RUNNING HEAD: Turkish Emotional Word Norms

Turkish Emotional Word Norms for Arousal, Valence, and Discrete Emotion Categories

Aycan Kapucu¹, Aslı Kılıç², Yıldız Özkılıç Kartal³, and Bengisu Sarıbaz¹

¹ Department of Psychology, Ege University

² Department of Psychology, Middle Eastern Technical University

³ Department of Psychology, Uludag University

Figures: 3

Tables: 5

Corresponding Author:

Aycan Kapucu

Department of Psychology, Ege University

Ege Üniversitesi Edebiyat Fakültesi

Psikoloji Bölümü, Kampus, Bornova,

35400, İzmir, Turkey

Phone: +902323111340

Email: aycankapucu@gmail.com

Abstract

The present study combined dimensional and categorical approaches to emotion to develop normative ratings for a large set of Turkish words on two major dimensions of emotion: arousal and valence, as well as on five basic emotion categories of happiness, sadness, anger, fear, and disgust. A set of 2031 Turkish words obtained by translating ANEW (Bradley & Lang, 1999) words to Turkish and pooling from the Turkish Word Norms (Tekcan & Göz, 2005) were rated by a large sample of 1685 participants. This is the first comprehensive and standardized word set in Turkish offering discrete emotional ratings in addition to dimensional ratings along with concreteness judgments. Consistent with ANEW and word databases in several other languages, arousal increased as valence became more positive or more negative. As expected, negative emotions (anger, sadness, fear, and disgust) were positively correlated with each other; whereas the positive emotion, happiness, was negatively correlated with the negative emotion categories. Data further showed that the valence dimension was strongly correlated with happiness and the arousal dimension was mostly correlated with fear. These findings show highly similar and consistent patterns with word sets provided in other languages in terms of the relationships between arousal and valence dimensions, relationships between dimensions and specific emotion categories, relationships among specific emotions, and further support the stability of the relationship between basic discrete emotions at the word level across different cultures.

Keywords: arousal, valence, discrete emotions, word norms

Many aspects of behavior and cognition is affected by emotion, such as memory (Kuperman, Estes, Brysbaert, & Warriner, 2014; Windmann & Kutas, 2001; Dougal & Rotello, 2007; Kapucu, Rotello, Ready, & Seidl, 2008; Thapar & Rouder, 2009; White, Kapucu, Bruno, Rotello, & Ratcliff, 2014), visual attention (Rowe, Hirsh, & Anderson, 2007) or automatic vigilance (Estes & Verges, 2008). Stimuli sets that include words (e.g. Bradley & Lang, 1999 for English word norms), pictures (e.g., Lang, Bradley, & Cuthbert, 1997), and digitalized sound (e.g.; Stevenson & James, 2008) have been normed for the benefit of research on various areas of psychology. The aim of this study was to develop a normed set of Turkish words rated on five basic emotion categories (happiness, sadness, anger, fear, disgust) as well as on dimensions of valence and arousal, and further present the relationship between the normed dimensions and basic categories.

There are two general approaches to how emotions are conceptualized. According to the dimensional models, emotions are defined along two major dimensions of *arousal* which ranges from calm to exciting and *valence* which ranges from negative to positive (Russell, 1980). In this model, anger and sadness are both negative emotions but anger is placed higher on the arousal dimension than sadness; whereas happiness and fear are more similar in terms of high arousal but one is positive while the other is negative.

In contrast to the dimensional approaches, categorical models focus on specific emotions and classify them in discrete categories (Ekman, Sorenson, & Friesen, 1969; Levenson, 2003). There is no definitive agreement on the exact number of categories but at least five are consistently considered to be basic and universal across different cultures and age periods: happiness, sadness, anger, fear, and disgust (Briesemeister, Kuchinke, & Jacobs, 2011a; Ferré, Guasch, Martínez-García, Fraga, & Hinojosa, 2017). Emotion categories can be dissociated from each other with behavioral and physiological patterns specific to each emotion (Ekman 1992).

For example, negative emotions such as fear, anger and disgust activate physiological systems to provide support for fleeing or fighting in the evolutionary perspective (Levenson, 2003).

Recently, this approach has been extended to include additional and more complex emotion categories such as pride, guilt, and compassion (e.g., Griskevicius, Shiota, & Nowlis, 2010).

Studies investigating interactions between emotion and cognition have adopted various materials as experimental stimuli including words, photographs of facial expressions, images of scenes, film and music clips, and environmental sounds. Word stimuli are frequently preferred by researchers, especially in studies exploring the effects of emotion on memory, as they offer opportunities to control for several stimulus properties beyond emotion (frequency, concreteness, familiarity, semantic relatedness, etc.) that might affect and confound memory performance (e.g., Talmi & Moscovitch, 2004; Dougal & Rotello, 2007). In addition to the experimental control advantage of using words against pictorial material, some researchers suggest that verbal materials are appropriate for reflective (systematic) processing while pictorial materials are appropriate for automatic (heuristic) processing (Imbir, 2015). The literature provides substantial evidence for memory differences between emotional and neutral materials: Memory accuracy has been shown to increase for emotional words compared to neutral ones (see Kensinger & Schachter, 2008; for a review); furthermore negatively-valenced words were consistently reported to lead to a more liberal response bias in recognition memory tests, as participants were more likely to endorse negative items as “studied” compared to positive or neutral items, regardless of an accompanying advantage in memory accuracy (e.g., Windmann & Kutas, 2001; Dougal & Rotello, 2007; Kapucu et. al., 2008; Thapar & Rouder, 2009; White et. al., 2014).

Studies from lexical decision tasks further investigate how cognitive demands influence the processing of affective words compared to neutral stimuli (Briesemeister, Kuchinke, & Jacobs, 2011a). In a series of behavioral and neuroimaging experiments, Briesemeister and

colleagues showed how discrete affective information differs from dimensional information: not only emotion's intensity (high vs. low) affected lexical decision performance but also discrete emotions of the same valence affected lexical decision reaction times differently (Briesemeister et al., 2011a, Briesemeister et al., 2011b). Furthermore, EEG and neuroimaging results revealed that discrete affective information was processed earlier than dimensional information (Briesemeister et al., 2014) and these two kinds of information activated different brain areas (Briesemeister et al., 2015). Similarly, studies on attentional control suggest that emotional words are processed more rapidly than neutral stimuli (Kanske & Kotz, 2011). Word stimuli are important not only in psychological research but also in developing natural language processing systems (Calvo & D'Mello, 2010).

The Affective Norms for English Words (*ANEW*; Bradley & Lang, 1999) is the most frequently used database for emotional words. *ANEW* words were developed based on dimensional approach: each word in the set has normed values for arousal, valence, and dominance (whether you feel dominated or in control). *ANEW* has been adapted to many other languages of different cultures such as Spanish (Redondo, Fraga, Padrón, & Comesaña, 2007), Portuguese (Soares, Comesaña, Pinheiro, Simões, & Frade, 2012), Finnish (Eilola & Havelka, 2010), and Italian (Montefinese, Ambrosini, Fairfield, & Mammarella, 2014). Similar emotional word norms have also been developed for French (Monnier & Syssau, 2014), German (Vö et al., 2009; Lahl, Göritz, Pietrowsky, & Rosenberg, 2009), Dutch (Moors et al., 2013), and Spanish (Ferré et al., 2017; Stadthagen-González, Imbault, Pérez Sánchez, & Brysbaert, 2017) words.

Although the effects of emotion on cognitive functioning have so far been mostly discussed within the framework of dimensional theory, more recent studies reported different effects of specific emotions beyond valence and arousal (e.g., Chapman, Johannes, Poppenk, Moscovitch & Anderson, 2012; see Angie, Connelly, Waples, & Kligyte, 2011; for a review). For

instance, anger and fear, two emotions that are similar in terms of both arousal and valence were shown to influence cognitive processes such as attention (Ford, Tamir, Brunye, Shirer, Mahoney, & Taylor, 2010), memory (Davis et al., 2011; Kapucu, Arıkan İyilikçi, Eroglu, & Amado, *in press*) and decision making (Arıkan İyilikçi & Amado, 2018) in different, often contrasting, ways.

Consistent with categorical approaches of emotion, Stevenson, Mikels and James (2007) reclassified ANEW words by providing ratings on each word for five specific emotion categories (happiness, sadness, anger, fear, disgust). Dimensional word norms in other languages have also been extended to include ratings for specific emotions (*German*; Briesemeister et al., 2011b; *Spanish*; Ferré et al., 2017 and other norms have also been developed with new set of words in English (Strauss & Allen, 2008), German (Briesemeister et al., 2011b), French (Ric, Alexopoulos, Muller, & Aubé, 2013), and Spanish (Hinojosa et. al., 2016).

As of date, there is not a comprehensive and standardized word set in Turkish yet to be used in studies of emotion and cognition. The present study aimed to combine dimensional and categorical approaches to develop normative ratings for a large set of 2031 Turkish words on two major dimensions of emotion: arousal and valence, as well as on five basic emotion categories of happiness, sadness, anger, fear, and disgust. Such a normed set is urgently needed for researchers in or outside of Turkey who wish to conduct studies using Turkish words to explore interactions between emotions and cognitive processes.

Method

Participants

A total of 1527 native Turkish speakers (952 women) took part in the study in exchange of course credit. The mean age of the participants was 22.56 ($SD = 2.81$) ranging from 18 to 58

years old. Participants were recruited from the METU research participation pool (92% of the sample), Ege University (5% of the sample) and other universities in Turkey.

Materials and procedure

A set of 2031 Turkish words were obtained by translating ANEW words to Turkish and pooling from the Turkish Word Norms (Tekcan & Göz, 2005). Each volunteering participant who was registered in the human participation pool received a Qualtrics link that allowed them to rate a total of 50 words that was randomly assigned from the word set. Prior to being presented with the assigned words, participants received instructions for rating five discrete emotions (happiness, anger, sadness, fear, disgust) in addition to the instructions for ratings of valence and arousal dimensions. The Self-Assessment Manikins (SAM, Bradley & Lang 1994) were presented for valence and arousal, and participants were advised to use those manikins throughout the survey.

Words were presented at the top center of the screen in upper-case Ariel font, 16-point bold. First, valence and arousal dimensions were asked on a 9-point Likert SAM scale (Bradley & Lang 1994). Then, in the following set of questions, participants were asked to rate each categorical emotion along with concreteness of the word with a sliding scale ranging from 0 (low intensity) to 100 (strong intensity). After completing all ratings for one word, the next word appeared on the following screen. All participants received the same 5 words (e.g., MICROPHONE, IMPOUNDAGE, ROUTINE, CAMPAIGN, PATTERN) as practice trials and they were informed when the practice ended. The ratings to the practice words were not included in the final analyses. Once the participant rated 50 words, a demographics screen was presented. On average, each word was rated by 35 participants.

Results and Discussion

The final word set included ratings for 2031 words, which is available in the Open Science Framework page <https://osf.io/rxtm/>. For each word, the number of participants who

were assigned the word (N) was presented. That can be considered as an approximate number because not every participant who received the word rated it in every dimension. The following columns show the mean and the standard deviation for valence and arousal ratings respectively. Following that, mean ratings for categorical emotions (happiness, anger, sadness, fear, disgust) and their standard deviations were presented along with mean concreteness ratings and the standard deviation for those ratings.

The descriptive statistics for each rating scale is presented in Table 1. Average valence and arousal ratings across the norm set are 4.93 (SD = 1.58) and 5 (SD = 0.91) respectively. These values and the range of these dimensions (Valence: 1.22 – 8.38; Arousal: 2.57 – 7.94) suggest that the norm set consists of a wide range of words.

Reliability of the measurements

In order to explore the interrater reliability, split-half intergroup procedure was applied. Responses for each word were divided into two groups that were sampled randomly. The correlations between the mean ratings of the subgroups were calculated. This procedure was repeated for 100 times and consequently, 100 Pearson correlation coefficients were obtained for each dimension and emotion category rating (see Stadthagen-Gonzalez et al., 2017, for a similar approach). The distributions of the Pearson correlation coefficients are presented in Figure 1. The mean value of the correlation coefficients shows high and positive correlations for all variables (Valence: $M = .92$, $SD = .002$; Arousal: $M = .70$, $SD = .007$; Happiness: $M = .92$, $SD = .003$; Anger: $M = .87$, $SD = .004$; Sadness: $M = .88$, $SD = .004$; Fear: $M = .85$, $SD = .005$; Disgust: $M = .83$, $SD = .005$; Concreteness: $M = .93$, $SD = .003$) when subgroups were sampled randomly.

Gender differences

The difference among ratings was analyzed by presenting the descriptive statistics for each variable across gender groups.

The Pearson correlation coefficients between female and male participants for dimensional scales and discrete categorical emotions were strong and positive (Table 2). This suggests that both dimensional ratings and categorical ratings are comparable across gender (see also Ferré et al., 2017). However, when the correlation coefficients are compared with the coefficients obtained from the reliability measures, one can observe that the correlation coefficients between genders are in fact outside the ranges presented in Figure 1. The highest discrepancy across genders is observed for arousal ratings. For example, males rated ORGASM higher ($M = 8.2$, $SD = 0.79$) than females ($M = 6.5$, $SD = 2.33$) whereas females rated LOVE ($M = 7.35$, $SD = 1.36$) to have higher arousal value compared to males ($M = 5.09$, $SD = 2.54$). That means, gender differences are mostly observed for the ratings of arousal, while the concreteness ratings had the highest correlation coefficient. This suggests that differences observed in emotion ratings could depend on gender but concreteness ratings are more consistent across genders.

When we look at the average ratings across gender, male participants rated words significantly higher than female participants consistent with earlier findings in other languages (e.g., Ferré et al., 2017; but see Stevenson et al., 2009). More specifically, pair-wise t-test results showed that the average rating of male participants were greater than female participants for valence, $t(2030) = 3.28$, $p < .01$, arousal, $t(2030) = 4.70$, $p < .001$, happiness, $t(2030) = 15.99$, $p < .001$, anger, $t(2030) = 20.94$, $p < .001$, sadness, $t(2030) = 11.99$, $p < .001$, fear, $t(2030) = 6.93$, $p < .001$, and disgust, $t(2030) = 24.42$, $p < .001$. However, it should also be noted that despite the significance of these results, the size of the effects could be minimal, such that the gender difference across valence ratings is 0.05 on a scale from 1 to 9, and similarly, the raw difference is 4.23 on a scale from 0 to 100 for happiness ratings.

Relationship between dimensions and discrete categorical emotions

In this section, we analyzed the pattern of correlations between affective dimension and discrete emotions. Figure 2 depicts the scatterplots and Pearson correlation coefficients across the dimensions and discrete emotions along with the distributions for each variable. There are two important findings that can be observed in these relationships. First, the correlation between valence and arousal ratings were not significantly different from 0 ($r = 0.004$), which further supports the well described finding that these ratings are reflecting two different dimensions of emotions. Related to this point, the curvilinear relationship between valence and arousal further indicate that words that have lower and higher valence values also have higher arousal values (see also Hanojasa et al., 2016). For example, the words MASSACRE and FREEDOM have high arousal values ($M = 7.58$), but the mean valence for MASSACRE ($M = 1.26$) is lower than FREEDOM ($M = 8.15$).

Second, the correlation coefficients indicate that valence is positively and strongly correlated ($r = 0.85$) with happiness but negatively correlated with negative emotions (anger: $-.71$, sad: $-.69$, fear: $-.63$, disgust: $-.68$). Despite their lower values, arousal was found to be positively correlated with all discrete emotion categories. However, a visual inspection of the scatterplots between arousal and discrete emotions show a curvilinear pattern, suggesting that higher values of arousal are observed with both higher and lower end of the scale of discrete emotions. For example, MOTHER has both high arousal ($M = 7.27$) and happiness ($M = 89$) ratings, while RAPE has a high arousal ($M = 7.43$) but a low happiness rating ($M = 1$). Similarly, words that received high arousal ratings also received both low and high ratings of anger. As another example, SPRING has a moderate high arousal rating ($M = 6.45$) along with a low anger rating ($M = 3.35$), whereas, BOMB has both high arousal ($M = 7.94$) and anger ($M = 92.13$) ratings. Finally, the correlation ($r = .46$) between arousal and fear was the highest among all discrete emotions, consistent with the findings in affective norms for Spanish words (Ferré et al.,

2017). Similar to Ferré et al.'s results, the lowest correlation among arousal and negative emotions was observed for disgust ($r = .27$). DIRT can be considered as an example with high ratings of disgust ($M = 80.97$) and neutral ratings of arousal ($M = 4.88$).

Relationship between five categorical emotions

As depicted in Figure 2, Pearson correlation results showed that all emotional categories were correlated with each other. As expected, negative emotions (anger, sadness, fear, and disgust) were positively correlated whereas the positive emotion, happiness, was negatively correlated with the negative emotion categories (see Ferré et al, 2017; Stadthagen-Gonzales et al., 2017).

The comparison between the correlation coefficients among negative emotions shows that the words that received higher anger ratings also received higher ratings for other negative emotions such as sadness ($r = .78$) and disgust ($r = .79$). Similarly, sadness and fear ratings were highly correlated ($r = .79$) whereas, the correlation between disgust ratings were relatively low for sadness ($r = .59$) and fear ratings ($r = .58$). In summary, patterns observed in the relationship across discrete emotions replicates the findings presented in the literature for Spanish words (Ferré et al, 2017; Stadthagen-Gonzales et al., 2017).

Distribution of words among discrete emotions

The distribution of words among discrete emotion categories was explored in a way similar to the classifications conducted in previous research (Hinojosa et al., 2016; Ferré, et al., 2017). Each discrete emotion category was split into high and low emotion groups, such that if the ratings exceeded 50, words were considered as belonging to high emotion group, otherwise low emotion group. If a word had values for all discrete emotion categories lower than 50, that word was considered as a neutral word. Based on this classification, 40.87% of 2031 words can be considered as neutral, which on average had neutral valence ($M = 4.86$, $SD = 0.70$) and neutral

arousal ($M = 4.29$, $SD = 0.70$) ratings (Table 3). A comparison between the percentages of the words that fall under each emotion category and the percentages reported by Ferré et al. (2017) and Hinojosa et al. (2016) suggests that these distributions agree with earlier studies on affective norms for Spanish words except the highest proportion of the words among negative emotion categories. In our study, the percentage of words was greatest for the words that received high sadness ratings rather than fear ratings as in the earlier studies. However, the percentage was lowest for the words that received high ratings for disgust as reported by Ferré et al. (2017) and Hinojosa et al. (2016). In addition to that, the average values of valence and arousal were consistent with the words that were classified in a certain emotion category. For example, the average valence rating for the words that were considered in happiness category was found to be 6.48 ($SD = 0.88$) whereas the average valence rating for the words classified in the anger category is 2.90 ($SD = 1.07$). Similarly, as consistent with the Pearson correlation coefficients, words that were classified in the fear category received the highest ratings of arousal. That is, words that received high ratings for the fear emotion also received high ratings for the arousal dimension.

We also investigated whether words belonging to a specific discrete emotion category also have differences in their concreteness ratings. Consistent with the results presented in Ferré et al.'s (2017) study, words that received the highest disgust ratings also received the highest ratings for concreteness ($M = 70.56$, $SD = 21.27$). The next most concrete set of words was the neutral words which did not receive high ratings for any of the emotion categories ($M = 66.42$, $SD = 22.83$) and the difference was not statistically significant, $t(57.31) = 1.35$, $p = 0.18$. That was followed by the words that received the highest ratings for the fear emotion ($M = 60.11$, $SD = 24.34$) and the concreteness ratings were significantly lower than the concreteness ratings for the neutral words, $t(190.86) = -2.90$, $p < .01$. The mean concreteness ratings for the words that

received the highest ratings for the happy emotion ($M = 58.15$, $SD = 26.02$) was similar to the mean concreteness ratings for the fear words, $t(221.61) = -0.86801$, $p = 0.39$. On the other hand, words that received the highest ratings for the sadness emotion received lower mean concreteness ratings ($M = 50.08$, $SD = 22.79$) when compared to the happy words, $t(352.71) = 4.20$, $p < .001$. Finally, the mean concreteness ratings for the words that received the highest ratings for the anger emotion ($M = 47.54$, $SD = 19.45$) was statistically similar to the words that received the highest ratings for the sadness emotion. These results further show that the words belonging to different discrete emotion categories also differed in their non-emotion related aspects.

Additionally, we classified the words based on whether they belong only to a single emotion category, which will be referred to as pure words, or multiple emotion categories, which will be referred to as mixed words (see also Ferré et al., 2017). If a word received high scores (ratings greater than 50) only for a single emotion category and ratings were lower than 50 for the rest of the discrete emotion categories, the word was considered under the pure emotion category. Table 4 shows the distribution of the words that belong to pure discrete emotions. For example, TRAFFIC belongs to the pure anger category because the mean rating for anger is 65.41 ($SD = 33.65$) while the mean rating for sadness is 30.69 ($SD = 33.61$), the mean rating for fear is 42.54 ($SD = 40.22$) and the mean rating for disgust is 33.10 ($SD = 35.40$). As another example, YEARNING belongs to the pure sadness category because the mean rating for sadness is 72.97 ($SD = 21.26$), while the mean rating for anger is 24.06 ($SD = 28.10$), the mean rating for fear is 37.71 ($SD = 31.10$), the mean rating for disgust is 11.00 ($SD = 18.73$). SHARK belongs to the pure fear category with a mean rating for fear being 66.03 ($SD = 29.00$) while the mean rating for anger is 24.54 ($SD = 32.02$), the mean rating for sadness is 23.18 ($SD = 30.35$), and the mean rating for disgust is 23.78 ($SD = 33.79$). Finally, an example for a word that belongs to the pure disgust category is VOMIT, which has the mean rating for disgust is 87.47 ($SD = 20.56$), while

the mean rating for anger is 26.43 (SD = 35.04), the mean rating for sadness is 34.48 (SD = 37.38), and the mean rating for fear is 27.90 (SD = 34.92).

Table 4 also shows that 42.88% of the words in the pool were rated as pure words either positive (32.23% of the total number of words) or negative (10.82% of the total number of words). A comparison between positive and negative words suggests that most of the words that received high ratings for happiness was pure (98.34%) but the words that received high ratings for negative emotions mostly received high ratings for more than one negative emotion category. For example, words that belong to the pure anger category were composed of only 31.03% of the words that received high ratings for anger. Even when we look at the highest proportion of the pure words within a negative discrete emotion category, which is 66.67% for the disgust words, the proportion of the pure disgust words is still lower than the proportion of pure happy words. However, we should also mention that the participants rated only one positive emotion compared to rating 4 negative emotion categories. That might have resulted in participants rating all the positive emotions under happiness rather than considering them as neutral. These results were also in accordance with the results reported by Ferré et al (2017) for the affective norms for Spanish words.

The words that received ratings higher than 50 for more than one emotion category were considered as mixed words (Ferré et al., 2017; Stadthage-Gonzales, in press). These mixed words are consisted of 16.20% of the words in the database (N = 329). Of these words, 3.3% (N = 11) were mixed positive words, such that they received mean ratings greater than 50 for happiness but they also received mean ratings greater than 50 for negative emotions. The secondary emotion of these 6 words was sadness (e.g., MUSIC, PASSIONATE LOVE), 4 was fear (e.g., EARTH, HEALTH) and 1 was anger (e.g., RESISTANCE). The remaining 318 mixed words were distributed across negative emotions (see Table 5).

To further investigate the relationship among mixed negative words, we applied the nonparametric multidimensional scaling (NMDS) method to assess how the mixed negative words are grouped based on their similarity (e.g., Kruskal, 1964). By using this method, multiple dimensions, in our case four negative emotions, can be reduced to 2-dimensions while the distance between the data points are preserved. Therefore, the reduced 2-dimensional representation allows for a visual examination (see Ferré et al., 2017 for a similar analysis). In the current analysis, we used a nonmetric scaling method by employing the *vegan* package in R (Oksanen et al., 2017), where rank orders are used instead of metric orders such as Euclidean distances. More specifically, Bray-Curtis dissimilarity index (Bray & Curtis, 1957) is used in the *vegan* package.

To run NMDS analysis, the dataset was reduced to 535 words, which includes all the words that received high ratings for the four negative emotions. Because we were interested in the similarity among the ratings for negative emotions, the dataset included ratings of those 535 words for anger, sadness, fear, and disgust emotion. Running the NMDS algorithms allowed reducing these four dimensions to two, so that we can plot the clusters of words on a 2-dimensional figure (Figure 3). This procedure resulted in a 2-dimensional space with a Stress value of 0.10. According to Kruskal (1964), this value represents a fair relationship between data and the reduced model. In other words, the stress value is a goodness of fit value that represents how well the structure in the data is represented with reduced dimensions. The value we obtained from our analysis suggests that the relationships among the words are preserved in the reduced model and the clusters that we observe in Figure 3 are consistent with the data.

Figure 3 depicts the 2-dimensional NMDS space for each discrete negative emotion. Each panel represents the words that received highest rating for the corresponding discrete negative emotion category. For example, the colored dots in the Fear Panel represent the words that

received the highest rating for the fear emotion. The blue dots represent the pure fear words, whereas the red dots represent the fear words that also have high ratings (mean ratings above 50 but lower than the mean ratings for fear) for anger. Similarly, green dots represent the mixed fear words whose secondary emotion is sadness and finally, orange dots represent the mixed fear words with disgust as the secondary emotion. The grey dots in each panel represent the remaining words that were included in the NMDS procedure but received highest rating for a different negative emotion and thus they are the colored points in their corresponding panel. One can observe that each discrete emotion is clustered in one quadrangle. Specifically, fear words were clustered in the top-right quadrangle, sadness words were clustered in the bottom-right quadrangle, anger words were clustered in the bottom-left quadrangle and finally, disgust words were clustered in the top-left quadrangle.

Another important point that is revealed in Figure 3 is that the colored dots in the Anger Panel (e.g., words with the highest rating for the anger emotion) were condensed contrary to the colored dots in other panels. Especially when the Disgust Panel was visually investigated, one can observe that the colored dots in that panel were dispersed compared to the colored dots in the Anger Panel. In fact, that is expected when the Pearson correlation coefficients across discrete negative emotions are examined as presented in Figure 2. For example, anger is highly correlated with other discrete negative emotions, which means that if a word received a high rating for the anger emotion, it is also likely that the same word would receive a high rating for another discrete negative emotion such as sadness, fear or disgust. As a result, one can expect to observe more condensed clustering for pure and mixed anger words. On the other hand, disgust was less correlated with other discrete negative emotions such as fear and sadness. Based on the lower values of Pearson correlation coefficients, one can infer that disgust is not strongly related with

fear and sadness. Therefore, the proportion of mixed words was lower for the disgust emotion (see Table 3) and these words were more dispersed in a 2-dimensional space.

Conclusion

This study was the first to develop a comprehensive standardized set of Turkish words with normative ratings on five discrete emotion categories (happiness, sadness, anger, fear, disgust), as well as on dimensions of arousal and valence. It is our hope that this word set will satisfy an immediate need for researchers in and outside of Turkey recruiting Turkish-speaking samples and wishing to use Turkish words as stimuli in studies of emotion and cognition.

Data presented here showed highly similar and consistent patterns with word sets provided in other languages in terms of the relationships between arousal and valence dimensions, relationships between dimensions and specific emotion categories, and relationships among specific emotions. These findings support the stability of the relationship between basic discrete emotions at the word level across different cultures. Like dimensional properties of emotion, discrete categories loading highly similarly with other discrete emotional word databases supported the literature on the universality of discrete emotions.

The fact that arousal and valence ratings were not correlated confirms dimensional models suggesting that there are two different dimensions of emotions (Russell, 1980). Related to this point, the curvilinear relationship between valence and arousal further indicate that words that have lower and higher valence values also have higher arousal values. This curvilinear relationship has been consistently found in ANEW (Bradley & Lang, 1999) as well as other databases in different languages (Eilola & Havelka, 2010; Redondo et al., 2007; Soares et al., 2012; Ferré et al, 2017).

Valence was positively and strongly correlated with happiness but negatively correlated with all negative emotions (sadness, anger, fear, disgust). Arousal, however, was found to be positively correlated with all discrete emotion categories yet showing a curvilinear pattern: higher values of arousal are observed with both higher and lower end of the scale of discrete emotions. This finding follows from the previously discussed curvilinear relationship between arousal and valence considering the correlations of valence with negative and positive discrete emotions.

All emotional categories were correlated with each other. As expected, negative emotions (anger, sadness, fear, and disgust) were positively correlated whereas the positive emotion, happiness, was negatively correlated with the negative emotion categories. Patterns observed in the relationship across discrete emotions replicate the findings presented in the literature for Spanish words (Ferré et al, 2017; Stadthagen-Gonzales et. al., 2017). Turkish emotional word set is similar to other discrete emotional word sets in the manner of the same emotional category words differing in their intensities (Briesemester et al., 2011b; Ferré et al., 2017). Briesemester and colleagues had shown that different emotional intensities affected lexical decision performance (Briesemester et al., 2011a; Briesemester et al., 2011b). Therefore, researchers must take into account not only the dimensional properties of a word but also its emotional intensity while choosing a word. Future studies can further explore whether this kind of intensity difference has effects on other cognitive processes such as attention, categorization, memory or decision-making.

Highest numbers of pure words were found in happiness and disgust categories as is the case with Spanish discrete emotional word set (Ferré et al., 2017). Happiness is only positive category so it is not surprising that most of the happiness-related words are not mixed with other category words. Studies in which different positive emotions were induced via film clips found that, like negative emotions, positive emotions can also be both pure and mixed (Gilman et al.,

2017; Schaefer et al., 2010). Thus it would be useful to conduct future studies that include different positive emotion word categories to see whether there is overlap with other emotional stimulus sets in the manner of mixed positive emotions. Disgust-related words, which are the purest category amongst negative emotions, are also the most concrete words, as in Ferré et al. (2017). Concreteness level might be the most decisive property of negative emotions for pure words. Highest number of mixed words was found in the anger category and these words were highly correlated with other negative emotions; this result is also consistent with Ferré et al. (2017).

In the current set, for those words that received their highest rating for fear, the secondary emotion was found to be sadness. These results support the hypothesis that people's evaluations about an affective experience depend on their cognitive appraisals (Moors et al., 2013). According to this theory appraisal is the core determinant of feelings. We can speculate that anger words trigger other emotional appraisals at the same time and fear words trigger mostly sadness appraisals after fear appraisals (for example; for the word "death").

Studies using mood induction via film clips revealed that some of those clips elicited both anger and sadness or anger and fear at similar intensities could be categorized as a mixed emotion category (Gilman et al., 2017). Like those film clips, certain words can also elicit mixed emotions. Therefore, researchers who wish to induce mixed, instead of pure, emotions can use these word stimuli, as well.

In the current study, Turkish emotional words appeared in the same boomerang shape as did other emotional word sets (Stevenson et al., 2007; Briesemeister et al., 2011b; Imbir, 2015; Ferré et al., 2017), supporting the dimensional approaches of emotion. Unlike neutral words, both negative and positive words had high levels of arousal. Arousal and valence dimensions determine which words were accepted as "emotional". Besides dimensional approaches,

categorical approaches are highly accepted by researchers (e.g., Ekman, Sorenson, & Friesen, 1969; Levenson, 2003). As in other discrete emotional word sets in several other languages, Turkish discrete emotional words could also be categorized purely in discrete categories, beyond dimensions of arousal and valence. This would allow researchers to pool words from different emotion categories with same arousal or valence levels to be used as their stimuli. This kind of controlled selection of word stimuli is critical to understand effects of discrete emotions on word recognition, memory and other areas of cognition, beyond effects of emotion dimensions.

References

- Angie, A. D., Connelly, S., Waples, E. P., & Kligyte, V. (2011). The influence of discrete emotions on judgement and decision-making: A meta-analytic review. *Cognition & Emotion*, 25(8), 1393-1422.
- Arikan İyilikci, E., & Amado, S. (2018). The uncertainty appraisal enhances the prominent deck B effect in the Iowa gambling task. *Motivation and Emotion*, 42(1), 1-16.
- Bradley, M. M., & Lang, P. J. (1994). Measuring emotion: the self-assessment manikin and the semantic differential. *Journal of Behavior Therapy and Experimental Psychiatry*, 25(1), 49-59.
- Bradley, M. M., & Lang, P. J. (1999). *Affective norms for English words (ANEW): Instruction manual and affective ratings* (Vol. 30, No. 1, pp. 25-36). Technical report C-1, the center for research in psychophysiology, University of Florida.
- Bray J.R., Curtis J.T. (1957). An ordination of the upland forest communities of Southern Wisconsin. *Ecological Monographs*, 27, 325-349.
- Briesemeister, B. B., Kuchinke, L., & Jacobs, A. M. (2011a). Discrete emotion effects on lexical decision response times. *PLoS ONE* 6, e23743.
- Briesemeister, B. B., Kuchinke, L., & Jacobs, A. M. (2011b). Discrete emotion norms for nouns: Berlin Affective Word List (DENNBWL). *Behavior Research Methods*, 43, 441-448.
- Briesemeister, B. B., Kuchinke, L., & Jacobs, A. M. (2014). Emotion word recognition: Discrete information effects first, continuous later? *Brain Research*, 1564, 62-71.
- Briesemeister, B. B., Kuchinke, L., Jacobs, A. M., & Braun, M. (2015). Emotions in reading: Dissociation of happiness and positivity. *Cognitive, Affective, & Behavioral Neuroscience*, 15, 287-298.

- Calvo, R. A., & D'Mello, S. (2010). Affect detection: An interdisciplinary review of models, methods, and their applications. *IEEE Transactions on Affective Computing*, 1(1), 18-37.
- Chapman, H. A., Johannes, K., Poppenk, J. L., Moscovitch, M. & Anderson, A. K. (2012). Evidence for the differential salience of disgust and fear in episodic memory. *Journal of Experimental Psychology: General*, 142(4), 1100-1112.
- Davis, F. C., Somerville, L. H., Ruberry, E. J., Berry, A. B., Shin, L. M., & Whalen, P. J. (2011). A tale of two negatives: differential memory modulation by threat-related facial expressions. *Emotion*, 11(3), 647.
- Dougal, S. & Rotello, C. M. (2007). "Remembering" emotional words is based on response bias, not recollection. *Psychonomic Bulletin & Review*, 14(3), 423-429.
- Eilola, T. M., & Havelka, J. (2010). Affective norms for 210 British English and Finnish nouns. *Behavior Research Methods*, 42(1), 134-140.
- Ekman, P., Sorenson, E. R., & Friesen, W. V. (1969). Pan-cultural elements in facial displays of emotion. *Science*, 164(3875), 86-88.
- Ekman, P. (1992). An argument for basic emotions. *Cognition & Emotion*, 6(3-4), 169-200.
- Estes, Z., & Verges, M. (2008). Freeze or flee? Negative stimuli elicit selective responding. *Cognition*, 108(2), 557-565.
- Ferré, P., Guasch, M., Martínez-García, N., Fraga, I., & Hinojosa, J. A. (2017). Moved by words: Affective ratings for a set of 2,266 Spanish words in five discrete emotion categories. *Behavior Research Methods*, 49(3), 1082-1094.
- Ford, B. Q., Tamir, M., Brunyé, T. T., Shirer, W. R., Mahoney, C. R. & Taylor, H. A. (2010). Keeping your eyes on the prize: Anger and visual attention to threats and rewards. *Psychological Science*, 21(8), 1098-1105.

- Gilman, T. L., Shaheen, R., Nylocks, K. M., Halachoff, D., Chapman, J., Flynn, J. J., ... & Coifman, K. G. (2017). A film set for the elicitation of emotion in research: A comprehensive catalog derived from four decades of investigation. *Behavior Research Methods*, 49(6), 2061-2082.
- Griskevicius, V., Shiota, M. N., & Nowlis, S. M. (2010). The many shades of rose-colored glasses: An evolutionary approach to the influence of different positive emotions. *Journal of Consumer Research*, 37(2), 238-250.
- Hinojosa, J. A., Martínez-García, N., Villalba-García, C., Fernández-Folgueiras, U., Sánchez-Carmona, A., Pozo, M. A., & Montoro, P. R. (2016). Affective norms of 875 Spanish words for five discrete emotional categories and two emotional dimensions. *Behavior Research Methods*, 48(1), 272-284.
- Imbir, K. (2015). Affective norms for 1,586 Polish words (ANPW): Duality-of-mind approach. *Behavior Research Methods*, 47(3), 860–870.
- Kanske, P., & Kotz, S. A. (2011). Positive emotion speeds up conflict processing: ERP responses in an auditory Simon task. *Biological Psychology*, 87(1), 122-127.
- Kapucu, A., Rotello, C. M., Ready, R. E. & Seidl, K. N. (2008). Response bias in “remembering” emotional stimuli: a new perspective on age differences. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 34(3), 703–711.
- Kapucu, Arıkan İyilikci, E., Eroglu, S., & Amado, S. (in press). Effects of fear vs. anger on recognition memory when emotion is induced before encoding or before retrieval. *Turkish Journal of Psychology*.
- Kensinger, E. A., & Schacter, D. L. (2008). Memory and emotion. *Handbook of Emotions*, 3, 601-617.

- Kruskal, J. B. (1964). Multidimensional scaling by optimizing goodness of fit to a nonmetric hypothesis. *Psychometrika*, 29(1), 1-27.
- Kuperman, V., Estes, Z., Brysbaert, M., & Warriner, A. B. (2014). Emotion and language: valence and arousal affect word recognition. *Journal of Experimental Psychology: General*, 143(3), 1065.
- Lahl, O., Göritz, A. S., Pietrowsky, R., & Rosenberg, J. (2009). Using the World-Wide Web to obtain large-scale word norms: 190,212 ratings on a set of 2,654 German nouns. *Behavior Research Methods*, 41(1), 13-19.
- Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (1997). International affective picture system (IAPS): Technical manual and affective ratings. *NIMH Center for the Study of Emotion and Attention*, 39-58.
- Levenson, R. W. (2003). Blood, sweat, and fears. *Annals of the New York Academy of Sciences*, 1000(1), 348-366.
- Monnier, C., & Syssau, A. (2014). Affective norms for French words (FAN). *Behavior Research Methods*, 46(4), 1128-1137.
- Montefinese, M., Ambrosini, E., Fairfield, B., & Mammarella, N. (2014). The adaptation of the affective norms for English words (ANEW) for Italian. *Behavior Research Methods*, 46(3), 887-903.
- Moors, A., De Houwer, J., Hermans, D., Wanmaker, S., Van Schie, K., Van Harmelen, A. L., ... & Brysbaert, M. (2013). Norms of valence, arousal, dominance, and age of acquisition for 4,300 Dutch words. *Behavior Research Methods*, 45(1), 169-177.
- Oksanen, J., F. Guillaume Blanchet, Michael Friendly, Roeland Kindt, Pierre Legendre, Dan McGlinn, Peter R. Minchin, R. B. O'Hara, Gavin L. Simpson, Pter Solymos, M. Henry H.

- Stevens, Eduard Szoecs and Helene Wagner (2017). vegan: Community Ecology Package. R package version 2.4-3. <https://CRAN.R-project.org/package=vegan>
- Redondo, J., Fraga, I., Padrón, I., & Comesaña, M. (2007). The Spanish adaptation of ANEW (affective norms for English words). *Behavior Research Methods*, 39(3), 600-605.
- Ric, F., Alexopoulos, T., Muller, D., & Aubé, B. (2013). Emotional norms for 524 French personality trait words. *Behavior Research Methods*, 45(2), 414-421.
- Rowe, G., Hirsh, J. B., & Anderson, A. K. (2007). Positive affect increases the breadth of attentional selection. *Proceedings of the National Academy of Sciences*, 104(1), 383-388.
- Russell, J. A. (1980). A circumplex model of affect. *Journal of Personality and Social Psychology*, 39, 1161–1178.
- Schaefer, A., Nils, F., Sanchez, X., & Philippot, P. (2010). Assessing the effectiveness of a large database of emotion-eliciting films: A new tool for emotion researchers. *Cognition and Emotion*, 24(7), 1153-1172.
- Soares, A. P., Comesaña, M., Pinheiro, A. P., Simões, A., & Frade, C. S. (2012). The adaptation of the Affective Norms for English words (ANEW) for European Portuguese. *Behavior Research Methods*, 44(1), 256-269.
- Stadthagen-González, H., Ferré, P., Pérez-Sánchez, M. A., Imbault, C., & Hinojosa, J. A. (2017). Norms for 10,491 Spanish words for five discrete emotions: Happiness, disgust, anger, fear, and sadness. *Behavior research methods*, 1-10.
- Stevenson, R. A., Mikels, J. A., & James, T. W. (2007). Characterization of the affective norms for English words by discrete emotional categories. *Behavior Research Methods*, 39(4), 1020-1024.

- Stevenson, R. A., & James, T. W. (2008). Affective auditory stimuli: Characterization of the International Affective Digitized Sounds (IADS) by discrete emotional categories. *Behavior Research Methods*, 40(1), 315-321.
- Strauss, G. P., & Allen, D. N. (2008). Emotional intensity and categorisation ratings for emotional and nonemotional words. *Cognition and Emotion*, 22(1), 114-133.
- Talmi, D., & Moscovitch, M. (2004). Can semantic relatedness explain the enhancement of memory for emotional words?. *Memory & Cognition*, 32(5), 742-751.
- Thapar, A., & Rouders, J. N. (2009). Aging and recognition memory for emotional words: A bias account. *Psychonomic Bulletin & Review*, 16(4), 699-704.
- Vo, M. L., Conrad, M., Kuchinke, L., Urton, K., Hofmann, M. J., & Jacobs, A. M. (2009). The Berlin affective word list reloaded (BAWL-R). *Behavior Research Methods*, 41(2), 534-538.
- White, C.N., Kapucu, A., Bruno, D., Rotello, C.M. & Ratcliff, R. (2014). Memory bias for negative emotional words in recognition memory is driven by effects of category membership. *Cognition and Emotion*, 28(5), 867-880.
- Windmann, S., & Kutas, M. (2001). Electrophysiological correlates of emotion-induced recognition bias. *Journal of Cognitive Neuroscience*, 13(5), 577-592.
- Tekcan, A. I., & Göz, I. (2005). *Türkçe Kelime Normları (Turkish Word Norms)*. Istanbul: Bogazici Universitesi Yayınevi.

Table 1

Descriptive statistics of the ratings for the dimensions and the categorical emotions

Variable	Mean	SD	Min	Max
Valence	4.93	1.58	1.22	8.38
Arousal	5	0.91	2.57	7.94
Happiness	36.45	24.43	0.69	90.1
Anger	25.81	18.51	0.78	97.41
Sadness	28.32	19.55	1.26	93.25
Fear	28.24	18.41	1.24	89.18
Disgust	21.52	16.37	0.57	91.62
Concreteness	60.45	24.60	5.91	96.92

Table 2

Descriptive statistics of the ratings for the dimensions and the categorical emotions by gender. Standard deviations are in parentheses.

Variable	Female	Male	Correlation
Valence	4.90 (1.66)	4.95 (1.55)	0.89
Arousal	4.97 (0.99)	5.06 (1.02)	0.64
Happiness	34.94 (25.52)	39.17 (24.17)	0.89
Anger	24.08 (19.18)	29.02 (19.23)	0.85
Sadness	27.32 (20.63)	30.22 (19.52)	0.85
Fear	27.64 (19.80)	29.42 (18.11)	0.82
Disgust	19.54 (16.90)	25.26 (17.52)	0.81
Concreteness	61.17 (25.90)	59.19 (23.64)	0.91

Table 3

Words that belong to each emotion category and their descriptive statistics

Emotion	N	%	Mean (SD)	Valence	Arousal
Happiness	666	32.79%	66.55 (10.10)	6.48 (0.88)	5.43 (0.71)
Anger	145	7.14%	66.51 (10.00)	2.90 (1.07)	5.65 (0.68)
Sadness	194	9.55%	67.07 (9.38)	2.93 (1.09)	5.42 (0.70)
Fear	145	7.14%	64.28 (8.98)	3.38 (1.08)	5.75 (0.57)
Disgust	51	2.51%	69.07 (10.18)	3.04 (1.07)	5.37 (0.65)
Neutral	830	40.87%	-	4.86 (0.70)	4.29 (0.70)
Total	2031	100%			

Table 4

Words that have high rating (over 50) only in one emotion category (pure words).

Emotion	N	Total %	Category %
Happiness	655	32.25%	98.34%
Anger	45	2.21%	31.03%
Sadness	73	3.59%	37.62%
Fear	64	3.15%	44.14%
Disgust	34	1.67%	66.67%
Total	871	42.88%	-

Table 5

The distribution of the mixed negative words based on their secondary emotion

Primary Emotion	Secondary Emotion				
	Anger	Sadness	Fear	Disgust	Total
Anger	-	35	27	38	100
Sadness	36	-	81	4	121
Fear	26	47	-	7	80
Disgust	10	1	6	-	17

Figure 1: Histograms of the Pearson correlation coefficients between two groups across affect dimension and discrete emotion category ratings. Each histogram contains 100 pairs of randomly sampled subgroups.

Figure 2. Pearson correlations among dimensions and categorical emotions. *** p<.001

Figure 3: 2-dimensional space for the words that belong to the corresponding mixed emotion category