other words, are we going to be holding elections with wretched legislation and every time promise that after the elections we will see these things again? The issue is under what conditions are we conducting the elections now.)
November 2015
Πήρε 3 δισεκατομμύρια σε ρευστό, πήρε βίζα για να εισέρχονται οι Τούρκοι και οι πάσης φύσεως τζιχαντιστές ισλαμιστές στην Ευρωπαϊκή Ένωση και να κάνουν ό,τι θέλουν και άρχισαν και οι ενταξιακές της διαπραγματεύσεις. (He took 3 billion in cash, he got visas for the Turks and all kinds of Jihadists and Islamists to enter the European Union and do whatever they want, and not only that but its accession negotiations began.)
April 2015
Ακόμα και το φλερτ με τον Πούτιν και τη Ρωσία καταλήγει στο πουθενά. (Even flirting with Putin and Russia is going nowhere.)
January 2019
Χέρι-χέρι ξεπουλάτε τη Μακεδονία μας, ΣΥΡΙΖΑ και Νέα Δημοκρατία. (Hand-by-hand, you SYRIZA and New Democracy, you are selling out our Macedonia.)
May 2019
Τι εννοώ δηλαδή: Επειδή τρομοκρατήθηκαν κάποιοι λεγόμενοι «κεντρώοι» ψηφοφόροι από τη συμπεριφορά της ακροδεξιάς πτέρυγας της Νέας Δημοκρατίας, η οποία έχει επιβάλει τον νόμο της στην ηγεσία της Νέας Δημοκρατίας, έρχεται τώρα η Νέα Δημοκρατία να δημιουργήσει ένα επικοινωνιακό αντίβαρο με βάση το ήθος του Πολάκη και να συζητάμε πηγαίνοντας προς εκλογές για τον Πολάκη και όχι οποιοδήποτε θέμα είναι σοβαρό και αφορά τη ζωή και την καθημερινότητα των πολιτών. (What I mean is: Because some so-called "centrist" voters were horrified by the behavior of the far-right wing within the New Democracy political party, which has imposed its law on the leadership of New Democracy, now New Democracy wants to create a communication counterweight based on the ethos of Mr. Polakis and while we are heading for elections we are talking about Mr. Polakis and not about issues that are serious and concern the everyday life of the citizens.)

Table 13: Parliamentary texts (with english translations) classified as DISGUST, selected from the 10 highest-scored months.

Target term	P value (pre/post 2001)	P value (pre/post 2011)
handicapped	1.000	**0.000**
disability	0.984	**0.000**
crazy	0.110	0.145
left	0.724	**0.000**
right	0.243	0.605
capitalism	0.260	0.406
communism	0.940	**0.048**
illegal immigrant	**0.024**	**0.000**
racism	0.077	0.075
good/bad	0.916	**0.000**

Table 14: Target terms along with their corresponding P values. On the top are terms used to stigmatise people, followed by terms related to politics whose usage could also be linked to stigma, followed by a control group. In bold are values lower than 0.05.

Handicapped
Γιατί δεν παίρνετε αυτά τα μέτρα, τα οποία—αν θέλετε—και κατά κάποιο τρόπο δικαιώνουν αυτούς τους ανθρώπους αλλά συλλήβδην και αθρόως έρχεστε και κόβετε όλες τις συντάξεις και περνάτε και τους νεκρούς ακόμα αναπήρους από τις υγειονομικές επιτροπές; Είναι ντροπή αυτό που γίνεται. (Why don't you take these measures, which—if you want—and in a way vindicate these people but come quickly and cut all the pensions and also pass the dead still as disabled through the health boards? It's a shame what's happening.)
Εδώ έχετε ισοπεδώσει εργασιακά και ασφαλιστικά δικαιώματα, οι ελαστικές εργασιακές σχέσεις τσακίζουν κόκκαλα, η παραβίαση του ωραρίου, η καταστρατήγηση του ημερήσιου χρόνου εργασίας είναι κανόνας, συλλογικές συμβάσεις δεν υπάρχουν, επιδόματα λοχείας και τοκετού κομμένα, οι εργοδότες εκβιάζουν τις γυναίκες να μην τεκνοποιήσουν, αλλιώς τις απολύουν και εσείς μας μιλάτε με περίσσιο υποκριτικό ενδιαφέρον για την εργασιακή εξασφάλιση των αναπήρων; (Here you have leveled labor and insurance rights, flexible working relationships break bones, violation of the work hours, circumventing daily working time is the norm, collective agreements do not exist, labor and delivery benefits are cut, employers blackmail women not to have children, or else they fire them and you talk to us with too much hypocritical interest in the job security of the handicapped?)
Που πάνε τα λεφτά, κυρίες και κύριοι συνάδελφοι; Πού πήγαιναν τα λεφτά; Στον πραγματικά δικαιούχο, αναγκαιούχο της ελληνικής κοινωνίας ή στον αετονύχη, με την κοινωνία που δημιουργήσατε, με όλους αυτούς τους μαϊμού-αναπήρους, μαϊμού-ανέργους, μαϊμού-δικαιούχους; Να τόσα χρόνια τι δεν κάνατε. (Where does the money go, ladies and gentlemen? Where did the money go? To the truly entitled, necessary person of the Greek society, with the society that you created, with all these fake-handicapped, fake-unemployed, fake-entitled? What have you not done for so many years?)
Αυτή η κάρτα, πραγματικά, μπορεί να δώσει στους πολίτες με αναπηρία τη χαμένη τους αξιοπρέπεια μία αξιοπρέπεια, η οποία καταπατάται με το χειρότερο τρόπο κάθε φορά, που καλείται για παράδειγμα ο παραπληγικός να αποδείξει τα αυτονόητα της αναπηρίας του στις υγειονομικές επιτροπές, μια αξιοπρέπεια που εκμηδενίζεται, όταν ο κινητικά ανάπηρος προσπαθεί να εξυπηρετηθεί από κάποια δημόσια υπηρεσία (This card, in fact, can give handicapped citizens their lost dignity, a dignity that is violated in the worst way every time, for example, the paraplegic is asked to prove the self-evident facts of his disability to the health boards, a dignity that is annihilated, when the physically disabled person tries to be served by a public service)
Είναι ειρωνεία, αλλά είναι τραγική, με χιλιάδες δολοφονημένους εργάτες που δεν γυρνάνε στο σπίτι τους, -πάνε να βγάλουν το μεροκάματο και σκοτώνονται επειδή δεν υπάρχουν μέτρα ασφάλειας- με δεκάδες χιλιάδες ανάπηρους -πάρτε τα στοιχεία της Ευρωπαϊκής Ένωσης, τελειώνει ο χρόνος μου και δεν θέλω να τον καταχραστώ- με εκατομμύρια σακατεμένους από επαγγελματικές ασθένειες –κανένα μέτρο γι' αυτούς!- με πειραματόζωα εργαζόμενους, κυριολεκτικά πειραματόζωα, σε άθλιες συνθήκες (It's ironic, but it's tragic, with thousands of murdered workers who don't come home, -go out to get their wages and get killed because there's no safety precautions- with tens of thousands handicapped - see the information from the Union, I'm running out of time and I don't want to - with millions crippled by occupational diseases - no measure for them! - with workers like guinea-pigs, literal guinea-pigs, in squalid conditions)

Table 15: Randomly selected parliamentary texts (with english translations), classified as DISGUST and comprising the term 'handicapped'.

Disability
Όλες αυτές, λοιπόν, τις παρανομίες και έχει καλύψει πολλές επί των ημερών σας το Ελεγκτικό Συνέδριο—αναφέρομαι στα άτομα με ειδικές ανάγκες, αναφέρομαι στις συμβάσεις περί ωρομισθίων τόσες και τόσες—δε θα τις πάτε ούτε καν στο δικαστικό έλεγχο; Δε θα αφήσετε τελικά να ελεγχθούν μέσα απο τη διαδικασία που μέχρι σήμερα προβλέπεται; Αυτό είναι επικίνδυνο για τη λειτουργία της Δημοκρατίας. (So, all these illegalities and the Court of Auditors has covered many during your days—I'm referring to people with disabilities, I'm referring to the contracts on hourly wages and so many—you won't even take them to judicial review? Won't you finally let them be controlled through the procedure that has been provided for up to now? This is dangerous for the functioning of the Democracy.)
Είναι ένας ακραίος ρατσιστικός λόγος, ο οποίος προσφάτως είδαμε να απευθύνεται εναντίον συνανθρώπων μας, ατόμων με ειδικές ανάγκες και ιδίως εναντίων των Παραολυμπιονικών μας, με χαρακτηρισμούς τους οποίους δεν θέλω να επαναφέρω στην Αίθουσα του Κοινοβουλίου, που εκφεύγουν όχι από τα όρια της ευπρέπειας—αυτό μάλλον είναι πολυτέλεια για τον συγκεκριμένο κύριο—αλλά από οποιοδήποτε όριο μιας ανθρώπινης συμπεριφοράς εις βάρος των Παραολυμπιονικών, δηλαδή συνανθρώπων μας που δίνουν ένα παράδειγμα αγωνιστικότητας και ήθους στην ελληνική κοινωνία. (It is an extreme racist speech, which we have recently seen directed against our fellow human beings, people with disabilities and especially against our Paralympians, with characterizations which I do not want to bring back to the House of Parliament, which escape the bounds of decency - this rather it is a luxury for the particular gentleman - but beyond any limit of human behavior at the expense of the Paralympians, i.e. our fellow human beings who set an example of competitiveness and ethics in Greek society.)
Αν είναι έτσι, γιατί δεν διαμαρτύρεστε και γιατί δεν δείχνετε την ίδια ευαισθησία σε άλλες περιπτώσεις που τώρα τελευταία, διαβάζουμε καθημερινά στον Τύπο για τα λεγόμενα «άτομα με ειδικές ανάγκες», που κάθε μέρα κατακλύζουν διάφορες επιτροπές και περνούν και μπαίνουν δια της πλαγίας οδού στο δημόσιο και έχουμε «άτομα με ειδικές ανάγκες» που είναι ποδοσφαιριστές, «άτομα με ειδικές ανάγκες» που υπηρέτησαν στο στρατό σε μονάδες υποβρυχίων καταστροφών και δεν δείξατε την ίδια ευαισθησία και δεν στείλατε κανέναν απ' αυτούς στον εισαγγελέα; Αλλά, βρήκατε τους ανήμπορους γέροντες και κόβετε τις συντάξεις. (If so, why don't you protest and why don't you show the same sensitivity in other cases that lately, we read every day in the press about the so-called "people with disabilities", who every day overwhelm various committees and pass and enter the public and we have "people with disability" who are football players, "people with disabilities" who served in the army in submarine disaster units and you didn't show the same sensitivity and send any of them to the prosecutor? But, you found the infirm elderly and cut the pensions.)
Είναι μαξιμαλιστικό να ζητάς πίσω αυτά που έχεις πληρώσει με αίμα και θεωρήθηκαν εργατικές κατακτήσεις τα τελευταία εκατό χρόνια του εργατικού, του φεμινιστικού και του κοινωνικού κινήματος; Θέλετε να μου πείτε σήμερα στη Βουλή ότι ο κ. Κουρουμπλής τόσα χρόνια έχει απαιτήσει να τυπώνονται τα πάντα σε «Braille» και να μπαίνουν μέσα για τους τυφλούς; Θέλετε να μου πείτε ότι μπορείτε να πάρετε μέτρα ώστε να υποχρεώσετε τα πανεπιστήμια να παίρνουν τους τυφλούς ή τους άλαλους ή το οποιοδήποτε άτομο με ειδικές ανάγκες και να τα παίρνει υποχρεωτικά και να είναι έτσι; Πηγαίνουν τα παιδιά στο σχολείο με άνεση όταν έχουν κινητικά προβλήματα; Έχουν κάποιον να τα συνοδεύει; Ακούστε: Σ' αυτό το κράτος, αν δεν πληρώσεις, δεν ζεις. (Is it maximalist to demand back what you have paid for and considered labor conquests over the last hundred years of the labor, feminist and social movements? Do you want to tell me today in Parliament that Mr. Kouroumbilis has for so many years demanded that everything be printed in "Braille" and that it be entered for the blind? Are you telling me that you can take steps to make it compulsory for universities to take the blind or the mute or any person with disability and make them compulsory and be like that? Do children go to school comfortably when they have mobility problems? Do they have someone to accompany them? Listen: In this state, if you don't pay, you don't live.)
Όταν όλοι σας, τα κόμματα που έχουν κάνει κυβερνήσεις, έχετε εμπορευματοποιήσει την υγεία των ανθρώπων, τη μόρφωση των παιδιών μας, τις ανάγκες των ατόμων με ειδικές ανάγκες και τόσα άλλα, θα εξαιρέσετε τώρα τα δάση; Απλώς, το σερβίρετε, όπως το συνηθίζετε, με τον μανδύα του φιλολαϊκού, για να έχετε δήθεν διαφορές από τους προηγούμενους. (When all of you parties that have made governments have commercialized people's health, our children's education, the needs of people with disability and so much more, will you now exclude forests? You just serve it, as usual, with the mantle of the philanthropist, so that you have no differences from the previous ones.)

Table 16: Randomly selected parliamentary texts (with english translations), classified as DISGUST and comprising the term 'disability'.

Crazy
Οι υπόλοιποι; Είναι όλοι τρελοί και ψεύτες; Όλοι αυτοί που μιλάνε για όλα αυτά που γίνονται μέσα στην ΕΡΤ λένε ψέματα; Όλοι, μα όλοι, λένε ψέματα; Κανείς, μα κανείς, δεν αξίζει, δεν χρήζει του βασικού σεβασμού εν μέσω μιας κοινοβουλευτικής διαδικασίας να πάρει μια συγκεκριμένη απάντηση γι' αυτά που καταγγέλλει; Μα κανείς; Είστε δύο εδώ σήμερα. The rest? Are they all crazy and liars? Are all those who talk about all that is happening in ERT lying? Everyone, but everyone, is lying? No one, but no one deserves, does not need basic respect in the midst of a parliamentary process to get a concrete answer for what he complains about? But anyone? There are two of you here today. hline Αναρωτιέται ο Έλληνας πολίτης που ακούει όλα αυτά τα πράγματα για το εξής: Είστε τρελοί; Είστε τρελοί για δέσιμο εσείς της Κυβέρνησης ή απλά νομίζετε ότι ο Έλληνας τρώει κουτόχορτο; Νομίζετε ότι απευθύνεστε σε κάφρους και τα λέτε όλα αυτά; Καλείτε σε απεργία τους πολίτες, που εσείς οι ίδιοι εκτελώντας εντολές ξένων κέντρων τούς καταδικάσατε σε θάνατο. The Greek citizen who hears all these things wonders: Are you crazy? Are you, the Government, crazy or do you just think that the Greek are idiots? Do you think you are speaking to idiots and saying all this? You are calling the citizens to go on strike, which you yourself have condemned to death by executing orders from foreign centers.
Ποιος τρελός σήμερα θα ανοίξει επιχείρηση; Ποιος; Με ποιες συνθήκες; Με μία φορολογία που φτάνει το 45% όταν κύριε Πρωθυπουργέ, η ίδια δουλειά, η ίδια επιχείρηση στην Κύπρο πληρώνει 10% και στη Βουλγαρία 15% Ποια προστασία θα κάνουμε, κύριε Πρωθυπουργέ; Μου είχατε υποσχεθεί εδώ ότι θα μελετήσετε το φόρο διοξειδίου του άνθρακος που εφαρμόζει ο Σαρκοζί για τα ξένα προϊόντα, τα οποία έρχονται στη χώρα και λειτουργούν ανταγωνιστικά προς τα ελληνικά. Which crazy person today will open a business? Who? Under what conditions? With a tax that reaches 45% when Mr. Prime Minister, the same job, the same business in Cyprus pays 10% and in Bulgaria 15% What protection will we do, Mr. Prime Minister? You promised me here that you would study the carbon dioxide tax applied by Sarkozy for foreign products, which come into the country and operate in competition with the Greek ones.
Κυρίες και κύριοι συνάδελφοι, σας είπα και χθες: Δεν είναι απλώς άδικο και προκλητικό, είναι τρελό ένα ψιλικατζίδικο στη Σίκινο να πληρώνει τον ίδιο φόρο, το ίδιο τέλος με ένα μπαρ ρέστοραν στη Μύκονο που βγάζει πολλά εκατομμύρια ευρώ. Colleagues ladies and gentlemen, I also told you yesterday: It is not only unfair and provocative, it is crazy that a mini market in Sikinos pays the same tax, the same fee as a bar-restaurant in Mykonos that makes several million euros.
Μα, ποιος τρελός θα πάρει το εποχιακό κάτω απ' αυτούς τους όρους που το μειώνει κατά 50% και δεν θα προστρέξει αμέσως στην τακτική επιδότηση; Άρα έχουμε άδικο όταν λέμε ότι αυτή τροπολογία ουσιαστικά καταργεί το εποχιακό επίδομα; Ό,τι άλλο και αν επινοήσετε κύριε Υπουργέ, δεν μπορείτε να πείσετε κανέναν άνθρωπο που διαθέτει ελάχιστη κρίση, τη στοιχειώδη δυνατότητα να κρίνει. But what crazy person will take the seasonal under these conditions that reduce it by 50% and not immediately rush to the regular subsidy? So are we wrong when we say that this amendment effectively abolishes the seasonal allowance? Whatever else you invent, Mr. Minister, you cannot convince any human being who possesses the slightest judgment, the rudimentary ability to judge.

Table 17: Randomly selected parliamentary texts (with english translations), classified as DISGUST and comprising the term 'crazy'.