

# The Moderating Role of the Emotional Valence on the Relationship between Big Five Personality Dimensions and Parasympathetic Activity

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## Abstract

High frequency heart rate variability (HF HRV) as the indicator of parasympathetic activation / vagal tone (VT) has been measured during the presentation of two pairs of movie clips of positive and negative emotional valence. Big five personality dimensions have been measured with NEO-PI-R questionnaire. VT has been significantly lower during movie clips aimed to induce negative emotion compared to positive emotion movie clips. Positive correlation between extraversion and VT during the presentation of both pairs of movie clips has been found. Agreeableness significantly interacted with the emotional valence of movie clips. More agreeable individuals reacted with significantly higher vagal activation during negative compared to positive movie clip. Data were also analyzed on the level of NEO-PI-R facets, and specific traits that lie in the basis of observed relations between personality and parasympathetic responses have been indicated.

## Introduction

According to the Polyvagal theory (Porges, 1995, 2001), affective states that follow the perception of a safe environment are characterized by higher parasympathetic activation in contrast to more distressing states. Data from numerous studies partly support this notion. Studies that relate vagal activation to major personality traits are scarce and studies that would investigate interactions between major personality traits and emotional valence on the VT are completely missing. Extraversion is previously found to be positively associated with VT during baseline (Oveis et al., 2009) and negatively associated with VT during mental arithmetic task (Knyazev et al., 2002). Other Five factor model dimensions are not found to be related to neither resting VT nor to VT reactivity. Nevertheless, there are numerous data on the links between resting VT as well as VT reactivity and other personality traits that are subsumed under Big five dimensions. Many studies have shown that aggressiveness and hostility (as components of Agreeableness and Neuroticism) are related to greater vagal reactivity, while anxiety and depressiveness (as components of Neuroticism) are related to low resting VT and low vagal reactivity. This study replicates findings on the relations between positive and negative emotions and VT and extends them in the context of individual differences.

Hypotheses:

- VT will be higher during the induction of positive compared to negative emotion.
- VT will be in positive correlation with Extraversion, Agreeableness and Conscientiousness and in negative correlation with Neuroticism.
- Agreeableness is going to interact with emotional valence on VT in a way that less agreeable individuals are going to react with greater VT decreases during negative emotional situation.

## Method

**Participants**  
50 students from the University of Rijeka (31 women and 19 men)

**Questionnaire measures**

**Subjective experience**  
After each movie clip a12-item questionnaire, developed for the purposes of this study, has been administered for the first and the second part of each video clip. Data have been aggregated in positive and negative affect scores.

**Personality**  
The Croatian version of the NEO-PI-R questionnaire (Costa & McCrae, 2005), measuring five basic dimensions of personality (Neuroticism, Extraversion, Openness to experience, Agreeableness and Conscientiousness) and 30 facets (six facets defining each of the five domains) was used. The questionnaire contains 240 items, with responses given on a 5-point Likert type scale.

**Facial expressions**  
2 independent raters estimated participants’ facial responses on the dimensions of positive and negative affect.

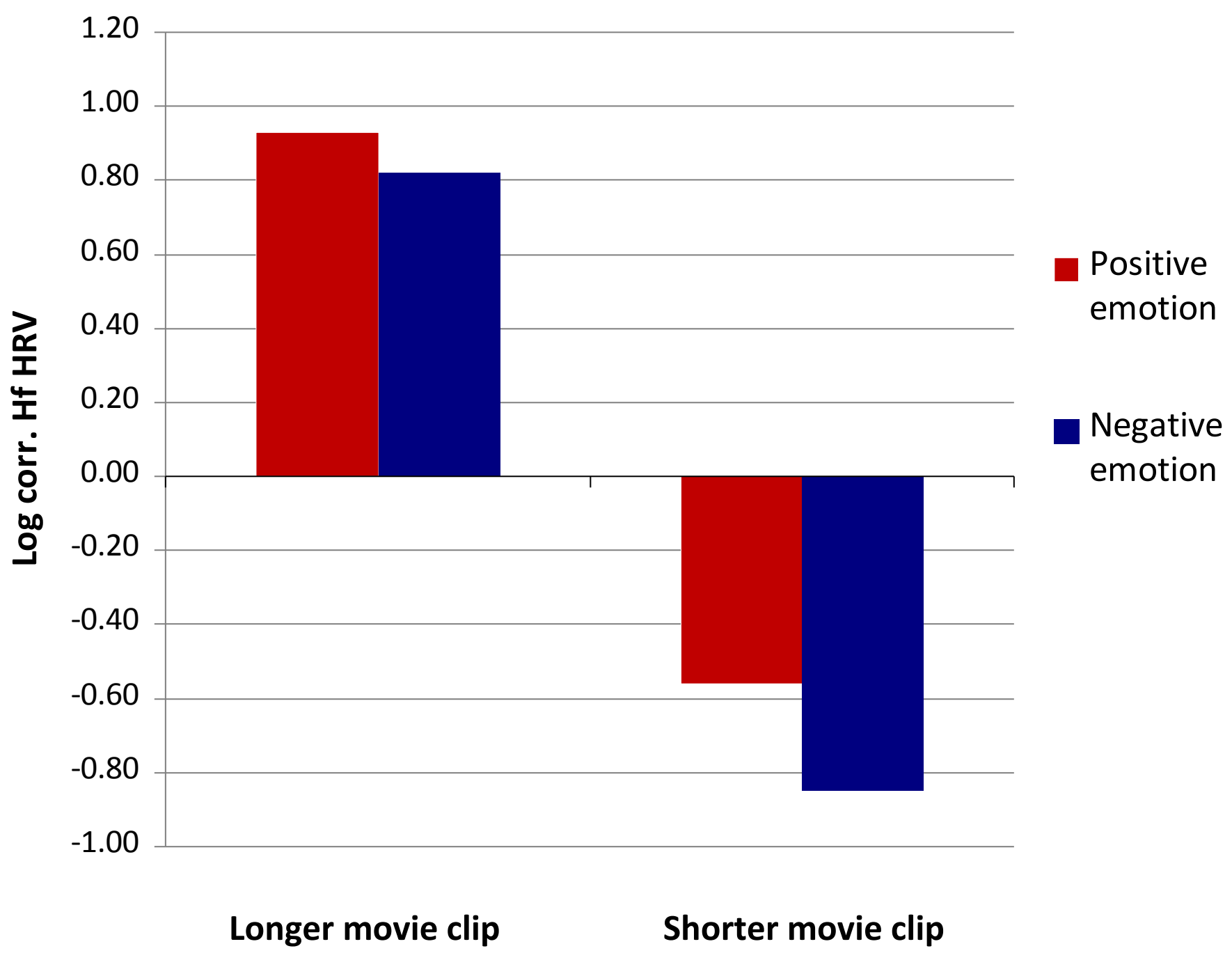
**Emotion induction**  
Four movie clips aimed to induce PA and NA were taken from the list of the emotional movie clips made by Schaefer et. al. (in press).

**Parasympathetic activation**  
HF HRV has been derived from the ECG data (1000 Hz) measured with Psychlab system during 2 minutes periods of the first pair and 1 minute periods of the second pair of the emotional movie clips.

## Results

Subjective experience and estimates of facial expressions changed in the expected direction for both pairs of movie clips. To derive an approximate measure of parasympathetic activation, HF HRV (.15 Hz – .4 Hz) has been extracted. In addition, in order to reduce or eliminate the influence of basal levels of the cardiac sympathetic tone from the HF HRV, root square of the spectral power of high frequency RRI power (ms<sup>2</sup>) divided with the mean RRI (ms) has been computed.

To test the difference in vagal activation between positive and negative emotion, two t-tests for dependent samples have been computed, first one for the two 2 minutes recording periods (longer movie clips) and second one for the two 1 minute recording periods (shorter movie clips). As expected, VT has been significantly higher during the induction of positive compared to negative emotion in both pairs of the clips. For the 2 min. periods t = 1.98; df = 46; p=.05. For the 1 min. periods t = 3.32; df = 46; p<.001.



Correlations between Big five dimensions and VT during the induction of positive and negative emotion

	Neuroticism	Extraversion	Openness	Agreeableness	Conscient.
Positive emotion	.18	.30*	.17	.04	.14
Negative emotion	.15	.46**	.23	.20	.08

As expected, Extraversion appeared to be positively related with parasympathetic activation during the induction of both positive and negative emotion. To investigate which facets of extraversion contributed to observed correlations, an additional correlational analysis has been performed.

Correlations between NEO-PI-R Extraversion facets and parasympathetic activation during the induction of positive and negative emotion

	E1	E2	E3	E4	E5	E6
Positive emotion	.19	.28	.08	.23	.24	.14
Negative emotion	.42**	.38**	.11	.23	.26	.30*

Four Extraversion facets correlated significantly with VT during the presentation of the clips aimed to induce negative emotion: E1 – warmth, E2 – gregariousness, E5 – excitement seeking and E6 – positive emotion . During the presentation of the positive movie clips, only E2 correlated significantly with VT.

Agreeableness interacted with the emotional valence of movie clips (F(1,43)=4.50; p<.05). More agreeable individuals reacted with higher vagal activation during negative compared to positive movie clip, while less agreeable individuals reacted with significantly lower vagal activation during negative compared to positive movie clip. In other words, differences in VT between less and more agreeable individuals have been found to be more pronounced during negative than during positive movie clips. None of the Agreeableness facets interacted significantly with the emotional valence of the clips.



## Conclusions

Expectedly, HF HRV corrected for the sympathetic influences, as a rarely used measure of parasympathetic activity, has increased during positive and decreased during negative emotion induced by movie clips of different lengths. This is the first study to demonstrate relatedness of Extraversion with VT during the induction of positive and negative emotion. Interestingly, it appears that different features of Extraversion are more related to VT during negative than during positive emotion experience. This is also the first study to demonstrate an interaction between a major personality trait – Agreeableness – and emotional valence of the situation on VT.

## References

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