An Emotional Mess!
Deciding on a Framework for Building a Dutch Emotion-Annotated Corpus

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Abstract
Seeing the myriad of existing emotion models, with the categorical versus dimensional opposition the most important dividing line, building an emotion-annotated corpus requires some well thought-out strategies concerning framework choice. In our work on automatic emotion detection in Dutch texts, we investigate this problem by means of two case studies. We find that the labels joy, love, anger, sadness and fear are well-suited to annotate texts coming from various domains and topics, but that the connotation of the labels strongly depends on the origin of the texts. Moreover, it seems that information is lost when an emotional state is forcedly classified in a limited set of categories, indicating that a bi-representational format is desirable when creating an emotion corpus.

Keywords: NLP, emotion detection, emotion annotation

1. Introduction
When dealing with the task of automatically detecting emotions in texts – a well-studied topic in the field of natural language processing or NLP (Mohammad et al., 2018; Chatterjee et al., 2019) – the first bottleneck is data acquisition. Not only is there the need to collect a considerable amount of data, one also needs to decide on an appropriate framework to annotate these data instances in order to build an emotion corpus. Seeing the plethora of existing emotion frameworks, this decision is not trivial.

On the one hand, emotions can be represented as categories, typically by using a set of basic emotions. The frameworks of Ekman (1992) (with the basic emotions anger, disgust, fear, joy, sadness and surprise) and Plutchik (1980) (in which trust and anticipation are added) are the most popular ones, but many other theorists provided sets of basic emotions, counting up to 14 emotion categories, e.g. the emotion theory of Roseman (1984).

Dimensional models, on the other hand, represent emotions as vectors in a multidimensional space. Mehra and Russell (1974) claimed that this emotional space is defined by the axes valence (unhappiness-happiness), arousal (calmness-excitement) and dominance (submission-dominance), so that every emotional state can be described as a combination of values on these VAD-axes. However, in later work, Russell (1980) argued that only the dimensions valence and arousal are necessary for describing any emotional state, whereas Fontaine et al. (2007) claim a fourth dimension, unpredictability, is needed.

Building an emotion-annotated corpus thus requires some well thought-out strategies concerning annotation method and framework choice. However, in most emotion datasets, the motives on which a particular emotion framework is selected are unclear or the choice even seems arbitrary. In almost all studies, preference is given to categorical approaches for building datasets, but only very rarely a motivation, let alone an experimentally grounded one, is given.

Moreover, in psychology, where these frameworks originate from, not a single study deals with fully-fledged textual data. The theory of Ekman (1992) is based on visual expressions, and Plutchik (1980) built his wheel of emotions on psychoevolutionary and behavioral observations. The works of Shaver et al. (1987) (in which a similarity-sorting task and cluster analysis of a large number of emotion terms led to an extensive emotion taxonomy) and Mehra and Russell (1974) (who performed rating studies of emotion-eliciting situations, but also of emotional words on the VAD-dimensions) do work with textual data, but stick to word-level experiments. This raises questions about the validity of these frameworks for research in NLP. How should we then, in this jumble of emotion models, decide on a framework, so that our corpus is experimentally grounded, usable and reliable?

To tackle this problem, De Bruyne et al. (2019) established an emotion framework based on a cluster analysis on real-life data (in their case: Dutch Twitter messages), justifying their framework both theoretically and practically. This resulted in an experimentally grounded label set consisting of the five emotions joy, love, anger, nervousness and sadness. However, the study only focused on categorical models.

In this work, we will pursue the work by De Bruyne et al. (2019) and investigate label sets by means of two case studies, using real-life data. Study 1 addresses categorical annotations and the need for an experimentally grounded label set in two different domains, namely Dutch twitter messages and subtitles from reality TV shows, in order to investigate the importance of domain and topic on the label set. Study 2 explores dimensional annotations in the Twitter domain. We investigate the robustness of the VAD-model on real-life data, and examine how emotional categories relate to dimensions. This way, we can validate the use of both dimensional and categorical models for labeling ‘texts in the wild’, going beyond word-level experiments.

We find that the labels found by De Bruyne et al. (2019) (joy, love, anger, sadness and nervousness – or more generally: fear), are well-suited to annotate texts coming from...
(a) Leary’s rose, divided into the octants leading, helping, cooperative, dependent, withdrawn, defiant, aggressive, competitive (Leary, 1957).

(b) Ekman’s basic six: anger, fear, disgust, surprise, joy, sadness (Ekman, 1992).

(c) Plutchik’s wheel of emotions with basic emotions joy, trust, fear, surprise, sadness, disgust, anger, anticipation (Plutchik, 1980).

(d) The self-assessment manikin, a tool for annotating the emotional dimensions valence, arousal and dominance (Bradley and Lang, 1994).

Figure 1: Examples of emotion frameworks.

Various domains, but that the connotation of the labels strongly depends on the origin of the texts. Moreover, it seems that the categories joy and love cannot express all nuances of positive emotional states, indicating that information is lost when emotional states are forcedly classified in a limited set of categories.

This paper begins by discussing related work on frameworks for building emotion datasets in Section 2. It will then go on to the description of the experiments and its results (Section 3), with Study 1 on categorical label sets in Section 3.1 and Study 2 on dimensional annotations in Section 3.2. We end this paper with some concluding thoughts and suggestions in Section 4.

2. Related Work

2.1 Dutch emotion corpora

The availability of Dutch emotion-annotated corpora is extremely restricted. The deLearyous dataset (Vaassen and Daelemans, 2011) is the only publicly available Dutch emotion dataset known to us. The dataset consists of 740 Dutch sentences from conversations, annotated according to Leary’s Rose or the Interpersonal Circumplex (Leary, 1957). Leary’s Rose is a circumplex model defined by the two axes opposite-together (willingness to cooperate with listener) and above-below (how dominant or submissive the speaker is towards the listener), resulting in eight octants (leading, helping, cooperative, dependent, withdrawn, defiant, aggressive, competitive), as shown in Figure 1a.

The choice for Leary’s Rose as framework is remarkable, not only because it is the first study that uses this framework in the scope of emotion detection, but especially because it was developed for structuring interpersonal behavior in personality theory, rather than emotion theory. Moreover, in his doctoral thesis, Vaassen (2014) concludes that the performance of his machine learning system for classifying sentences into the quadrants or octants of Leary’s Rose is too low to be used in practice, and attributes this to shortcomings in gold-standard data: the data are too sparse, and the inter-annotator agreement is low (Fleiss Kappa of 0.37 for quadrants and 0.29 for octants). He suggests collecting larger datasets with higher agreement of emotion annotations for future work and encourages to work within a cross-domain framework to expand datasets.

2.2 Categorical frameworks in emotion corpora

When looking at other languages, we see that a substantial number of emotion corpora have been created by NLP researchers, but almost all of them focus on the English language. Categorical frameworks are dominant, and both Ekman’s (Figure 1b) and Plutchik’s (Figure 1c) set of basic emotions are popular. Even more often, variations of these
2.3 Dimensional frameworks in emotion corpora

Although dimensional models are used to a lesser extent in emotion detection, some researchers recently emphasized the potential of and even need for a dimensional approach. In an attempt to combat the plethora of emotion frameworks used in emotion detection studies, Schröder et al. (2006) expressed the need for a standardized model for annotating emotions. This resulted in the creation of the Emotion Annotation and Representation Language (EARL), but its construction was not data-driven nor experimentally grounded. Moreover, rather than having a universal and standardized framework, one could give preference to a well-motivated model, adjusted to the domain and task at hand. Pestian et al. (2012), for example, organised a shared task on emotion detection in suicide notes and employed a set of 15 emotions which might be indicative of suicidal behavior. However, tailoring the framework to the specific task or domain of the data only happens in rare cases, and in most studies, the motives for choosing a particular emotion framework are unclear (De Bruyne et al., 2019).

### Table 1: Most commonly used English emotion datasets and their frameworks.

<table>
<thead>
<tr>
<th>Dataset</th>
<th>Reference</th>
<th>Framework</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affect in Tweets</td>
<td>(Mohammad et al., 2018)</td>
<td>Plutchik + optimism, pessimism, love</td>
</tr>
<tr>
<td>Affective Text</td>
<td>(Strapparava and Mihalcea, 2007)</td>
<td>Ekman</td>
</tr>
<tr>
<td>Blogs</td>
<td>(Aman and Szpakowicz, 2007)</td>
<td>Ekman + no emotion, mixed emotion</td>
</tr>
<tr>
<td>Daily-Dialg</td>
<td>(Li et al., 2017)</td>
<td>Ekman + no emotion</td>
</tr>
<tr>
<td>Electoral Tweets</td>
<td>(Mohammad et al., 2015)</td>
<td>Acceptance, admiration, amazement, anger, anticipation, calmness, disappointment, disgust, dislike, fear, hate, indifference, joy, like, sadness, surprise, trust, uncertainty, vigilance</td>
</tr>
<tr>
<td>EmoBank</td>
<td>(Buechel and Hahn, 2017)</td>
<td>Valence, arousal, dominance + subset with additional Ekman annotations</td>
</tr>
<tr>
<td>EmoInt</td>
<td>(Mohammad and Bravo-Marquez, 2017)</td>
<td>Anger, fear, joy, sadness</td>
</tr>
<tr>
<td>Emotion in Text</td>
<td>(Figure Eight/CrowdFlower, 2016)</td>
<td>Anger, disgust, fear, joy, sadness, surprise, enthusiasm, fun, hate, love, boredom, relief, empty, neutral</td>
</tr>
<tr>
<td>Emotion-Stimulus</td>
<td>(Ghazi et al., 2015)</td>
<td>Ekman + shame</td>
</tr>
<tr>
<td>Facebook-VA</td>
<td>(Preoţiuc-Pietro et al., 2016)</td>
<td>Valence, arousal</td>
</tr>
<tr>
<td>ISEAR</td>
<td>(Scherer and Wallbott, 1994)</td>
<td>Ekman + guilt, shame</td>
</tr>
<tr>
<td>SSEC</td>
<td>(Schuff et al., 2017)</td>
<td>Plutchik</td>
</tr>
<tr>
<td>Tales</td>
<td>(Alm et al., 2005)</td>
<td>Ekman with positive surprise and negative surprise + neutral</td>
</tr>
<tr>
<td>TEC</td>
<td>(Mohammad, 2012)</td>
<td>Ekman</td>
</tr>
</tbody>
</table>

This considering, EmoBank was created by Buechel and Hahn (2017) in a bi-representational format: 10k sentences were annotated with VAD-scores, of which a subset also has annotations for Ekman’s six. The dimensional annotations were obtained using the 5-point self-assessment manikin or SAM-scale (see Figure 10), a pictorial scale depicting the VAD-dimensions (Bradley and Lang, 1994). Some studies have used a dimensional approach to categorical annotation, meaning that category ratings are used instead of discrete classes. Mohammad and Bravo-Marquez (2017) obtained ratings for the intensity of anger, fear, joy and sadness by using Best-Worst scaling. In this approach – which they claim to give more reliable scores than rating scales – annotators are given four items, of which they have to indicate which one is most representative for a certain emotion category (or highest on the emotional axis) and which one is not at all (lowest on the axis). This information is then converted into real-valued scores.

3. Experiments

The creation of a new Dutch emotion corpus is a necessity, as also claimed by Vaassen (2014). In order to build a corpus that is well-motivated and experimentally grounded, we explore both categorical and dimensional annotations on our data. Therefore, we perform two studies, one exploring categorical label sets obtained by a data-driven approach, and a subsequent study investigating how these categorical labels relate to emotional dimensions and how emotions described by the VAD-model behave on real-life data.
3.1. Study 1: Comparing categorical label sets obtained by a data-driven approach

3.1.1. Goal
In most studies on automatic emotion detection, the motives on which a particular emotion framework is selected are unclear or the choice even seems arbitrary. De Bruyne et al. (2019) combatted this problem and performed a cluster analysis of 25 emotion terms, based on the annotations of real-life data (Dutch Twitter messages). This resulted in a label set with the five emotions joy, love, anger, nervousness and sadness.

Claiming that the framework needs to be derived from experiments on real-life data from the same distribution as the data that is used for emotion detection, one could assume that experiments on data from other domains and even topics lead to other label sets. To verify this, we repeat the experiments done in the work of De Bruyne et al. (2019) on a new domain, namely subtitles of two Flemish reality TV shows, and compare the resulting clusters between tweets and subtitles and between different TV shows.

3.1.2. Method

Data Apart from the data used in the study of De Bruyne et al. (2019), namely Dutch Twitter messages (Tweet dataset), we collect additional data coming from a different domain: subtitles from reality TV shows (Subtitles dataset). A total of six episodes of two Flemish reality TV shows (Blind getrouwd and Bloed, zweet en luxeproblemen, see Figure 2) were transcribed. In Blind getrouwd, couples that never have met before get married, based on a match made by a team of experts. In the course of six weeks they test their match, after which they can decide to stay together or divorce. Bloed, zweet en luxeproblemen is a docuseries in which six adolescents travel to Asia and Africa to experience how luxury products are made. For three weeks, they get immersed in the life of inequality and hard work. The spontaneous utterances of the participants in the shows are transcribed, using a literal transcription method. From these transcripts, 300 utterances (sentences or short sequences of sentences) were chosen, roughly screened on the presence of emotional content.

Procedure Following De Bruyne et al. (2019), we label the utterances from the TV shows with a large set of 25 emotions obtained from Shaver et al. (1987), namely anger, contentment, disappointment, disgust, enthrallment, enthusiasm, envy, fear, frustration, irritation, joy, longing, love, lust, nervousness, optimism, pity, pride, rejection, relief, remorse, sadness, suffering, surprise, torment. The annotators were asked to project themselves into the speaker’s perspective and indicate which of the 25 emotions were (explicitly or implicitly) expressed by the speaker. There was no minimum or maximum for the number of emotions indicated as present.

The 300 utterances were labeled by a team of three experienced linguists, by splitting the dataset in batches of 100 utterances. The first annotator labeled the first and last batch, the second annotator labeled batch 2 and 3, and the third annotator only labeled the last batch. Inter-annotator agreement was calculated with Cohen’s Kappa (κ) between each annotator pair on batch 3, and the mean of those two scores was taken. As shown in Table 2, IAA varied largely depending on the emotion category. A fair (0.2 < κ < 0.4) to moderate (0.4 < κ < 0.6) agreement was observed for most categories. When the emotions that were never indicated as present by at least one annotator (envy, relief and torment) were disregarded, we obtained an average Kappa score of 0.444 (moderate agreement). The average Kappa score between the first two annotators was 0.438; between the last two 0.475; and 0.402 between annotator 1 and 3.

The annotations for the first batch were taken by annotator 1, of the second batch by annotator 2 and the last batch by

<table>
<thead>
<tr>
<th>Emotion</th>
<th>κ</th>
<th>Emotion</th>
<th>κ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anger</td>
<td>0.510</td>
<td>Lust</td>
<td>1</td>
</tr>
<tr>
<td>Contentment</td>
<td>0.461</td>
<td>Nervousness</td>
<td>0.315</td>
</tr>
<tr>
<td>Disappointment</td>
<td>0.188</td>
<td>Optimism</td>
<td>0.438</td>
</tr>
<tr>
<td>Disgust</td>
<td>0.328</td>
<td>Pity</td>
<td>0.597</td>
</tr>
<tr>
<td>Enthrallment</td>
<td>0.386</td>
<td>Pride</td>
<td>0.524</td>
</tr>
<tr>
<td>Enthusiasm</td>
<td>0.431</td>
<td>Rejection</td>
<td>0.357</td>
</tr>
<tr>
<td>Envy</td>
<td>nan</td>
<td>Relief</td>
<td>nan</td>
</tr>
<tr>
<td>Fear</td>
<td>0.254</td>
<td>Remorse</td>
<td>0.602</td>
</tr>
<tr>
<td>Frustration</td>
<td>0.644</td>
<td>Sadness</td>
<td>0.678</td>
</tr>
<tr>
<td>Irritation</td>
<td>0.423</td>
<td>Suffering</td>
<td>0.442</td>
</tr>
<tr>
<td>Joy</td>
<td>0.529</td>
<td>Surprise</td>
<td>0.079</td>
</tr>
<tr>
<td>Longing</td>
<td>0.528</td>
<td>Torment</td>
<td>0.01</td>
</tr>
<tr>
<td>Love</td>
<td>0.061</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2: IAA scores per emotion category.

Figure 2: Transcribed TV shows.
annotator 3. Utterances for which not a single emotion was indicated as present were considered objective and were excluded from further analysis, resulting in a final Subtitles set of 293 emotional utterances, of which 151 are from Blind getrouwd and 142 from Bloed, zweet en luxeproblemen.

Considering the annotations as vectors per emotion category, we end up with 25 n-dimensional vectors, with n depending on the number of utterances taken into account. We construct a 25x25 distance matrix for the total Subtitles set and for the two subsets by measuring the Dice dissimilarity between each emotion vector pair. This is used as input for a hierarchical cluster analysis, with Ward’s method (Ward Jr, 1963) as clustering algorithm.

First, we look at the newly annotated Subtitles set and do a frequency analysis. Then, a cluster analysis is executed, first on a merged set of both TV shows, then for the two shows separately. The dendrograms resulting from this hierarchical cluster analysis are compared between domains, namely Subtitles and Tweets (dendrograms from Twitter data taken from De Bruyne et al. (2019)), and between different topics, namely the different TV shows (Blind getrouwd en Bloed, zweet en luxeproblemen).

We validate the label sets obtained by the cluster analysis by mapping them in the VAD-space. The mapping is based on the ratings of the label set’s terms in the Dutch VAD-lexicon of Moors et al. (2013). This lexicon was developed in the field of psychology and consists of 4,300 Dutch words, rated on valence, arousal, dominance and age of acquisition. The mapping will show the distribution of the new labels along the VAD-axes.

3.1.3. Results

Frequency analysis Figure 3 shows the frequencies of emotion categories indicated as present in the subsets of Blind getrouwd and Bloed, zweet en luxeproblemen. Seeing that some emotions are underrepresented in the data, we decide to leave the categories with fewer than 10 instances in the full dataset and fewer than 5 instances in the subsets out of consideration, meaning that envy and lust are discarded in the full dataset. For Bloed, zweet en Luxeproblemen, envy, lust and longing are discarded.

Cluster analysis Figure 4 shows the dendrogram of the hierarchical cluster analysis of the complete Subtitles dataset (293 utterances), without the categories envy and lust. Same as in the Tweets dendrogram (Figure 4), obtained from De Bruyne et al. (2019), the first separation of the tree makes the distinction between positive emotions on the left-hand side and negative emotions on the right. For both Subtitles and Tweets, the positive emotions separate into two clusters, one with terms related to joy and one with terms related to love (although the composition differs). However, the negative side looks somewhat different. In the Tweets dendrogram, the negative emotions cluster around the categories anger, sadness and nervousness (related to fear), but in the Subtitles tree, sadness and anger are clustered together, giving space to a new cluster containing remorse, disgust and pity. We suspect that the latter cluster is very much influenced by the utterances from Bloed, zweet en luxeproblemen. The third negative cluster has suffering/torment and fear/nervousness as its cores, strangely accompanied by surprise. However, the many utterances in Blind getrouwd where the participants are nervous, shocked and surprised by the news of their blind wedding, could explain the composition of these clusters.

For Bloed, zweet en luxeproblemen, the tree is more similar to the one for Tweets. Surprise is here clustered together with sadness, representing the participants’ shock when being confronted with all the distress and inequality in the communities they visit. Disgust, which is – if it is not seen as a basic emotion on its own – most commonly merged with anger, is here clustered together with sadness as well, probably for the same reason.

We thus can conclude that the labels joy, love, anger, sadness and nervousness (or more generally: fear), are well suited to annotate texts coming from various domains, but that the composition of the clusters and the connotation of the labels strongly depend on the origin of the texts.

Mapping in VAD-space The labels joy, love, anger, sadness and fear have been selected by means of a data-driven approach, making them more experimentally grounded.
than the randomly chosen label sets used in most studies on emotion detection. However, another criticism on the commonly used label sets, more specifically on Ekman’s six, is that these emotion categories are not equally distributed along the axes of valence and arousal (Buechel and Hahn, 2016). Indeed, in Ekman’s six, only one category is unambiguously positive (joy), while anger, sadness and generally also fear, are negative. Surprise, however, can be either positive or negative. By discarding disgust as a separate category and adding love, this distribution becomes a bit more equal, at least regarding valence.

We show this graphically by mapping the emotion categories of Ekman into the VAD-space and we compare it with our proposed labels (Figure 5). The mapping is based on the ratings of the label set’s terms in the Dutch VAD-lexicon of Moors et al. (2013). The mapping of these Dutch emotion terms is very similar to the English mapping by Mehrabian and Russell (1974) (Figure 6), with the exception that surprise is placed more neutrally on the valence axis compared to the English version (where it has a more positive score). This is also more in line with the observation that surprise can be both positive and negative.

Contrary to emotion categories, for which we showed their interpretation and connotation is domain-dependent, dimensional annotations seem fairly robust, at least across different languages/rating studies. Moreover, seeing the variation in interpretability of emotional categories, dimensional annotations could offer an important added value to emotion corpora, reinforcing the need for dimensional or bi-representational datasets.
3.2. STUDY 2: Validating dimensional annotations

3.2.1. Goal
When using a dimensional emotion framework, the VAD-model is the most common one. According to Mehrabian and Russell (1974), every emotional state can be described using the dimensions valence, arousal and dominance. For illustration, they placed several emotional terms, including Ekman’s basic emotions, in the 3-dimensional space (see Figure 6). Following the line of thought of the study in 3.1, we want to investigate if real-life data (‘sentences in the wild’), can be mapped in a similar way in the VAD-space. Assuming that every sentence is written under a certain emotional state, sentences with a similar state should be mapped close to each other. We will link this to the emotional categories obtained in study 3.1 to evaluate a) the validity of the VAD-model (is it also robust for sentences?) and b) the usefulness of the categories obtained in study 3.1 (can we find clusters in the VAD-space that correspond to these categories?).

3.2.2. Method
Data
For this study, 1000 tweets were labeled with a) the categories obtained from Study 1 (Section 3.1) and b) scores for the dimensions valence, arousal and dominance. The tweets were collected as described by De Bruyne et al. (2019).

Procedure
For the categorical annotation, a single-label method is used, meaning that the annotators had to choose one out of the five emotions joy, love, anger, fear and sadness. Related emotion categories and terms from the clusters were given to the annotators, so that they had a clear comprehension of what the emotion categories consisted of. When these emotions were not uttered in the tweet, the annotators could label the tweet with either other or neutral. However, the other category was only very rarely indicated (15 cases) and could be omitted by replacing it with one of the five emotion categories in a revision round.

Two annotators executed this task. The dataset was split in two parts, so that both annotators labeled 500 sentences. Additionally, annotator 2 labeled 100 tweets from annotator 1’s batch, in order to calculate inter-annotator agreement. Using Cohen’s Kappa, we found a global inter-annotator agreement of 0.504, which is seen as moderate agreement. When looking at the separate categories, we found a substantial agreement (0.6 < $\kappa$ < 0.8) for anger ($\kappa$ = 0.608) and sadness ($\kappa$ = 0.682) and fair agreement for fear ($\kappa$ = 0.313), joy ($\kappa$ = 0.380) and love ($\kappa$ = 0.210). For the neutral category, a moderate agreement was found ($\kappa$ = 0.513).

For the dimensional annotation, we used the Best-Worst scaling approach, performed by a single trained linguist. In a previous study we conducted, we found that inter-annotator agreement was significantly higher when best-worst scaling was used compared to rating scales for labeling tweets on the dimensions valence, arousal and dominance (Krippendorff’s alpha: 0.721, 0.349 and 0.352 for respectively valence, arousal and dominance in Best-Worst, versus 0.582, 0.242 and 0.112 in rating scale annotations).

The 1000 tweets were converted into 2000 4-tuples, meaning that the annotator got to see 2000 trials of 4 tweets each. For each trial, the annotator had to indicate the best and worst example for each of the VAD-dimensions (i.e. highest valence and lowest valence, highest arousal and lowest arousal, and highest dominance and lowest dominance). These counts were converted to scores with the Rescorla-Wagner update rule (Rescorla et al., 1972), that assigns values to items based on the results of Best-Worst annotations. Each tweet is mapped into the three-dimensional VAD-space, using its scores obtained from the Best-Worst scaling annotation (after applying the scoring rule) as co-ordinates. A different color is used depending on the tweet’s categorical annotation. For every category, the average valence, arousal and dominance is calculated for the tweets corresponding to that category, resulting in an average vector per category. These vectors are also drawn in the VAD-space.

3.2.3. Results
Figure 7a shows the mapping of all instances per category mapped in the VAD-space. A clear distinction is visible between the anger (blue) and joy (green) cloud, mostly divided in terms of valence. In the negative valence area, anger is more or less separated from sadness and fear on the dominance axis. Joy and love seem to overlap rather strongly.

The separations become even clearer when looking at average vectors: for every dimension of the space, we took the average score per category and mapped these vectors in the space as well. The average VAD-scores for the five categories are shown in Figure 7b. Indeed, we see that joy and love are very close to each other in the VAD-space, while the negative emotions are better separated. Fear mostly dif-

(a) Mapping of tweets into the VAD-space, based on VAD-annotations. Represented in different colours depending on the tweet’s categorical annotation.

(b) Mapping of emotion categories into the VAD-space, based on average valence, arousal and dominance of the tweet annotations.

Figure 7: Mapping of tweets into the VAD-space, based on VAD and categorical annotations.
fers from anger in terms of dominance, while fear and sadness mainly diverge on the arousal axis.

The image from Figure 7b is very similar to the mapping of individual emotion terms (Figure 5), with the difference that the mapping based on sentences is shifted somewhat down on the dominance axis and that the positive categories are placed in a more neutral area of the valence axis.

On the one hand, this shows that the VAD-model is rather robust (similar mapping for terms and sentences). On the other hand, the wider spread of the positive emotion categories also indicates that quite some information is lost when an emotional state is forced to be pigeon-holed in only a limited number of categories. This again strengthens the suggestion of using dimensional labels as well.

4. Conclusion

In this study, we addressed the problem of choosing an appropriate framework for building an emotion-annotated corpus. Virtually all emotion detection works fall short of giving a motivation for the framework choice, let alone a practically grounded one. Moreover, in the field of psychology (where these frameworks originate from), not a single study deals with fully-fledged textual data, making it unclear whether these frameworks can successfully be adopted for research in NLP.

In this work, we performed two case studies, using real-life data. Study 1 addressed categorical annotations. By means of a cluster analysis, we examined the importance of domain and topic on categorical label sets in two different domains, namely Dutch twitter messages and subtitles from reality TV shows. Study 2 explored the robustness of the VAD-model on real-life data, and examined how emotional categories relate to dimensions.

We found that the labels from the cluster analysis (namely anger, fear, joy, love and sadness), are well-suited to annotate text from various origins, but that the composition of the clusters and the connotation of the labels strongly depends on the domain and topic of the texts. Moreover, although this label set already has one positive emotion extra compared to Ekman, it seems that the categories joy and love cannot express all nuances of positive emotional states, indicating that information is lost when emotional states are forcibly classified in a limited set of categories. Dimensional annotations, on the other hand, seemed fairly robust, at least regarding language, rating study and text type (words versus sentences). Following Buechel and Hahn (2017), we thus believe in the advantage of a bi-representational corpus design, where categorical labels are accompanied by dimensional annotations.

These findings will help us in the creation of a Dutch Emotion Corpus, in which Dutch Tweets and subtitles from reality TV shows will be annotated both with the categorical labels anger, fear, joy, love and sadness, and with scores for the dimensions valence, arousal and dominance. Moreover, by including different domains and topics, we meet the suggestion made by Vaassen (2014) of working within a cross-domain setting.

5. Acknowledgements

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