# Identifying human emotional dimensions and their contextual relationships based on machine learning

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## 1. Introduction

In this **doctoral research area**, we investigate the most common and stable emotional dimensions that can explain the highest amount of variability in different human emotions. To do so, we propose a novel methodology that relies on observational, rather than experimental data.

**The motivating force** behind this work comes from the idea that if we can objectively analyze and understand the emotional dimensional space, we might then be able to focus only on a few key dimensions instead of all different individual emotions. Since emotions underpin human behavior, those key dimensions can then be used in future studies by researchers trying to map emotional states onto actions and behaviors.

## 2. Problem Description

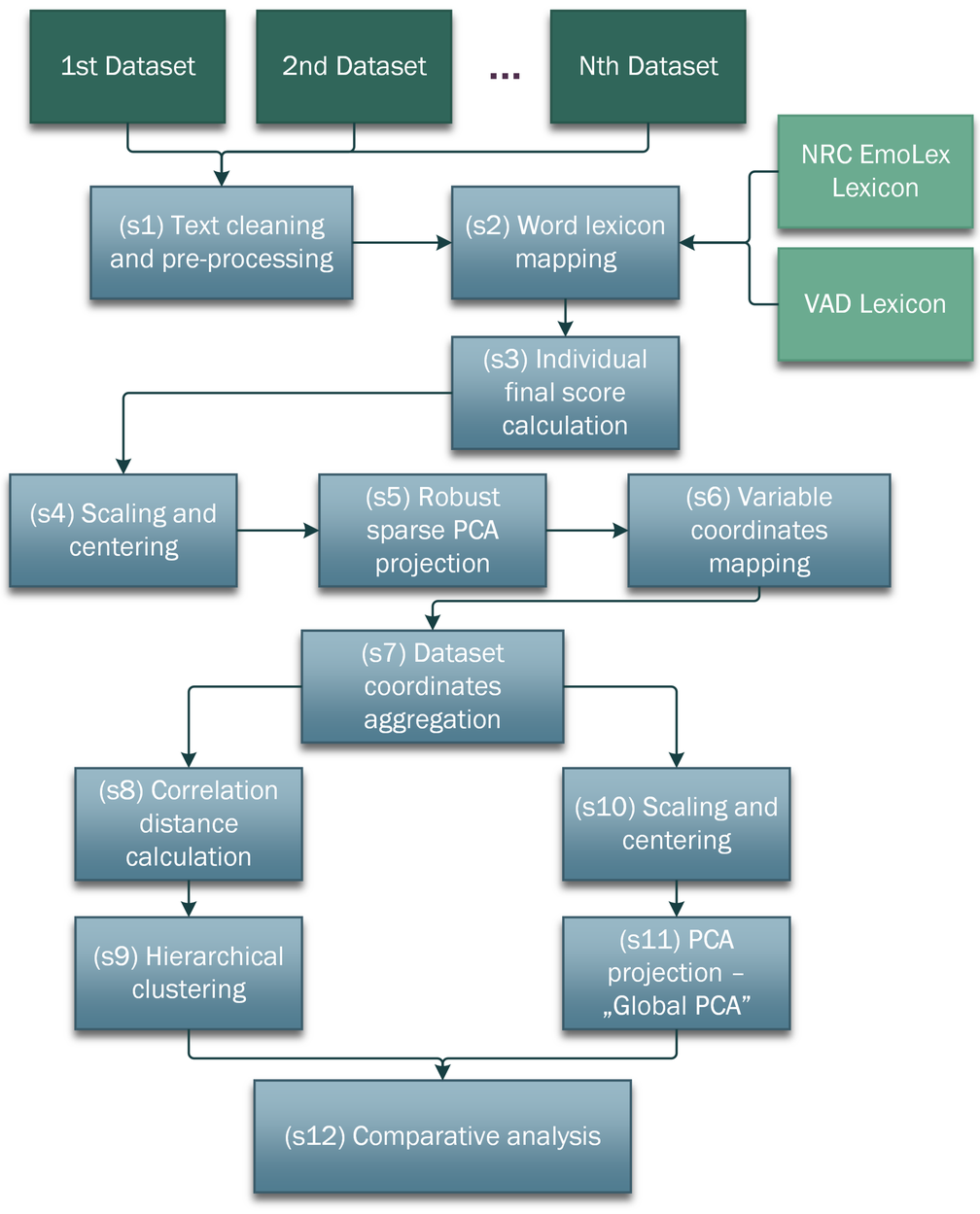
Our main goals are to propose and validate a methodology for **discovering the true orthogonal space where emotions can be mapped** to.

**RQ1:** How can one methodically validate findings from previous emotional dimensional models based on textual data?

**RQ2:** What are the orthogonal emotional dimensions that are stable across several textual datasets?

## 3. Methodology

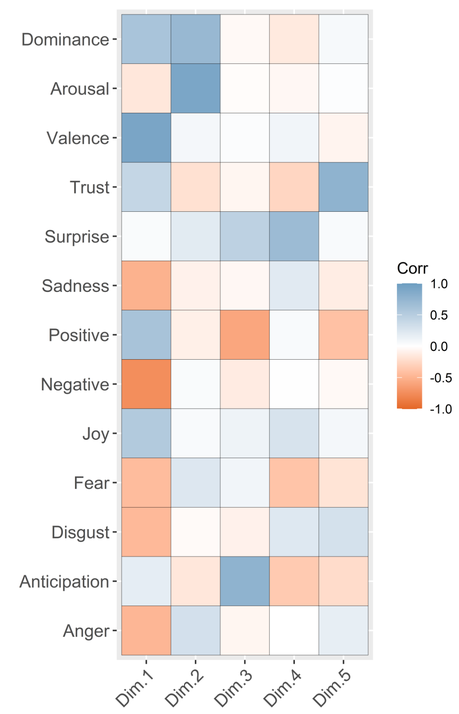
We employ two different techniques in our analysis to derive our conclusions concerning stable emotional dimensions, namely similarity clustering and principal component analysis (PCA). The whole methodology can be seen in the following figure:




## 4. Results

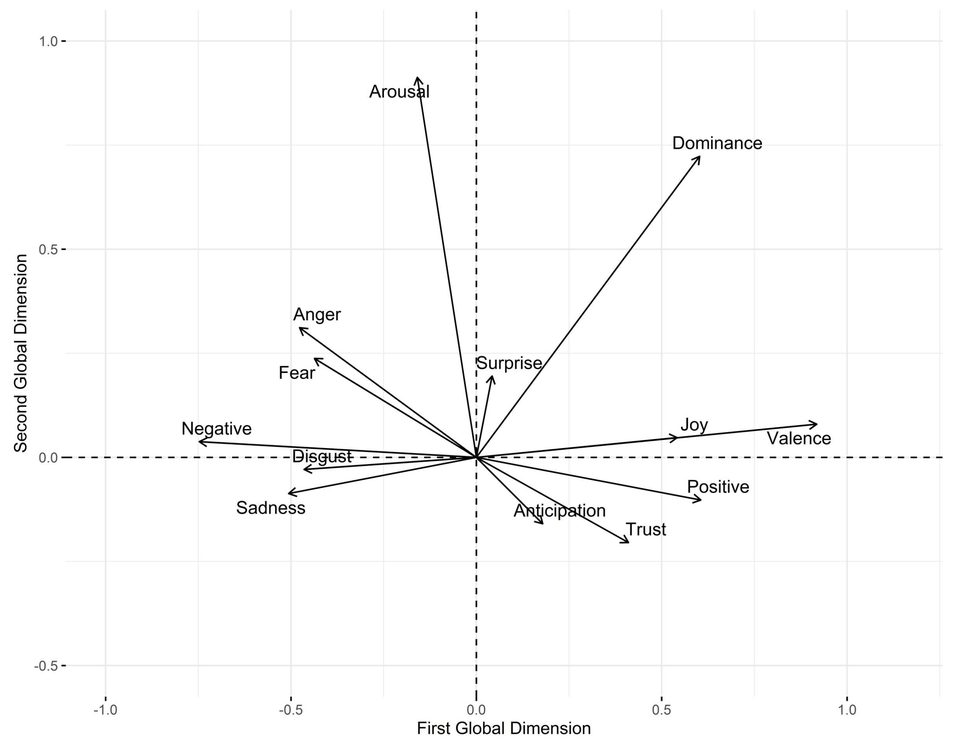
Our results show that three orthogonal emotional dimensions are consistently found in each and every dataset, regardless of the underlying analysis we performed. We name these dimensions:

1) **valence**, representing positive-negative sentiment;
2) **activation arousal**, representing the combination of arousal-dominance; and
3) **expectancy tension**, which is the tension derived from the expectancy towards future scenarios.




**Correlations of original variables to underlying emotions found across the textual datasets**

We corroborate the previous results finding valence and arousal as core dimensions:




**Mapped variables to top 2 dimension following results of 12-point circumplex structure of core affect by Yik 2011**

## 5. Conclusion

Our methodology confirms previous findings identifying that pleasure (valence) and arousal explain most of the variance in emotional states. Furthermore, similar to previous research, we show that dominance contributes to both the valence and arousal dimensions.
Finally, we identify the existence of a new dimension named the „expectancy tension" dimension, which is independent of the second arousal dimension.