

# Evaluation of lexical and semantic features for English emotion words

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## Introduction

Lexical processing of written words is the base for constructing meaning from text, as words are the primary meaningful elements provided to the reader. Words are characterised by many different lexical/semantic features which affect verbal processing and hence behavioural performance as reaction times, eye-movements, fixation times and brain activity, as shown by ERPs and neuroimaging. We distinguish here lexical features as word frequency, familiarity, age of acquisition, from semantic ones as imageability and concreteness ("cold features") and from affective ones as emotional valence and arousal ("warm features"). In particular, emotional valence (positive, negative) has a strong early impact on cognitive processing (Kissler et al., 2007; Sereno et al., in press) and texts containing emotional information are processed in a qualitatively different way than texts containing chronological or spatial information (Ferstl et al., 2007; 2005). For empirical investigations of lexical/semantic processing of words as well as comprehension of sentences or texts, it is important to be able to control or manipulate not only lexical and semantic features of words, but also features related to emotional connotations.

## Aim

The aim of the present study was to generate a corpus of English words of different emotional valence, evaluated for various lexical and semantic features. The corpus will be useful for experiments employing ERPs and eye-tracking techniques, to allow a better control of the effects of these features. Furthermore, the corpus could allow a well balanced selection of words employed for discourse processing research, so that the effect of text context can be separated from word level effects. This corpus goes beyond similar works, in which only a subset of these variables was considered.

Table 1: Examples of other word Corpora with ratings for different features.

Corpus	Authors	Language	Rated Features
Berlin Affective Word List	Vö et al., 2006	German	Emotional Valence, Imageability
Balanced Affective Word List	Siegle, 1994	English	Emotional Valence, Arousal
The Bristol Norms	Stadthagen-Gonzales et al., 2006	English	Familiarity, Imageability, Age of Acquisition
MRC Psycholinguistic Database	Wilson, 1988	English	Words from several corpora evaluated for several features

## Our Corpus

Table 2: Original contributions from our Corpus.

What's new?	Why?	Strengths!
Within-participants ratings	Between-participants ratings are usually collected or ratings for a few features, compared then with other ones from other authors	Homogeneous evaluations between features and words
Ratings for both "warm" and "cold" features	Traditional studies usually investigate either the former or the latter ones	Possible comparison between warm and cold features
Emotionally valenced words and emotion words (adjectives)	Word corpora usually contain non-inflected versions of words	The Corpus is suitable for investigating warm features, with actual emotions being well represented
Pairs of antonyms (opposites)	Not usually present in word corpora	Useful for consistency paradigms (text comprehension lit.)

## Methods

### Participants

82 psychology students from the University of Sussex (71 women, 11 men), native speakers of English, aged between 18-42 years (M=20.5, SD=3.98).

### Material

300 emotionally valenced words: 1/3 positive, 1/3 negative and 1/3 neutral

#### Where are our words from?

- BAWL (Vö et al., 2006), translated into English;
- the Compass DeRose guide to emotion words (DeRose, 2005);
- words added from the experimenter.

**Word Lengths** in letters, syllables, phonemes and **Frequency of Use** were obtained using the CELEX database.

**Concreteness** was determined by classifying the words as either concrete or abstract referring to Paivio's definition of concreteness (Paivio et al., 1968).

### Rating procedure

- online questionnaire (using Macromedia Dreamweaver MX 2004)
- 7-point Likert scales
- Features: **Emotional Valence, Arousal, Familiarity, Imageability and Age of Acquisition**

Table 3: Words from our Corpus.

Our words	Examples
214 words	achievement, chocolate, chaos, forest, journey, kiss, morning, ban, treasure, wound...
86 emotions	cheerful, distressed, happy, exhausted, protected, trusting...
Pairs of antonyms	abandon-adopt, floor-ceiling, delighted-disappointed...

Table 4: Lexical, semantic and affective features: definitions and examples.

Features	Definitions	Examples
<b>Word length</b>	In letter, syllables or phonemes, it can be determined by looking at the surface structure.	strawberry > tree
<b>Frequency of use</b>	It depends on the relationship to a larger corpus of words, it can be determined by placing the word within a certain linguistic context (word frequency corpora, such as CELEX or BNC).	stuff > flattery
<b>Emotional valence</b>	The ability of a word to evoke positive or negative feelings, as well as neutral ones.	flower / prison / chair
<b>Arousal</b>	The intensity of a word, how exciting or agitating it is.	tornado > rain
<b>Concreteness</b>	The ability to experience something in a sensory modality.	pencil > faith
<b>Imageability</b>	The ease with which a word evokes a sensory mental image.	finger nail > permission image.
<b>Familiarity</b>	The subjective frequency of exposure to a word	joke > riddle
<b>Age of acquisition</b>	It refers to the age at which a word was learnt.	apple > avocado

## Results

Valence categories (positive, negative, neutral) were created by grouping the valence scores. A dummy variable called "Absolute Valence" was created to obtain low and high emotionality ratings independent of valence.

### Reliability analysis

The MRC Psycholinguistic database contains familiarity and imageability ratings for 181 out of our 300 words and AoA ratings for 72 words. Spearman correlations between the MRC ratings and the present ones were highly significant (Fam: rho=.788, p<.001; Imag: rho=.908, p<.001; AoA: rho=.92, p<.001), showing high reliability of our ratings with previous ratings.

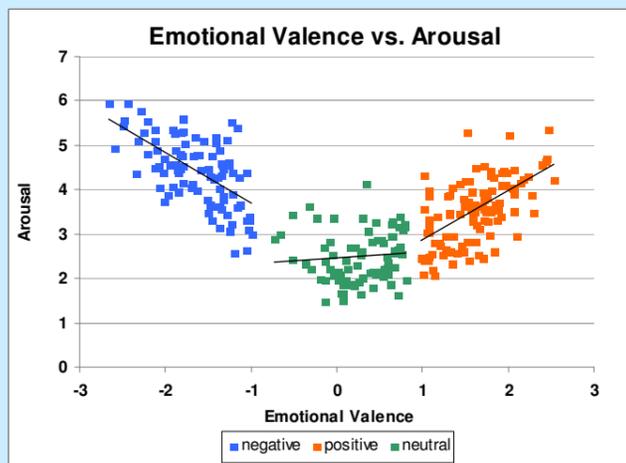
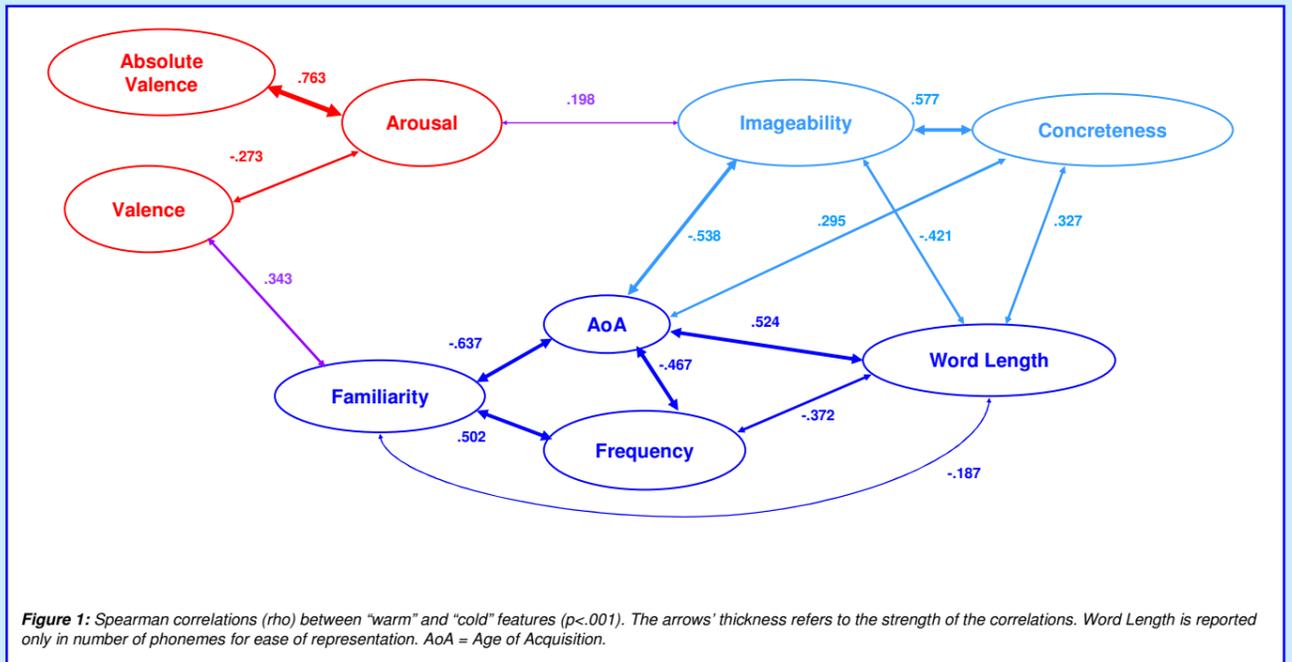


Figure 2: Emotional Valence ratings plotted with Arousal ratings. Valence ratings are categorised as positive, neutral and negative.

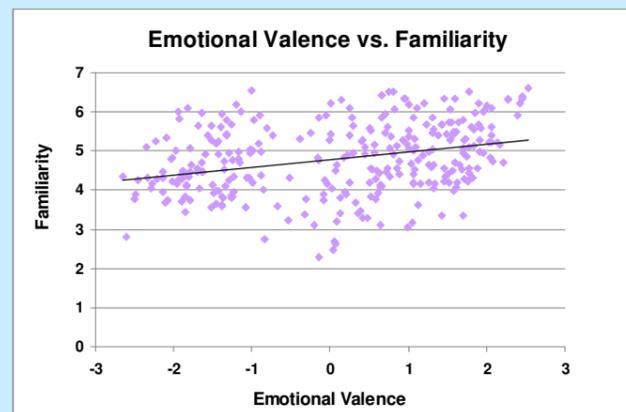


Figure 3: Emotional Valence ratings plotted with Familiarity ratings.

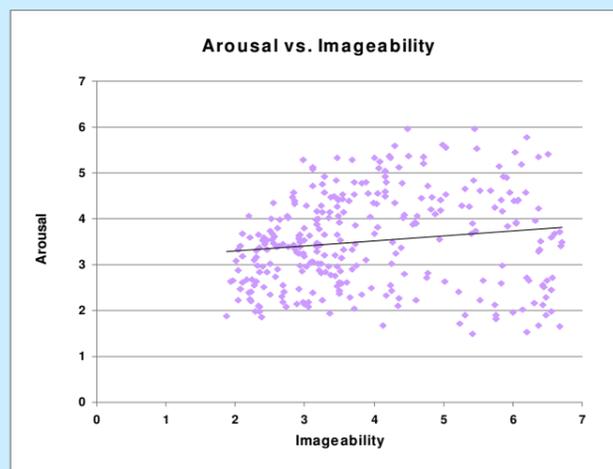


Figure 4: Imageability ratings plotted with Arousal ratings.

## Discussion

### Familiarity, age of acquisition, frequency of use

Familiarity, AoA and frequency of use were all highly correlated to one another, suggesting that words which are familiar are also frequently used and were acquired early. These results support previous findings (Morrison et al., 1997; Stadthagen-Gonzales et al., 2006).

### Word length

Word length in letters, syllables and phonemes showed very high positive correlations with one another and were all correlated with familiarity, imageability, frequency of use and AoA. As expected, shorter words were rated as more familiar, more imageable, more frequent and earlier acquired than longer words (Morrison et al., 1997; Stadthagen-Gonzales et al., 2006).

### Emotional valence and arousal

Absolute valence and arousal were highly correlated, with highly valenced words being highly arousing. A negative correlation between emotional valence and arousal suggested that highly negative words are naturally more arousing than highly positive ones, as very intense positive feelings like "ecstasy" would transform into negative ones (but see Jennings et al., 2000 for different findings).

### Emotional valence and familiarity

This correlation suggests that positive words are more familiar. This could be due to the fact that positive words tend to be earlier acquired than negative ones (as shown by a weak correlation to AoA). Alternatively, there might be a response bias for negative words: Who wants to admit that they are very familiar with "murder"?

### Imageability and Concreteness

Concreteness and imageability are highly correlated to one another and show a similar correlation patterns.

### Arousal and Imageability

This correlation suggests that highly imageable words are slightly more arousing than not imageable words. Only imageability but not concreteness was correlated with arousal. Imageability seems to be more closely related to human picturing activity while reading words, in particular in the context of emotional features (Paivio et al., 1968).

### Imageability and age of acquisition

Imageability correlated with AoA, suggesting that highly imageable words are acquired earlier than less imageable words (Morrison et al., 1997; Bird et al., 2001).

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