Personality and Individual Differences 52 (2012) 664–669

Contents lists available at SciVerse ScienceDirect

Personality and Individual Differences

journal homepage: www.elsevier.com/locate/paid

The relationship between extraversion, neuroticism and aspects of trait affect

Philippe Verduyn *, Karen Brans

Department of Psychology, University of Leuven, Tiensestraat 102, 3000 Leuven, Belgium

ARTICLE INFO

Article history:
Received 28 September 2011
Received in revised form 8 December 2011
Accepted 13 December 2011
Available online 5 January 2012

Keywords:
Extraversion
Neuroticism
Emotion
Frequency
Intensity
Duration

ABSTRACT

Individual differences in the affective component of global personality traits such as extraversion and neuroticism can be described in terms of three different aspects: frequency, intensity and duration. Extraversion and neuroticism have been found to be related to the frequency and intensity of positive and negative emotions, respectively. However, it is unclear whether both personality traits are related to the duration of emotions and which aspect of trait affect most strongly characterizes the emotional life of extraverts and neurotics. For a period of 1 week, participants were asked to report at the end of each day the frequency, intensity and duration of the positive and negative emotions they experienced earlier that day. Correlational analyses revealed that extraversion is positively related to the frequency, intensity and duration of positive emotions whereas neuroticism is positively related to the frequency and duration of negative emotions. Regression analyses and a comparison of effect sizes further showed that the duration of positive emotions is the strongest predictor of extraversion whereas the frequency of negative emotions is the strongest predictor of neuroticism.

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1. Introduction

Even though almost all people occasionally smile or shed a tear, some people tend to feel good most of the time whereas others are especially prone to negative feelings (e.g., Diener & Larsen, 1984). This reflects individual differences in trait affect which has been defined as people's disposition to experience certain emotions and moods across situations and over time (Watson, Clark, & Tellegen, 1988). This construct is broad and encompasses several components. Schimmack, Oishi, Diener, and Suh (2000) distinguished three different aspects of trait affect: frequency, intensity and duration. The authors defined *frequency* as the number of times an affect is elicited, *intensity* as the intensity of an affective experience at any moment in time, and *duration* as the time an affect is present after elicitation until it ceases to be present. Across aspects, individual differences are largely independent (Larsen & Diener, 1987; Schimmack & Diener, 1997). Within aspects, individual differences partially generalize across emotions; people who experience often positive emotions also experience often negative emotions (Schimmack, 2003; Schimmack et al., 2000), those who experience intense positive emotions also experience intense negative emotions (Schimmack, 2003; Schimmack & Diener, 1997), and those who experience long positive emotions also experience long negative emotions (Schimmack, 2003).

One important advantage of distinguishing between aspects of trait affect is that it allows for a fine-grained analysis of the affective components of global personality traits (Schimmack, 2003). In previous research five major personality traits have been identified: agreeableness, conscientiousness, extraversion, neuroticism and openness (McCrae & Costa, 1991). Two of these, extraversion and neuroticism, have repeatedly been shown to contain a strong affective component (e.g., DeNeve & Cooper, 1998) and their relationship with the aspects of trait affect has been examined. In particular, for frequency small positive correlations were found between extraversion and the frequency of positive emotions whereas small to moderate positive correlations were found between neuroticism and the frequency of negative emotions (Carstensen, Pasupathi, Mayr, & Nesselroade, 2000; Schimmack, 2003). For intensity moderate positive associations were found between extraversion and the intensity of positive emotions whereas moderate positive associations were found between neuroticism and the intensity of negative emotions (Schimmack & Diener, 1997; Williams, 1989). For duration the picture is less clear. Schimmack (2003) found a significant small positive correlation between neuroticism and the duration of negative emotions but no significant correlation between extraversion and the duration of positive emotions. In two studies Verduyn, Delvaux, Van Coillie, Tuerlinckx, and Van Mechelen (2009) also examined the relation between extraversion, neuroticism and emotion duration but their findings were inconsistent across studies.

Limitations of the studies of Schimmack (2003) and Verduyn, Delvaux et al. (2009) may have caused this ambiguous pattern. In the study by Schimmack, duration was measured with a scale ranging from 0 to only 30 min, which is rather short in view of theoretical claims on emotion duration by leading scholars (e.g., Frijda,

* Corresponding author.
E-mail address: philippe.verduyn@psy.kuleuven.be (P. Verduyn).

0191-8869/$ - see front matter © 2011 Elsevier Ltd. All rights reserved.
doi:10.1016/j.paid.2011.12.017

2007) and empirical work which revealed that emotions may last from only a few seconds up to several hours or even longer (Scherer, Walbott, & Summerfield, 1986; Sonnemans & Frijda, 1994; Verduyn, Van Mechelen, & Tuerlinckx, 2011). Hence, to measure emotion duration, one should either make use of an open-format response scale or an interval scale which has a sufficient broad range to cover all possible durations. In the studies by Verduyn, Delvaux et al. (2009) the sample sizes may have been rather small to reliably examine correlates of individual differences in emotion duration (Study 1: $N = 59$; Study 2: $N = 43$). In sum, whereas ample evidence is available that extraverts experience positive emotions frequently and intensely, and, neurotics experience negative emotions frequently and intensely, evidence on the relation between both personality traits and emotion duration is inconclusive. This is troublesome as emotion duration is a central parameter of an emotional response (Frijda, 2007) and, consequently, any description of individual differences in affect is incomplete when no reference to duration is made (Van Mechelen, Verduyn, & Brans, in press). Moreover, as the duration of negative emotions plays a role in the development of various types of somatic disease such as cardiovascular illness (e.g., Brosschot, Gerin, & Thayer, 2006) and is characteristic for several mental disorders according to the DSM-IV (American Psychiatric Association, 2000), it is important to investigate which dispositional dimensions are related to emotion duration to identify which person-types run a risk of developing such diseases.

One further limitation of previous research on aspects of trait affect is that typically only one or two aspects were studied at a time. As a result, it is unclear which of the three aspects is most characteristic for the emotional life of extraverts and neurotics. It remains, for example, uncertain whether extraverts experience especially frequently positive emotions or whether their positive emotions are especially intense or long. Insight in the relative strength of these relationships would refine our understanding of the affective component of extraversion and neuroticism, and would further reflect to what degree both personality traits can be predicted by the three aspects of trait affect. So far, only in one study (Schimmack, 2003), information on extraversion, neuroticism and the three aspects of trait affect was collected simultaneously but the distinctive contribution of each aspect to the prediction of neuroticism and extraversion was not examined and, as mentioned above, the assessment of emotion duration was not optimal.

In the present study we aimed to contribute to a better understanding of the emotional life of extraverts and neurotics by examining how these traits are related to aspects of trait affect. In line with previous studies (Carstensen et al., 2000; Schimmack, 2003; Schimmack & Diener, 1997; Williams, 1989), we hypothesized that extraversion is positively related to the frequency, intensity and duration of positive emotions whereas neuroticism is positively related to the frequency, intensity and duration of negative emotions. Due to a lack of prior research incorporating all three aspects of trait affect, no specific a priori hypotheses were made regarding the relative predictive value of each aspect.

We collected information on emotion frequency, intensity and duration by means of a daily diary approach (Kahneman, Krueger, Schkade, Schwartz, & Stone, 2004). By aggregating the collected data within participants across days for each aspect separately, we reduced situational variance which allowed us to obtain information regarding affect-related traits (Diener & Larsen, 1984; Schimmack & Diener, 1997). Furthermore, in order to overcome the limitations of the studies by Schimmack (2003) and Verduyn, Delvaux et al. (2009), information on emotion duration was collected from a rather large number of participants using a free response format. The set of emotions included both negative (anger, fear, sadness, guilt, shame, disgust and depression) and positive emotions (joy and relaxed) as we expected neuroticism and extraversion to be related to aspects of negative and positive emotions, respectively. Furthermore, emotions were selected such that the set included both high and low arousal emotions of both valences which occur frequently (Scherer et al., 1986).

2. Method

2.1. Participants

Participants were 100 students from the University of Leuven. They were selected from an initial sample of 439 first-year psychology students based on two criteria that are of no direct relevance for the present manuscript: (a) their score on a depression questionnaire in order to cover the whole range of depression scores with gradual oversampling of extreme scores to maximize variability, and (b) their medical history as individuals suffering from cardiovascular disease and/or taking medication affecting the cardiacvascular or central nervous system were excluded. Two participants never completed the daily questionnaire, leaving a final sample of 98 participants; 37 men and 61 women with a mean age of 19 ($SD = 1.3$). Overall, compliance was good as participants filled out the questionnaire on average 6.2 times during the 1 week study period. The measures reported here were completed as part of a larger study, for which participants received payment of €70.

2.2. Procedure

On the first day of the study participants were invited to the psychology department. They were informed that they were taking part in a study on emotional experience that would last seven consecutive days. They were further told that they would have to complete a questionnaire before going to bed each evening that would ask them about the emotions they experienced earlier that day. To ensure that they provided information regarding emotional episodes rather than moods, participants were asked to focus on experiences that were clearly elicited by specific internal or external events (Beedie, Terry, & Lane, 2005). Furthermore, as the end of an emotional episode can be defined in several ways (Van Mechelen et al., in press), participants were explained that an emotional episode was defined to end as soon as the emotion was no longer felt for the first time (i.e., the point in time at which the intensity of the emotion is again zero); if the emotion was experienced again later on, they were asked to consider this a new episode (Verduyn, Delvaux et al., 2009; Verduyn et al., 2011). These instructions were repeated each day of the study. At the end of this session participants received the web address where the daily questionnaire could be found. Finally, 2 days later participants returned to the department to complete a number of personality questionnaires, including the neuroticism and extraversion scales.

2.3. Materials

2.3.1. Daily questionnaire

To obtain information on the frequency, intensity and duration of emotion episodes, a daily questionnaire was developed which was highly similar to the questionnaire used by Verduyn, Delvaux et al. (2009) and Verduyn et al. (2011). In particular, the daily questionnaire was divided into nine blocks, each block corresponding to one of the nine emotions we examined. Block order was randomized for each participant on each day.

2.3.1.1. Emotion frequency. During each block, participants were first asked how many times they experienced the target emotion that day (fear, anger, sadness, disgust, shame, guilt, depressed, joy or relaxed, depending on which prompt was randomly presented

first). If during a block participants indicated that they did not experience the target emotion, they were immediately presented with the block for the next emotion. If they indicated "one time", they were then asked to answer two questions about that emotional experience (described below). Subsequently, they were presented with the next block for another emotion, and completed the same set of questions. If they indicated that they experienced two or more episodes of the target emotion, they were successively asked to answer the questions described below concerning the most salient one only.

2.3.1.2. Emotion intensity. Participants were asked to rate the intensity of the emotion at the beginning of the emotional episode on an 8-point scale ranging from not intense at all (0) to very intense (7).

2.3.1.3. Emotion duration. Participants were asked to rate the duration of the emotion by specifying the number of hours, minutes and seconds that the emotional experience lasted.

2.3.2. Trait questionnaires

Neuroticism and extraversion were measured with the Dutch version of the Ten Item Personality Inventory (Gosling, Rentfrow, & Swann, 2003; Hofmans, Kuppens, & Allik, 2008). The TIPI consists of five scales, each scale reflecting the mean of two 7-point items. For the present study, only the scores on the neuroticism and extraversion scales were used. Cronbach alpha's for neuroticism and extraversion were .71 and .76, respectively, reflecting acceptable internal consistency of both scales.

3. Results

3.1. Descriptive statistics for neuroticism and extraversion

For neuroticism and extraversion, the mean, median and standard deviation are presented in Table 1. From the means (which are close to the scale mid-points) and the size of the standard deviations, it can be inferred that the sample covers a wide range of neuroticism and extraversion scores.

3.2. Descriptive statistics for aspects of trait affect

For the three different emotion aspects, the mean, median and standard deviation are presented for each emotion in Table 2. For each emotion aspect, we first examined whether differences between emotions occurred. Subsequently, we examined all pairwise comparisons (with Tukey–Kramer correction) to get a more refined understanding of the nature of the between emotion differences. Only statistically significant differences will be described below.

Regarding frequency, differences between emotions were found ($F(8,873) = 74.22$, $p < .001$). Pair-wise comparisons revealed that the positive emotions, joy and relaxed, were more often experienced than the negative emotions.

Concerning intensity, differences between emotions were found as well ($F(8,1631) = 5.32$, $p < .001$). In particular, joy was on average more intense than relaxed, fear and shame. Additionally, sadness was on average more intense than shame and relaxed.

Table 1
Descriptive statistics for neuroticism and extraversion.

	Neuroticism	Extraversion
Mean	3.37	4.47
Median	3.00	5.00
SD	1.52	1.43

Regarding duration, a highly positively skewed distribution was obtained which is reflected by the sizeable difference between the mean and the median of the distribution. To avoid that outliers (i.e., very long emotional episodes) would bias our conclusions, we compared the duration medians instead of the means. Evidence for variability in duration between emotions was found ($\chi^2_{(8)} = 242.81$, $p < .001$) with positive emotions on average lasting longer than negative emotions ($\chi^2_{(1)} = 143.95$, $p < .001$) even though it should be noted that the difference between joy and depression was not significant. Among the negative emotions, depressed lasted the longest followed by sadness.

Before examining the correlates of the aspects of trait affect, two remarks need to be made. First, as the frequency of certain emotions was rather low, we collapsed data across emotions of the same valence for all subsequent analyses. Second, as the distribution of emotion duration was positively skewed, duration ratings were logarithmically transformed for all subsequent analyses.

3.3. Relation between aspects of trait affect

To investigate how the different emotion aspects are related to each other we calculated for each person the frequency of negative and positive emotions, the average intensity of negative and positive emotions and the average (log transformed) duration of negative and positive emotions. The correlations between the different aspects of trait affect across persons are shown in Table 3. Within two aspects, individual differences in positive emotions were found to partially generalize to individual differences in the corresponding aspect of negative emotions. In particular, participants who tended to experience intense positive emotions and long positive emotions also tended to experience intense negative emotions and long negative emotions, respectively. Across aspects, all correlations were small or not significant except for a moderate negative correlation between the frequency of positive emotions and the duration of negative emotions ($r = -.34$), and a moderate positive correlation between the intensity and duration of negative emotions ($r = .45$).

3.4. Relation between extraversion, neuroticism and aspects of trait affect

The correlations between both global personality traits (i.e., extraversion and neuroticism) and the aspects of trait affect are presented in Table 4. As expected, extraversion correlated positively with the frequency, intensity and duration of positive emotions whereas neuroticism correlated positively with the frequency and duration of negative emotions. Surprisingly, neuroticism was not correlated with the intensity of negative emotions, even though a trend in the expected direction was observed ($p = .13$).

To examine which aspects were most predictive of extraversion and neuroticism we entered the frequency, intensity and duration of positive and negative emotions (i.e., six predictors) simultaneously to regression models. First, we examined how much of the variability in extraversion and neuroticism was explained by (a) all aspects of trait affect simultaneously, (b) the three positive aspects and (c) the three negative aspects. Subsequently, we examined the distinctive contribution of each specific aspect on top of all other aspects. The results of these analyses are presented in Table 5. Significance tests indicate whether a particular aspect has a distinctive contribution to the prediction on top of all other aspects in the model. The effect sizes reflect the proportion of variability in the criterion variable which is additionally explained by adding the aspect in question to the model on top of all other aspects.

Aspects of trait affect predicted a substantial amount of variance in neuroticism and extraversion scores. Regarding variability in neuroticism, 34% was explained by all aspects simultaneously.

Table 2
Descriptive statistics for frequency (by week), intensity and duration (in minutes) for each emotion separately and by emotion valence.

	Emotion									Valence	
	Relaxed	Joy	Depressed	Sadness	Anger	Fear	Guilt	Disgust	Shame	Negative	Positive
Frequency											
Mean	13.83_{a}	12.79_{a}	3.06_{b}	3.05_{b}	2.58_{b}	1.61_{b}	1.31_{b}	0.73_{b}	0.90_{b}	13.24	26.62
Median	12.00	11.10	0.00	1.40	2.00	0.00	0.00	0.00	0.00	8.00	23.90
SD	9.81	10.33	7.22	4.40	3.24	3.85	2.28	1.71	1.73	17.54	19.35
Intensity											
Mean	4.38_{c}	4.90_{a}	$4.60_{a,b,c}$	$4.82_{a,b}$	$4.72_{a,b,c}$	$4.32_{b,c}$	$4.48_{a,b,c}$	$4.70_{a,b,c}$	4.09_{c}	4.59	4.63
Median	4.00	5.00	5.00	5.00	5.00	4.00	5.00	5.00	4.00	5.00	5.00
SD	1.43	1.41	1.47	1.60	1.44	1.44	1.71	1.79	1.90	1.59	1.44
Duration											
Mean	126.87	103.60	105.46	81.15	54.47	66.35	53.85	33.96	27.16	66.83	115.86
Median	90.00_{a}	60.00_{b}	$60.00_{a,b}$	35.00_{c}	25.00_{d}	$20.00_{c,d,e}$	$20.00_{c,d,e}$	$6.00_{d,e}$	10.00_{e}	30.00	60.00
SD	153.28	160.64	123.13	139.90	125.36	168.99	114.28	63.95	64.62	128.34	157.15

Note: Means or medians in the same row that do not share subscripts differ significantly.

Table 3
Correlation between the frequency, intensity and (log transformed) duration of positive emotions (PE) and negative emotions (NE).

	Frequency PE	Intensity PE	Duration PE	Frequency NE	Intensity NE	Duration NE
Frequency PE	–	.18	−.20*	.10	−.16	−.34**
Intensity PE		–	.01	−.23*	.35**	−.02
Duration PE			–	−.10	.11	.43**
Frequency NE				–	.09	.12
Intensity NE					–	.45**
Duration NE						–

* $p < .05$.
** $p < .01$.

Table 4
Correlation between neuroticism, extraversion and the frequency, intensity and (log transformed) duration of positive emotions (PE) and negative emotions (NE).

	Frequency PE	Intensity PE	Duration PE	Frequency NE	Intensity NE	Duration NE
Neuroticism	−.14	−.15	.06	.48**	.15	.32**
Extraversion	.19†	.26*	.23*	−.20†	−.02	−.07

† $p < .06$.
* $p < .05$.
** $p < .01$.

Table 5
Weights (β), standard errors (SE) and variance accounted for (VAF) by the frequency, intensity and duration of positive emotions (PE) and negative emotions (NE) as predictors of neuroticism and extraversion in regression analyses.

	Neuroticism			Extraversion		
Predictors	β	SE	VAF	β	SE	VAF
Frequency NE	.04**	.01	.17	−.01	.01	.01
Intensity NE	.05	.15	.00	−.04	.16	.00
Duration NE	.28†	.15	.03	−.12	.16	.01
Frequency PE	−.01	.01	.01	.02†	.01	.03
Intensity PE	−.14	.17	.01	.29	.18	.02
Duration PE	−.10	.21	.00	.63**	.22	.08

† $p < .06$.
** $p < .01$.

This was mainly due to the predictive value of the aspects of negative emotions. In particular, when entering the aspects of negative emotions to the model first, 31% of the variability was accounted for whereas aspects of positive emotions only explained an additional 3%. Inversely, when entering the aspects of positive emotions first, 6% of the variability was accounted for whereas aspects of negative emotions still explained an additional 28%. When examining the distinctive contribution of each specific aspect to the prediction of neuroticism, it was found that the frequency as well as the duration of negative emotions had a distinctive contribution on top of all other aspects of trait affect. When comparing their effect sizes, it was found that the frequency of negative emotions was the strongest predictor.

Regarding variability in extraversion, 20% was explained by all aspects simultaneously. This was mainly due to the predictive value of the aspects of positive emotions. In particular, when entering the aspects of positive emotions to the model first, 17% of the variability was accounted for whereas aspects of negative emotions only explained an additional 3%. Inversely, when entering the aspects of negative emotions first, 4% of the variability was accounted for whereas aspects of positive emotions still explained an additional 16%. When examining the distinctive contribution of each specific aspect to the prediction of extraversion, it was found that the frequency and the duration of positive emotions had a distinctive contribution on top of all other aspects. When comparing their effect sizes, it was found that the duration of positive emotions was the strongest predictor, followed by the frequency of positive emotions.

4. Discussion

In the present study we aimed to get a better understanding of the emotional life of extraverts and neurotics by examining the

relation between both personality traits and three aspects of trait affect, namely frequency, intensity and duration. Before discussing our key research questions, we will first comment on our findings regarding the aspects of trait affect per se.

4.1. Aspects of trait affect

For each aspect differences between emotions were found. The most notable finding was that positive emotions are more frequent and, on average, longer lasting than negative emotions. This confirms previous research showing that our daily life is more characterized by positive than negative emotions (Kahneman et al., 2004). Furthermore, confirming previous studies on aspects of trait affect (Schimmack, 2003; Schimmack & Diener, 1997; Schimmack et al., 2000) individual differences in different aspects were found to be largely independent whereas, within aspects, individual differences in the intensity and duration of positive emotions were found to partially generalize to individual differences in the corresponding aspects of negative emotions.

4.2. Relation between extraversion, neuroticism and aspects of trait affect

As expected, extraversion was positively related to the frequency, intensity and duration of positive emotions. Moreover, confirming our hypotheses, neuroticism was related to the frequency and duration of negative emotions. Contrary to our expectations, no significant relation between neuroticism and the intensity of negative emotions was found, although a trend in the expected direction was observed. It should be noted that in a study of Carstensen et al. (2000) the relation between neuroticism and the intensity of negative emotions was also found to be not significant. Future studies are needed to further examine the strength of this relation. Interestingly, the duration of emotions was related to both personality traits. This reflects the importance of taking emotion duration into account to get a detailed picture of the emotional life of extraverts and neurotics.

The aspects of trait affect explained a fifth and a third of the variability in extraversion and neuroticism, respectively. This implies that a reasonable part of the emotional life of extraverts and neurotics can be described in terms of the frequency, intensity and duration of negative and positive emotions. However, the largest amount of variance in both personality traits was not accounted for by aspects of trait affect. As such, the concepts of neuroticism and extraversion are broader than a combination of emotion frequency, intensity and duration.

A comparison of the predictive strength of each aspects of trait affect showed that neuroticism is mainly related to the frequency of negative emotions. This relates to research associating neuroticism with emotional variability (Kuppens, Van Mechelen, Nezlek, Dossche, & Timmermans, 2007) and may be partially accounted for by neurotics' tendency to select relatively often stressful situations (Bolger & Schilling, 1991). Extraversion was found to be mainly related to the duration of positive emotions which adds to our understanding of the emotional life of extraverts as this aspect was typically not taken into account in previous studies. The experience of long positive emotions may well be the affective property that most clearly distinguishes extraverts from introverts. One of the underlying processes that accounts for the strength of this relation might be extraverts' tendency to spend a lot of time in positive situations (Emmons, Diener, & Larsen, 1986) as this emotion regulation strategy may cause their positive emotions to persist.

4.3. Limitations of the study

Obviously, the present study has a number of limitations that leave opportunities for future studies. First, the sample consisted of psychology students who were paid for their participation. Further research is needed to investigate to what degree the present results generalize to other populations. Second, the present set of emotions included several negative but only two positive emotions. Future studies may use a broader set of positive emotions (e.g., pride, curiosity, interest, gratitude). Third, intensity was measured by asking participants to estimate the intensity of the emotion at onset. The intensity of emotions changes within emotional episodes (Sonnemans & Frijda, 1994; Verduyn, Van Mechelen, Tuerlinckx, Meers, & Van Coillie, 2009) and somewhat different estimates might have been obtained when specifying a different time point. However, an advantage of the current approach is that measures of the initial intensity of emotions are less ambiguous than overall time-independent assessments of intensity (Sonnemans & Frijda, 1994). Nevertheless, future studies using multiple measures of intensity may be an interesting extension of the present study. Fourth, the data still contain some retrospection (albeit at the within-day level only) and, consequently, memory biases may have somewhat affected the present end-of-day reports. However, as memory biases only start to substantively influence people's judgments with delays that exceed one day (Dockray et al., 2010), it seems reasonable to assume that the present end-of-day reports were largely accurate.

5. Conclusion

Extraverts experience often positive emotions which are highly intense and last for a long time. Neurotics experience often negative emotions which last for a long time. The duration of positive emotions is the strongest predictor of extraversion whereas the frequency of negative emotions is the strongest predictor of neuroticism.

Acknowledgments

We would like to thank Peter Kuppens for his helpful comments on an earlier version of this paper. This research was supported by Grant GOA/10/02 from the Research Fund of the University of Leuven.

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