Positive affect and its relationship to free recall memory performance in a sample of older Dutch adults from the Maastricht Aging Study

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SUMMARY

Objective A Dutch translation of the Positive and Negative Affect Scale (PANAS) was used to measure Positive Affect (PA) and its relationship to episodic memory in a sample of Dutch adults between the ages of 40 to 82 years. Specifically, the role of PA was examined as a predictor of performance on a serial list learning task that included a recognition and free recall component.

Methods Participants were divided into two age groupings representing middle-age (40 to 64 years) and older (65 to 82 years) adults with respect to the study sample.

Results PA was not related to recognition performance in either age grouping. In the older age group, however, PA predicted free recall.

Conclusion PA facilitated episodic memory in older adults when unsupported tasks conditions were present that placed heavy demands on processing resources. Copyright © 2005 John Wiley & Sons, Ltd.

key words — positive affect; PANAS; episodic memory; Dutch; older adults

Positive affect (PA) is a state of mood that is characterized by subjective well-being, happiness, and positive life engagement (Watson and Tellegen, 1985). The quantification of PA originated in the United States where it was conceptualized along a continuum of affective states with negative affect (NA) at the opposite end (Russell, 1980). It has been argued, however, that this one-dimensional scaling of PA and NA is overly simplistic and a tripartite model has been suggested with the two emotional states representing independent processes (Watson et al., 1999). Specifically, NA is presumed to be a general expression of negative mood that is specific to psychiatric conditions such as depression and anxiety. PA, on the other hand, is not associated with a pathologic state but is best described by its behavioral manifestations including an optimistic outlook, increased energy, and a state of active engagement (Schwarz, 1990). These features of PA have been found in reflective problem solving, the persistence of optimism even in the face of adversity or negative life events (Mroczek, 2001), and selected manifestations of creativity (Isen et al., 1987).

Because of the features noted above, it could be argued that PA is an emotional mechanism that catalyzes specific cognitive capabilities through identified neurological pathways associated with enhanced information processing resources (Isen et al., 1991). To be sure, in several studies that have been conducted with younger adult volunteers, PA has been found to be positively correlated with superior performance.
on higher-order intellectual tasks such problem solving, executive functioning, and creativity (Ashby et al., 1999). In these and other studies it has been argued that PA impacts performance through facilitating one’s ability to sustain attention in order to solve a problem at hand. In other words, PA may work to bolster one’s thought-to-action repertoire which, in turn, makes available psychological resources that can then be mobilized to enhance cognitive functioning (Fredrickson, 2001).

Based on this premise it could also be argued that PA may exert a preservation effect on cognitive processes in old age as well. Interestingly, the relationship between PA and cognitive function has not been examined in older adults per se. However, based on the extant literature available in younger subjects the role of PA may be most observable in old age on those tasks where optimal performance requires sustained self-initiated processing resources. The impact of PA may be most identifiable, for example, on tasks that place the heaviest demands on information processing resources as is found when performance is in unsupported task conditions. This would be in contrast to more supported conditions as can be found on tasks where there is a rich source of available cues to aid performance (e.g. recognition tasks). In order to test this assumption, the relationship between PA and memory performance was examined on a serial list learning task that was graded with respect to the provision of cognitive support to facilitate task performance.

The study sample consisted of community-dwelling Dutch adults who ranged in age between 40 and 82 years and could be characterized as aging normally. The cognitive task of interest was a multitrial verbal list learning test normed on Dutch adults that included a free recall (unsupported) and a recognition (supported) task component with respect to the provision of cues at the point of retrieval (Brand and Jolles, 1985). Based on the conceptual argument noted earlier it was anticipated that a relationship between PA and memory performance would most apparent in those participants who were older and on the least supported task with respect to cue provision; namely, free recall.

PA was measured using the Positive and Negative Affect Scale or PANAS (Watson et al., 1988) a widely known standardized measure of PA and NA respectively. The PANAS was selected because it has been employed in the United States and elsewhere to assess these constructs in both younger and older adults. In fact, the PANAS is, perhaps, the most commonly used instrument to assess PA worldwide. This is under-

scored by the availability of translations of the PANAS in German (Krohne et al., 1996), Russian (Balatsky and Diener, 1993), Spanish (Joiner et al., 1997), Italian (Terracciano et al., 2003), Swedish (Hilleras et al., 1998), and Turkish (Gencoz, 2000). At present, however, no Dutch language version of the PANAS exists in the English literature. Therefore, a secondary goal of this study was the validation of a Dutch language version of the PANAS to assess PA and NA in Dutch-speaking citizens in the Netherlands.

METHODS

Sample

The sample for this study consisted of individuals from the Maastricht Aging Study (MAAS). MAAS was designed to examine the biological determinants and cognitive consequences of normal aging. Between 1993 and 1995, participants were selected from a register of 15 family practices in the South of The Netherlands (Metsmakers et al., 1992). In the first cross-sectional panel of the MAAS of which the data for the present study was taken, 3,754 individuals were invited to participate. These individuals were asked to complete a demographic and health questionnaire and (for a smaller group) a series of a medical and neuropsychological examinations. The invited men and women were—according to the medical practitioners’ register from which they were chosen—without medical conditions that could interfere with optimal brain function. Persons with chronic neurological pathology (e.g. dementia, cerebrovascular disease, epilepsy, parkinsonism and malignancies related to the nervous system), mental retardation, or chronic psychotropic drug use were excluded. Furthermore, the sample was stratified according to age (five-year age groups), sex, and general ability (measured by an index of occupational attainment in the register: low vs high). In total, 2,043 persons completed the demographic and health questionnaire and 1,252 persons subsequently agreed to participate. Of these, a total of 470 individuals were invited to take part in the follow-up study. It was from this subgroup of participants that the PANAS and the specific cognitive tasks were available.

As part of the MAAS protocol each participant who received both the neuropsychological tests and the self-report instruments (e.g. the PANAS) were of primary interest (Jolles et al., 1995). Of those, 241 who had complete data and were within the age range for

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inclusion where the minimum cutoff was 40 years. Twenty-two individuals in this group had incomplete data on individual items from the Symptom Checklist SCL-90; (Derogatis, 1977). Missing items from these participants were replaced by substituting group means with respect to the named variables. Because it is well known that reductions in attentional resources make it more difficult for individuals in late and very late life to engage in processes that facilitate memory consolidation (Salthouse, 1996), it was anticipated that the oldest participants in the MAAS study would show greater variation in task performance and this would increase the likelihood that non-cognitive factors (such as PA) would exert a measurable impact on outcomes. Thus, two age groupings of participants were created and these were expected to differ with respect to within-group variation on the serial word list task with less within-subjects variance attributable to those who were younger. Specifically, those who ranged in age between 40 and 64 years (a middle-age low variance group) and a grouping inclusive of the very oldest MAAS participants who ranged in age between 65 and 82 years (an old age high variance group). These two groupings were examined separately.

Memory measure

The episodic memory measure used in this study was a multitrial visual verbal learning task (VVLT) that has been previously validated in a Dutch sample (Brand and Jolles, 1985). The list of words consisted of 15 common nouns that were monosyllabic in nature. With respect to the testing protocol, the nouns were presented one at a time as they appeared on a computer screen at sec per noun and a one sec intertrial interval. After the 15 nouns had been presented the participant was then asked to state as many of the 15 nouns as could be remembered. Following this first recall interval, the words appeared once again on the screen at the same rate as in the initial trial and the procedure was repeated four additional times in succession. After each presentation trial the participant was asked to verbally free recall as many of the words as possible. Each trial was presented on a computer screen that displayed the entire list of words at the conclusion of each recall trial and whether or not the participant correctly recalled the words in the previous trial. A recognition task that involved the presentation and identification of the 15 original nouns (randomly intermixed with 15 words that had not been previously seen) was administered 20 min after the free recall task.

Self report measures

The PANAS was used to assess PA and NA respectively. As noted earlier, the PANAS was chosen because it is based on the conceptual model used to describe the role of PA on cognitive function in non-diseased adults (Ashby et al., 1999) and it has been previously used in a very old sample of community-dwelling individuals to assess subjective well-being (Kercher, 1992). The PANAS also has been previously examined with respect to its psychometric properties in Dutch adults (Peeters et al., 1996) although this early reference is published in a Dutch language journal. Like the English language version, the Dutch PANAS consists of 20 descriptors of mood state (10 positive, e.g. enthusiastic; 10 negative, e.g. nervous). Participants are asked to rate on a five-point scale the extent to which they experienced each mood state during the past two weeks. The points on the scale were labeled as follows: 1 = very slightly or not at all, 2 = a little, 3 = moderately, 4 = quite a bit, and 5 = very much. These response labels carry the same meaning in Dutch as they do in the original English version. In addition to the PANAS, demographic data including age, sex, and years of education were also obtained from the participants. Education was measured using a Dutch scoring system (de Bie, 1987) which consists of an eight-point scale ranging from unfinished primary education to university education. In addition to these demographic data, symptoms of depression and anxiety were measured using the Depression and Anxiety subscales of the SCL-90 (Arrindell et al., 1986).

RESULTS

As noted in Table 1, the mean age of the 241 participants was 62.67 years (SD = 10.98; range: 40 to 82 years). The mean level of education for the entire group was 3.0 (SD = 1.81) indicating that these participants had all completed at least a basic education equivalent to high school in the United States. Table 1 notes, however, that the two age-groupings differed in self-reported education. Specifically the older age grouping reported less formal education (M = 2.55) than the middle-age grouping (M = 3.44). The proportion of male vs female participants did not differ between age groupings. For VVLT performance, mean scores favored the middle-age grouping in contrast to the older age grouping for both the recall (M = 45.0 vs M = 35.68) and recognition (M = 14.50 vs M = 13.65) tasks. In addition, VVLT recall
performance standard deviations for the older age grouping were larger ($SD = 9.48$) than for the middle-age grouping ($SD = 7.78$).

Table 2 highlights the psychometric properties of the PANAS with respect to the total sample of 241. This analysis produced a factor structure that replicated, in this Dutch language sample, the previously described factor structure in an American sample (Watson et al., 1988); namely, a PA and an NA factor emerged that together encompassed all 20 PANAS items. As noted in Table 2, the most heavily loaded descriptor for the negative affect items was ‘upset’ contrasted by the item ‘enthusiastic’ that characterized the PA items. The inter-item means and standard deviations for the 20 PANAS items with respect to their NA and PA factor-analytically derived positions are also reported. The internal consistencies for the PA ($\alpha = 0.84$) and NA ($\alpha = 0.80$) items were within acceptable limits and consistent with those reported in a previous validation study of the PANAS in American participants (Bagozzi, 1993). NA was positively correlated in the total sample of 241 with Anxiety, $r = 0.57$, $p < 0.01$, and Depression, $r = 0.51$, $p < 0.01$, as measured by the SCL-90 indicating that it was a valid measure of negative affective symptoms.

Table 3 depicts the zero-order correlations among the selected demographic variables (age, education, sex), the two SLC-90 subscales (depression and anxiety), the factor analytically derived PA and NA scores, as well as the VVLT recall and recognition scores. The separate correlation matrices in Table 3 depict these relationships for the two age groupings. The PA score was not related to cognitive performance in the middle-age grouping; however, in the older age grouping the VVLT recall score was positively correlated with PA, $r = 0.23$; $p < 0.05$ although not the recognition score. NA did not correlate with any of the cognitive measures in either age grouping, although, as noted above for the overall group, it was correlated with SCL-90 depression and anxiety.

Employing a hierarchical regression procedure with the VVLT recall total score as the dependent measure, the impact of PA on word list performance...
was examined in the 65 to 82 year old age grouping. Variable entry was constrained to those variables that were significantly correlated with VVLT total scores at the zero-order level including age and sex that were entered as a single block. The PA factor score was entered next. As noted in Table 4, the demographic block accounted for 11% of the explanatory variance. PA contributed an additional 3% of the variance when entered last. In this case those individuals within the older age grouping who performed best on the VVLT recall score were younger, female, and reported higher PA scores.

To examine whether high PA could be influential in enhancing memory consolidation with respect to recall across the five trials of the VVLT, a repeated measures MANCOVA was employed with word list trials (1 through 5) as the within groups factor; age and sex were covariates. The PANAS PA score was dichotomized using a median split procedure. The mean PANAS PA score for the group labeled ‘high PA’ was 36.77 \( (n = 68, SD = 4.13, \text{Range: 32 to 47}) \). For the group labeled ‘low PA’ the mean score was 20.07 \( (n = 51, SD = 4.40, \text{range: 16 to 31}) \). As expected, age was a significant covariate, \( F (1, 116) = 6.48; \)

Table 3. Zero-order correlations between demographics, VVLT performance, the SLC-90, the PANAS positive and negative affect schedule

<table>
<thead>
<tr>
<th>Age grouping: 40–64 years ((n = 122))</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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</thead>
<tbody>
<tr>
<td>1. Age (years)</td>
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<tr>
<td>3. Sex</td>
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<tr>
<td>4. SLC-Dep</td>
<td>0.08</td>
<td>-0.03</td>
<td>0.18*</td>
<td>1.0</td>
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<tr>
<td>5. SCL-Anx</td>
<td>0.06</td>
<td>0.08</td>
<td>0.20*</td>
<td>0.78</td>
<td>1.0</td>
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<tr>
<td>6. PANAS-PA</td>
<td>-0.03</td>
<td>0.16</td>
<td>-0.06</td>
<td>0.00</td>
<td>-0.01</td>
<td>1.0</td>
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<tr>
<td>7. PANAS-NA</td>
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<td>0.10</td>
<td>0.18</td>
<td>0.50b</td>
<td>0.66b</td>
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<tr>
<td>8. VVLT recall</td>
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<td>0.30b</td>
<td>0.32b</td>
<td>-0.02</td>
<td>-0.07</td>
<td>-0.05</td>
<td>0.07</td>
<td>1.0</td>
<td></td>
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<td>-0.00</td>
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Table 4. Hierarchical Regression with VVLT Recall as the dependent variable

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Predictors</th>
<th>(^a\text{Incr } R^2)</th>
<th>(^b\text{Cum } R^2)</th>
<th>Beta weights</th>
<th>(P)</th>
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<tr>
<td>older age group ((n = 119))</td>
<td>Demographics</td>
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<td>0.11</td>
<td>0.001</td>
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<tr>
<td>VVLT recall</td>
<td>Age</td>
<td></td>
<td></td>
<td>-0.22</td>
<td></td>
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<tr>
<td></td>
<td>Sex</td>
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<td></td>
<td>0.25</td>
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<tr>
<td></td>
<td>PANAS PA</td>
<td>0.03</td>
<td>0.14</td>
<td>0.17</td>
<td>0.048</td>
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\(\text{VA}\)p < 0.05.
\(\text{V}\)p < 0.01.
\(^c\)An eight-point scale unfinished primary education (level 1) to university education (level 8).
\(^d\)Visual Verbal Learning Task (Recall) is the total number words recalled over five learning trials (15 words per trial).
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DISCUSSION

The goal of this study was to examine the relationship between PA and word recall performance on a multi-trial serial word list task in adult Dutch volunteers who were participants in the Maastricht Aging Study. Two age groupings were examined; namely, a middle-age (40 to 64 years) and an older group (65 to 82 years). The primary finding that PA was not related to word recall or recognition performance in the middle-age grouping, but did predict word recall in the older age group supports our initial supposition that the effects of PA on cognitive performance would be most identifiable among older adults on tasks that push the limits of processing resources. A subsequent repeated measures analysis of variance that examined the specific pattern of performance on the serial recall task among the older participants who reported higher levels of PA revealed that these ‘High PA’ participants showed superior memory consolidation across the five performance trials in contrast to the ‘Low PA’ subjects.

The fact that the relationship between PA and word recall performance was only observable in the older age group and confined to the free recall task suggests that the impact of PA on cognitive performance in older adults may be limited to only those tasks that place heavier demands on processing resources. For tasks that are supported or are rich with respect to the provision of contextual cues, such as is found in recognition paradigms, it was only in the older age group that this effect was measurable. One explanation for this finding may be that those older persons with higher PA were simply more engaged in the memory task (Schwarz, 1990); that is, they may have perceived the recall task as more challenging and therefore expended greater effort to accomplish it. It is possible, given this consideration, that the enhanced engagement activated specific neurological processes as has been proposed with respect to the mechanism through which PA may facilitate problem solving and cognitive flexibility in younger persons (Ashby et al., 1999). Although to empirically test such a neuropsychological mechanism is beyond the scope of this data it is interesting to note that in the original validation study of the serial list learning task, the authors reported that a flatter learning curve could be explained as indicative of frontal neocortical dysfunction producing deficits in the utilization of effective rehearsal strategies that often involve ‘...errors of repetition and sometimes a rigid, stereotyped order of recall’ (Brand and Jolles, 1985; p. 202).

It is noteworthy that NA did not correlate with cognitive performance, although it did appear to be a valid measure of affective and anxiety symptomatology based on the SCL-90. Bäckman (Bäckman et al., 1996) employed specific items from the DSM-III to define NA in a non-clinical group of older Swedish adults. They concluded that the relationship between depressive symptoms was essentially a matter of severity, and that the more severe the symptoms the greater their negative impact on cognitive performance. The PANAS, on the other hand, defines NA through a wide range of descriptive terms such as ‘upset’, ‘jittery’, ‘distress’ and so forth. Thus, the PANAS questions were not necessarily characteristic of only depressive symptoms nor was this a sample of persons who would be characterized by clinical depression. If a linkage between cognitive performance and NA exists through depressive symptomatology, it is unlikely that the PANAS would have identified such a relationship in this sample.

In sum, this study documented a modest association between PA (as measured by the PANAS) and free recall performance in a subset of MAAS participants who were 65 years of age and older on a serial word list task designed to assess episodic memory. Although the VVLT allowed for an examination...
of patterns of learning associated with memory consolidation, it was not possible to assess the role of PA in the employment of specific encoding strategies per se. Thus, a future research direction would be to explore the influence of PA on specific aspects of learning and memory in old age such as the propensity to spontaneously generate effective strategies that could facilitate memory consolidation or other processes related to the preservation of memory function in later life.

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