The BAWL databases in research on emotional word processing

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Introduction

Language and emotion are discussed to be closely related. Subcortical networks that support emotional processing also contribute to music and prosody, which in turn are the probable evolutionary basis for spoken language (Panksepp, 2008). Thus, it is suggested in the language-as-context hypothesis that language evolved to reduce uncertainty in the perception of emotional stimuli (Feldman Barrett, Lindquist & Gendron, 2007). At an experimental level, the interaction of both is well documented, for example in spoken (e.g., Buchanan et al., 2000) and in written language (e.g., Briesemeister et al., 2011; Hofmann et al., 2009). Given such a close relationship, we consider lexical (word) stimuli to be an excellent candidate for the investigation of different models of affective space.

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A two-dimensional affective space: Valence and arousal effects in word processing

A fundamental model in emotion research describes the affective space by two dimensions: Emotional valence, indicating the hedonic value (positive vs. negative), and arousal, indicating the emotional intensity (from low to high; e.g., Bradley & Lang, 2000; Russell, 2003). For German words, we developed the Berlin Affective Word List (BAWL), a database containing 2,911 words and their rated norms for valence, arousal, and imageability (as a measure of a words' concreteness, Võ et al., 2006; BAWL-R: Võ et al., 2009). Additionally, the BAWL-R provides the following CELEX-based word features: length, frequency, number of syllables (NoS), number of phonemes (NoP), number (N) and frequency of orthographic neighbors, number and frequency of higher frequency orthographic neighbors, and mean bigram frequency (Baayen, Piepenbrock & Gulikers, 1995).

Based on the BAWL-R norms and controlling for other variables known to affect word recognition, Hofmann et al. (2009) showed that both affective dimensions modulate performance in the lexical decision task (LTD). High-arousing negative and positive words accelerated lexical decisions, as compared to low-arousal negative and neutral words. The facilitatory effects of positive and high-arousal negative words were also visible 100ms following word onset in the event-related potentials, suggesting fast and automatic processing of emotional stimuli (Pratto & John, 1991).

Higher dimensional affective space: a role of discrete emotions in word processing?

The two-dimensional affective space model is often contrasted with models assuming a limited number of discrete emotions (Ekman, 1992, for a direct comparison of both models, see Reisenzein, 1994). Although there is an ongoing debate on how many discrete emo-

tions actually exist, at least five – happiness, anger, fear, disgust and sadness – are established.

The English Lexicon Project (ELP, Balota et al., 2007) provides a possibility to investigate the discrete emotion approach in word recognition, containing normative LDT response times (RT) and naming data for more than 40,000 English words. Combining the ELP with an English discrete emotion norm database (Stevenson et al., 2007) allows for a first examination of discrete emotion effects in word recognition. Computing a multiple regression backward elimination procedure to select the best predicting variables for lexical decision and naming performance reveals that three out of five discrete emotion variables significantly explain variance in RTs in both tasks (see Table 6.1). A negative beta value indicates that disgust slows down RTs, while happiness significantly accelerates RTs in both tasks. In addition to that, task specific facilitatory effects for fear (LDT) and sadness (naming) were discovered.

Given these results it is obvious that the discrete emotion model significantly explains human word recognition data. Disgust and happiness seem to mirror the effects of low-arousing negative and positive words in Hofmann et al. (2009), but this prediction needs further investigations. How can this be compared to the predictions of the two-dimensional affective space model? To be able to further investigate these questions, we collected German discrete emotion norms for 1,958 nouns from BAWL-R, forming the Discrete Emotion Norms for Nouns – Berlin Affective Word List (DENN-BAWL, Briesemeister et al., 2011).

A direct comparison of the affective space models

The combination of the valence and arousal scores from BAWL-R and discrete emotion norms from DENN-BAWL allows for a direct comparison of both models in a LDT. We selected a stimulus set that comprises five discrete emotion conditions (for details, see Briesemeister et al., 2011): High and low happiness words as well

Table 6.1: Backward regression procedure on lexical decision and naming response times

Mean lexical decision RT				
Action	Var	Beta	t-value	p-value
remove	anger	-0.004	-0.100	0.920
remove	orthoN	-0.007	-0.168	0.867
remove	bigram	-0.005	-0.226	0.821
remove	sad	-0.021	-0.559	0.576
model	hap*	-0.086	-2.812	0.005
model	fear*	-0.077	-2.526	0.012
model	disgut*	0.086	2.851	0.004
model	length*	0.222	4.798	<0.001
model	freq*	-0.475	-18.918	<0.001
model	phonoN	0.051	1.728	0.084
model	phon	0.091	1.822	0.069
model	syll*	0.113	3.056	0.002

Mean naming RT				
Action	Var	Beta	t-value	p-value
remove	orthoN	-0.024	-0.535	0.593
remove	phonoN	0.016	0.483	0.629
remove	fear	0.035	0.785	0.432
remove	anger	-0.035	-0.748	0.455
remove	syll	-0.040	-0.957	0.339
model	hap*	-0.072	-2.118	0.034
model	sad*	-0.077	-2.329	0.020
model	disgust*	0.085	2.543	0.011
model	length*	0.196	3.858	<0.001
model	freq*	-0.330	-11.757	<0.001
model	bigram*	0.059	2.371	0.018
model	phon*	0.213	4.258	<0.001

Note: orthoN = number of orthographic neighbors; phonoN = number of phonological neighbors; freq = log HAL frequency; phon = number of phonemes; * = significant variable ($p<0.05$)

as high and low fear-related words were carefully controlled for valence and arousal, and an additional set of low-arousing neutral words were selected as a baseline condition. Given the appropriateness of the two dimensional model of affective space, no differences between the processing of high and low happiness, or high and low fear-related words should be observed. This is not the case!

Instead, the results of the regression analysis were replicated: High-happiness and high fear-related words facilitate lexical decisions (Briesemeister et al., 2011), thus providing evidence for a higher dimensionality of affective space.

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