ABSTRACT

Personality factors determine the course of depression. They may do this via nonverbal interpersonal interactions and via cognitive interpretations of nonverbal behaviour. Alternatively, personality factors, interactions, and cognitions may influence the course of depression independently.

Personality factors in this study were Neuroticism and Extraversion. Nonverbal interpersonal interactions were studied by measuring patients' "support seeking behaviour" and interviewers' "support giving behaviour" from videotaped clinical interviews (n= 26). The attunement between patients' and interviewers' behaviour (reflecting interpersonal satisfaction) was calculated over the time-course of the interviews. Cognitions were assessed by measuring the perception of emotions from schematic faces.

Perception of negative emotions from ambiguous faces (A-neg) mediated the relationship between Neuroticism and the course of depression over 6 weeks. A-neg, increase of the nonverbal attunement during the interview, and Extraversion predicted this course independently.

The present findings on nonverbal behavioural processes extend the empirical basis for the integration of personality, cognitions and interpersonal factors in depression-theory.
INTRODUCTION

Several authors have connected interpersonal theories of depression to cognitive theories of depression and to theories of the connection between personality traits and depression (e.g. Gotlib and Hammen, 1992; Poulton and Andrews, 1992; McCann and Lalonde, 1993; Clark et al., 1994). In the present study we attempt to find an empirical basis for these connections by investigating the interrelationship between variables in the interpersonal domain, the cognitive domain, and the personality domain, and their relation with the course of depression in severely depressed patients.

Interpersonal processes

From the perspective of an interpersonal approach of depression (e.g. Coyne et al., 1990) substantial empirical evidence exists, indicating that interpersonal difficulties between depressed persons and their social environment as well as lack of supportive behaviour from this environment are related to an unfavourable course of depression (Hickie et al., 1991; Brown et al., 1994). Unsatisfactory interactions with fellow-men and rejecting behaviour towards the depressed persons by them are considered to be important mechanisms underlying this relationship (Segrin and Dillard, 1992). About 60% of human communication is nonverbal (Burgoon, 1985). It may therefore be expected that an ethological approach of depressives' interactions with others may provide more insight in the role of interpersonal processes in the course of depression. And indeed, it has been demonstrated that high levels of depressed patients' nonverbal behaviour reflecting "involvement" and "support seeking" predict depression-persistence (Troisi et al., 1989; Bouhuys and van den Hoofdakker, 1993; Geerts et al., 1995). Moreover, interviewers' nonverbal behaviour manifesting "support giving" is also associated with the course of depression (Bouhuys and van den Hoofdakker, 1993; Geerts et al., 1995).

Experimental manipulations of the nonverbal "support giving behaviour" displayed by an interviewer demonstrated that the depressed patients' "nonverbal support seeking behaviour" is causally related with that "support giving behaviour": patients attune durations and frequencies of elements of their nonverbal "support seeking behaviour" to the levels of an interviewer's nonverbal "support giving behaviour" (Geerts et al., 1997). In non-experimental interactions the time-course of such attunement has been shown to have predictive value with respect to the course of depression: the more
patients and interviewers became attuned during a clinical interview, the more
favourable the course of their depression turned out to be (Geerts et al., 1996; Geerts
et al., submitted). In normals attunement of nonverbal behaviour during an interaction is
related to interpersonal satisfaction (Cappella and Palmer, 1990). Hence, insufficient
nonverbal attunement may be an important element in the mechanisms underlying the
unsatisfactory interactions in depression, and therefore in the mechanisms underlying its
course (Geerts et al. 1996; Geerts et al., submitted)

Cognitive processes
Various studies link aspects of interpersonal processes to cognitive processes. In marital
interactions it has been demonstrated that cognitive interpretations of the partner's
behaviour determine to a large extend the behavioural responses to the partner's
behaviour (Halford and Sanders, 1990). Furthermore, high levels of accurate processing
of other's nonverbal behaviour are related to more meaningful and supportive
relationships (Hodgins and Zuckerman, 1990). Moreover, people judge persons who are
highly accurate in the processing of other's behaviour as more warm and sympathetic
than persons who are less accurate (Funder and Harris, 1986). With respect to the
processing of social stimuli in depression also the cognitive theory of depression
proposed by Beck et al. (1979) is of relevance. According to Beck's theory depression
is to be understood by a negative view of the self, of others, and of the future (the
"negative triad"). These negative distortions manifest themselves in particular in the
interpretation of neutral or ambiguous stimuli. Several authors have demonstrated that
depressed mood is associated with a tendency to interpret emotional stimuli negatively
(Hokanson et al., 1991; Bouhuys et al., 1995a; see also Mathews and MacLeod, 1994,
for a review). Such negative interpretations of stimuli are expected to play a causal role
in the onset and persistence of a depressive episode (Beck et al., 1979; Teasdale and
Dent, 1987). Hokanson et al. (1991) demonstrated in non-depressed college students
that a relative overestimation of a roommate's hostility predicts the subsequent
development of a depression in the roommate's partner. In contrast to Beck's model
Bouhuys et al. (1996) found that in depressed outpatients a negative interpretation of
emotions in ambiguous schematic faces predicted a favourable course of depression.
The results were interpreted as a sign of hyposensitivity to negative social stimuli in
patients that did not improve. Such hyposensitivity to social stimuli in depression has
also been observed in other studies (e.g. Gur et al., 1992). Bouhuys et al. (1996) suggested that a hyposensitivity to negative stimuli may have emerged in response to the rejecting behaviour displayed by fellow-men. Both the study by Hokanson et al. (1991) and by Bouhuys et al., (1996) indicate that cognitions about others' behaviour may be involved in the development and maintenance of depression.

**Personality**

Also personality features are presumed to play a role in the relationship between interpersonal processes and the course of depression (Gotlib and Hammen, 1992). High Neuroticism (N) and low Extraversion (E) are known to be related to depression-persistence (N: see Clark et al., 1994, for a review; E: Clark et al., 1994; Bagby et al., 1995; Geerts et al., submitted). It is assumed that N and E exert their effects on the course of depression via interpersonal events: high N subjects have been found to evoke negative interpersonal events and interpersonal distress (Ormel and Wohlfarth, 1991; Poulton and Andrews, 1992; Clark et al., 1994), subjects with low E have less satisfactory interactions (Clark et al., 1994). These relationships between N and E on the one hand and interpersonal processes on the other may be explained by cognitive processing of social stimuli: high N has been found to be related to negative interpretations of social and emotional stimuli (Martin, 1985; Teasdale and Dent, 1987) whereas extraverts are considered to be more sensitive to reward signals (Clark et al., 1994). For both N and E it has been experimentally demonstrated that they are related with a subject's nonverbal responses to an interviewer's nonverbal behaviour (Wiens et al., 1980).

In summary, substantial empirical evidence points to the involvement of factors in different theoretical domains in the course of depression: the interpersonal, the cognitive, and the personality domain. As already mentioned each domain has been linked to each other domain theoretically and empirically. The present study aims to extend the investigation of the linkage between these domains. Specifically, the hypothesis is proposed that nonverbal interpersonal processes (particularly attunement) and cognitions about nonverbal behaviour represent the link between personality (N, E) and the course of depression. We examine the possibility that nonverbal interpersonal processes and cognitions about others' nonverbal behaviour either play a mediating role
- i.e. interpersonal processes and cognitions explain the way in which personality is related to the course of depression - or that personality influences the degree to which interpersonal processes and cognitions play a role in the course of depression - i.e. personality plays a moderating role. Alternatively, it is possible that personality (N, E), cognitions about nonverbal behaviour, and nonverbal behavioural processes contribute to the prediction of the course of depression independently. Because cognitive and interpersonal functioning may change when depression takes a more persistent or chronic course (Segrin and Dillard, 1992; Mathews and MacLeod, 1994), attention will also be given to possible differences between the patients who improve and those who do not improve with respect to the interrelationships between the variables in the different domains.

**METHODS**

**Subjects and design**

Subjects with a primary depression (DSM-IV, APA, 1994) were recruited from the inpatient ward of the Psychiatric University Clinic of the Academic Hospital Groningen. Patients at age > 18 years were included in the study if they 1) had a severity of the depression on the Hamilton Rating Scale for Depression (HRSD, 21-item version; Hamilton, 1967) ≥ 16; 2) had not participated in our previous studies on the relationship between observable behaviour and the course of depression; and 3) had given written informed consent. Patients with uncontrolled hypothyroid functioning or diabetes and patients with a primary disorder of the CNS (e.g. cerebral vascular attack, dementia, etc) were excluded from the study. Twenty-six patients entered the study (8 males, 18 females, mean age = 47.7, SD = 13.8, range 19 - 74). All but one patient met the criteria for Major Depression (DSM-IV: bipolar depression, n= 3; psychotic depression n= 12; recurrent depression n= 8). One patient was diagnosed as depression not otherwise specified (DSM-IV). The severity of the depression was assessed at the start of the experimental period by using the HRSD and the Beck Depression Inventory (BDI, Beck et al., 1979) (T1). The mean duration between hospital admission and T1 was 21.1 days, SD = 15.9 (range 7 - 82). The severity of the depression was also assessed 6 weeks later by using the BDI (T2). Analogue to the criteria for improvement of depression on the basis of HRSD-scores (Frank et al., 1991) we judged patients to be improved if their BDI-score on T2 had dropped at least 9 points. No attempt was made
to control for treatment at the start of the study or during the experimental period. Three patients were medication free at the start of the study. The other patients received anti-depressants (n=19), Lithium (n=6), benzodiazepines (n=22), neuroleptics (n=7), anti-Parkinson (n=2), or other, non-psychotropic, medication (n=11). Medication was prescribed according to the patients' clinical needs. Apart from medication the patients received psychotherapies (e.g. cognitive therapy, behavioural therapy, marital therapy, group therapy, etc.).

**Nonverbal interpersonal domain: assessment of nonverbal attunement**

The HRSD interviews at T1 were videotaped. All interviews were conducted between 9:00 and 12:00 am. There were 4 interviewers (1 male, 3 females, mean age=37.5 years, range=27 - 55). By the use of ethological techniques, the occurrence of various elements of nonverbal behaviour of the patients and of the interviewers (e.g. speaking, looking, gesticulating, and yes nodding) was continuously registered for the first 15 minutes of the interviews. The elements of behaviour that were registered are summarized in appendix 1. Speaking and listening affect the occurrence of the different behaviours. Therefore, the duration and the frequency of each element was analysed during the speaking-bouts of the patients and during the speaking-bouts of the interviewers. The durations and frequencies of looking at the interviewer and of gesticulating during the patients' speaking-bouts are assumed to reflect involvement and support seeking (Bouhuys and van den Hoofdakker, 1993; Geerts et al., 1995).

Bouhuys et al. (1991) demonstrated that these elements can be pooled into one factor by using factor-analytic techniques. The factor is called "Speaking Effort" (see appendix 1 for a precise description of how the different behavioural elements constitute this factor). Apart from the duration and the frequency of gesticulating and of looking at the interviewer also general head movements contributed to this factor. For the interviewer a factor has been described that consists of behavioural elements that refer to nonverbal "support giving behaviour" and nonverbal involvement (see Bouhuys and van den Hoofdakker, 1993). This factor, called Encouragement, consists of the duration and frequencies of yes-nodding and of verbal backchannel ("hmm hmm, yes yes, emitted to ensure one is listening and to encourage the other to continue speaking) during the speaking-bouts of the patients (see appendix 1).

We assessed the attunement between the patients' Speaking Effort and the
interviewers' Encouragement by calculating the absolute difference between these factors per 3-minutes epoch of the interview: high absolute differences reflect low levels of attunement (see also Cappella and Palmer, 1990; Geerts et al., 1996; Geerts et al., submitted). In particular the change of the attunement over an interaction is of interest with respect to the course of depression (Geerts et al., 1996; Geerts et al., submitted). This change of the attunement was assessed by subtracting the attunement as calculated over the last 3 minutes of the 15 minutes interview from the attunement as calculated over the first 3 minutes of the interview (Δ attunement). Thus, a positive value of the change-measure reflects an increase of the attunement. In addition, Speaking Effort and Encouragement were calculated over the 15 minutes interview. All behaviour was registered by one observer who was blind to the course of depression between T1 and T2, as well as to the performance on the cognitive task and the patients' personality scores. When compared to previous ratings of observable behaviour in other patient populations (see our previous reports) the mean inter-rater reliability (Cohen's kappa, Cohen, 1968) was 0.86 (range 0.72 - 0.99).

Cognitive domain: perception of schematic facially expressed emotions
We applied the questionnaire that has previously been described by Bouhuys et al. (1995a; 1995b; 1996; 1997). This questionnaire contains 12 schematic faces in which the position of the eyebrows and of the mouth are systematically varied (see figure 1). The faces are judged on a 5 point likert-scale (0 - not applicable, 25 - little applicable, 50 - moderately applicable, 75 - rather applicable, and 100% - highly applicable) with respect to the following emotions: anger, disgust, elation, fear, invitation, sadness, and rejection. The faces are presented in random order in a booklet form. Patients filled in the questionnaire at T1 (between 4:00 pm and 5:00 pm).
Figure 1: Schematic faces judged by the patients at hospital admission on five negative emotions (anger, disgust, fear, sadness, and rejection) and two positive emotions (elation and invitation). Face no 3, 4, and 5 represent so-called ambiguous faces.

Positive and negative affect are two important dimensions of expressed mood (Watson and Tellegen, 1985; Russell et al., 1989). Bouhuys et al. (1997) demonstrated that in depressed patients the emotions judged from the schematic faces can be pooled into two clusters too: negative emotions and positive emotions. In the present study the ratings of the negative emotions (anger, disgust, fear, sadness, and rejection) and of the positive emotions (elation and invitation) were averaged over the 12 faces (M-neg and M-pos). In addition, mean values of the negative and the positive emotions were calculated separately for a subset of faces, so called "ambiguous" faces (figure 1: face no 3, 4, and 5; A-neg and A-pos). The ambiguous faces are characterized by a similar amount of positive and negative expressed emotions (see Bouhuys et al., 1995a).

Personality traits
Neuroticism and Extraversion were assessed by using the Amsterdam Biographic Questionnaire (ABQ, Wilde, 1963). The ABQ is based on the translation of Eysenck's personality questionnaire and has been validated for the Dutch population.

Statistical analyses
To reduce the set of possible predictors only those variables were selected for further analyses that were correlated with the short term outcome of depression at $p<0.10$. Partial correlations were applied between the BDI at T2 and the variables of the interpersonal behavioural domain, the cognitive domain, and the personality domain, while the severity of baseline depression (BDI T1) was statistically corrected for. In this way, possible effects of regression towards the mean and spurious relationships are avoided (see Lord, 1963).

Stepwise multiple regression analyses were applied to investigate how the short term outcome of depression was best predicted by the variables in the nonverbal interpersonal domain, the cognitive domain, and the personality domain. The severity of baseline depression was forced into the equation as the first step while BDI T2 had to be predicted. Possible moderating relations were investigated for with respect to those variables that contributed to the prediction of the course of depression. First-order interaction-terms were calculated. To avoid multicollinearity the variables were centred ($X_{new} = X_{old} - X_{mean}$) before calculating the interaction-terms (Aiken and West, 1991). It was tested whether the first-order interaction terms contributed to the prediction of the course of the depression while the variables that constituted the interaction terms were partialled out. Partial correlations were applied to investigate for possible mediating relations between variables that 1) were correlated with each other and 2) were individually correlated with the course of depression.

**RESULTS**

**Course of depression**

The severity of depression significantly decreased over the experimental period (T1: BDI= 31.08, SD= 9.57 (range 18 - 48), T2: BDI= 22.65, SD= 13.19 (range 1 - 44) 1-way Analysis of Variance (ANOVA) with repeated measures on time: $F(1,25)= 9.34$, $p= .005$). Eleven patients met the criterium for improvement (mean BDI T1= 35.27, SD= 9.43, range 22 - 48, mean BDI T2= 14.18, SD= 14.08, range 1 - 38), 15 patients did not improve (mean BDI T1= 28.00, SD= 8.71, range 18 - 43, mean BDI T2= 28.87, SD= 8.45, range 13 - 44). The BDI at T1 was not significantly correlated with the BDI at T2 (Pearson's $r= 0.27$, $p= 0.182$). There was no relationship between age and the course of depression (partial $r= -0.02$, $p= 0.911$). Furthermore, the course of the depression did not differ between sexes (ANOVA [between groups with repeated
measures on time): F(1,24)= 2.35, p= 0.138). Also, no differences were found with
respect to the various diagnostic subgroups and the various interviewers. ANOVA’s
between groups with repeated measures on time yielded the following findings:
recurrent versus non-recurrent depression: F(1,23)= 1.86, p= 0.186; psychotic versus
non-psychotic depression: F(1,23)= 0.12, p= 0.735; bipolar versus unipolar depression:
F(1,23)= 2.38, p= 0.137); between interviewers: F(2,23)= 0.55, p= 0.583).

Individual relationships
Partial correlations were calculated between Δ attunement, M-neg, M-pos, A-neg, A-
pos, N, and E on the one hand and the BDI T2 on the other while the BDI T1 was
statistically controlled for. E (partial r=-0.52, p= 0.007), N (partial r= 0.41, p= 0.041),
A-neg (partial r= 0.39, p= 0.051), and Δ attunement (partial r= -0.36, p= 0.073) were
correlated with the course of depression at p<0.10. Hence, individual variables of the
different domains explain 9-25% of the variance in the short term outcome. Figure 2a-d
depicts the individual relationships between these variables and the course of the
depression. The levels of Speaking Effort and of Encouragement over the entire 15
minutes interview (Speaking Effort: partial r= -0.27, p= 0.197; Encouragement: partial
r= 0.19, p= 0.393), M-neg (partial r= 0.15, p= 0.473), M-pos (partial r= -0.16,
p= 0.437), and A-pos (partial r= -0.27, p= 0.183) did not meet the selection criterium
for further analyses.

Hypothesis testing
A Stepwise multiple regression analysis (with baseline depression forced to enter the
equation as the first step) revealed that a favourable course of the depression was best
predicted by high levels of E (b= -0.36, p= 0.004), by low levels of A-neg (b= 0.52,
p= 0.018), and by an increase of Δ attunement over the baseline interview (b= -8.32,
p= 0.036) (see also table 1-a). In other words, the more Extravert the patients were,
the less negative emotions were perceived from the ambiguous faces, and the more the
patients and the interviewers became attuned during the baseline interview, the more
the patients would improve over the period of 6 weeks. N did not contribute to the
equation.
Figure 2: Relationship between the outcome of the depression over a period of 6 weeks (BDI T2 corrected for BDI T1) and a) the change of the nonverbal attunement between the patients’ Speaking Effort and an interviewer’s Encouragement over the baseline interview (partial r= -0.36, p= 0.073), b) The patients' perception of negative emotions from ambiguous faces (partial r= 0.39, p= 0.051), c) the patients' baseline levels of Neuroticism (partial r= 0.41, p= 0.041), and d) the patients' baseline levels of Extraversion (partial r= -0.52, p= 0.007).

We investigated whether first-order interaction effects between Δ attunement, A-neg, and E contributed to the prediction of the change of depression. The variables that contributed to the interaction-terms and the BDI T1 were forced to enter the equation while BDI T2 had to be predicted. No significant interaction effects (i.e. no moderating effects) were observed. Hence, E, A-neg, and Δ attunement contribute to the prediction of short term outcome in depression independently. E accounted for 27% of the total explained variance in the course of the depression, A-neg and Δ attunement explained an additional 23%.
Table 1: Summary of multiple regression analyses

1-a: Prediction of the outcome of the depression over the period of 6 weeks

<table>
<thead>
<tr>
<th>step</th>
<th>predictor</th>
<th>b-value</th>
<th>p</th>
<th>$\Delta R^2$</th>
<th>F(df)</th>
<th>adj. $R^2$</th>
<th>p</th>
<th>predicted variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BDI T1$^1$</td>
<td>-0.01</td>
<td>0.964</td>
<td>0.07</td>
<td>F(4,21)= 6.81</td>
<td>0.48</td>
<td>0.001</td>
<td>BDI T2</td>
</tr>
<tr>
<td>2</td>
<td>E</td>
<td>-0.36</td>
<td>0.004</td>
<td>0.27</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>A-neg</td>
<td>0.52</td>
<td>0.018</td>
<td>0.13</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>$\triangle$ attunement</td>
<td>-8.32</td>
<td>0.036</td>
<td>0.10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$^1$BDI T1 was forced to enter the equation as the first step

1-b: Prediction of the perception of negative emotions in ambiguous faces (gender effects included)

<table>
<thead>
<tr>
<th>step</th>
<th>predictor</th>
<th>b-value</th>
<th>p</th>
<th>$\Delta R^2$</th>
<th>F(df)</th>
<th>adj. $R^2$</th>
<th>p</th>
<th>predicted variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N</td>
<td>0.21</td>
<td>0.039</td>
<td>0.19</td>
<td>F(3,22)= 4.35</td>
<td>0.29</td>
<td>0.015</td>
<td>A-neg</td>
</tr>
<tr>
<td>2</td>
<td>gender</td>
<td>0.58</td>
<td>0.870</td>
<td>&lt; 0.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>N x gender</td>
<td>0.53</td>
<td>0.034</td>
<td>0.15</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1-c: Prediction of the change of the attunement between the patients’ Speaking Effort and the interviewers’ Encouragement over the baseline-interview

<table>
<thead>
<tr>
<th>step</th>
<th>predictor</th>
<th>b-value</th>
<th>p</th>
<th>$\Delta R^2$</th>
<th>F(df)</th>
<th>adj. $R^2$</th>
<th>p</th>
<th>predicted variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Improvement</td>
<td>0.47</td>
<td>0.016</td>
<td>0.22</td>
<td>F(3,22)= 3.34</td>
<td>0.22</td>
<td>0.038</td>
<td>$\triangle$ attunement</td>
</tr>
<tr>
<td>2</td>
<td>A-neg</td>
<td>&lt; -0.01</td>
<td>0.792</td>
<td>&lt; 0.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>I x A-neg$^1$</td>
<td>-0.04</td>
<td>0.093</td>
<td>0.10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$^1$I x A-neg = interaction between A-neg and improvement

Pearson correlations indicated only a significant association between A-neg and N (Pearson’s $r = 0.48$, $p = 0.014$, see figure 3 and table 1-b). We investigated whether this interrelationship between A-neg and N might imply possible mediating effects of A-neg between N and the course of depression. Therefore, we calculated the partial correlation between the course of depression and N while BDI T1 and A-neg were statistically
controlled for. N lost significance when A-neg was partialled out (partial r = 0.298, p = 0.157). In addition, the partial correlation between A-neg and the short term outcome was calculated while BDI T1 and N were statistically controlled for (partial r = 0.270, p = 0.201). This finding supports our hypothesis that cognitions about others' behaviour may play a mediating role in the link between N and the course of depression (or vice versa).

![Figure 3: Pearson correlation between the perception of negative emotions from ambiguous faces and Neuroticism (Pearson's r = 0.48, p = 0.014).](image)

No direct relationships were observed between Δ attunement on the one hand and A-neg, N, E, or their interaction-terms on the other hand. Thus, the time-course of the attunement over the baseline interview cannot be attributed to the patients' cognitions about nonverbal social stimuli, N, or E. Possible associations between N, E, A-neg, and Δ attunement may differ between the patients that improve and those who do not. We investigated whether improvement of depression might play a moderating role in the relationship between A-neg, N, and E on the one hand and Δ attunement on the other. The interaction between A-neg and difference in improvement (improvers versus non-improvers) tended to contribute to the prediction of Δ attunement (b = -0.035,
p = 0.093) (see table 1-c and figure 4 for a graphic representation of the interaction-effect). This finding may suggest that improvement is indicated by a more strongly association (indicated by the slope of the curve, see figure 4) between A-neg and Δ attunement compared to depression-persistence. No other differences in the interrelationships between interpersonal, cognitive and personality variables were observed between the patients that would improve and patients that would not improve.

**Gender effects**
Recent findings in a non-clinical population indicated that the role of cognitions in connecting N to self-reported psychological distress may be more pronounced in females than in males (Bouhuys and Geerts, submitted). We investigated whether our findings on the prediction of the course of depression and on the interrelatedness between variables that predict the course of depression were affected by gender. It was found that gender had influence on the relationship between A-neg
and N. The interaction between gender and N significantly contributed to the prediction of A-neg (b = 0.53, p = 0.034, see also table 1-b). In particular high N females perceived more negative emotions from the ambiguous faces than high N males. The gender x N interaction did not affect the contribution of N in the prediction of the perception of negative emotions. Thus, apart from N also gender in interaction with N contributes to the prediction of A-neg. No other significant gender-effects or interactions with gender were observed.

**DISCUSSION**

**Main results**

In the present study we attempted to find an empirical link between three important domains that have been found to play a role in the course of depression (the domains of nonverbal interpersonal and cognitive processes and the personality domain). In particular, we investigated the hypothesis that nonverbal interpersonal behavioural processes and cognitions about nonverbal social stimuli link personality to short term outcome of depression, either via mediating roles - i.e. the relationship between personality and the course of depression can be explained by interpersonal processes and by cognitions - or via moderating roles - i.e. personality influences the degree to which interpersonal processes and cognitions play a role in the course of depression. Our findings provide support for the hypothesis: the relationship between Neuroticism (N) and the course of depression over 6 weeks was mediated by the perception of negative emotions from ambiguous faces (A-neg). However, our results also provide support for the alternative hypothesis that personality, cognitions about nonverbal stimuli, and nonverbal interpersonal processes are associated with the course of depression independently. A favourable outcome was predicted by high levels of Extraversion (E), low levels of A-neg, and by an increase of the attunement between the patients and the interviewers over the baseline interview (Δ attunement). The effects of E, A-neg and Δ attunement were additive: variables related to nonverbal behaviour (i.e. A-neg and Δ attunement) explained an additional 23% of the variance in the course of depression next to personality (E) (26% of the explained variance). In general, our data support the involvement of personality, cognitions about nonverbal social stimuli, and nonverbal interpersonal processes in the course of depression.
Cognitions linking Neuroticism to depression

Negative cognitions are assumed to play a role in the relationship between N and depression-onset (Martin, 1985; Teasdale and Dent, 1987). We found that high levels of A-neg can explain the relationship between high N and poor outcome of depression. This suggests that negative cognitions may also serve a mediating role in the relationship between neuroticism and depression-persistence. Highly neurotic patients may be vulnerable to depression-persistence via their negative interpretation of nonverbal social stimuli. Apart from N, it was found that the interaction between gender and N also plays a role in the perception of emotional stimuli: high N females demonstrated higher levels of A-neg than high N males. This indicates that gender effects in the perception of negative nonverbal social stimuli may depend on the level of N. Moreover, the interaction-effect may partially explain the higher prevalence of depression in females (e.g. Weissman and Klerman, 1977). The risk of becoming depressed is higher in females because of their higher N-scores (Wilhelm and Parker, 1993). Our results indicate that high N females are even more at risk than high N males because they perceive more negative emotions than males. This finding is in line with findings by Bouhuys and Geerts (submitted) who found in a non-clinical population that the interaction between N and negative cognitions about others' emotions is associated with psychological distress in females but not in males.

The relationship between high A-neg and lack of improvement is in line with Beck's cognitive theory for depression (Beck et al., 1979). According to Beck negative biases in the interpretation of social stimuli become overt in particular with respect to ambiguous and neutral stimuli (see also Bouhuys et al., 1995a). This may explain why the relationship between the perception of negative emotions and short term improvement could be detected in a subset of ambiguous faces but not in the total set of investigated faces. To our knowledge only two other studies have investigated the relationship between cognitive processing of interpersonal behaviour and depression in a longitudinal design, however, with equivocal results (Hokanson et al., 1991; Bouhuys et al., 1996). The results by Hokanson et al. (1991, see introduction) and our findings are in line with Beck's model for depression. However, in contrast with Beck's model, Bouhuys et al. (1996) found in an outpatient population that perception of high levels of A-neg are related to a favourable outcome of depression. We applied the same methods as Bouhuys et al. (1996). To understand the conflicting findings, we checked whether
the difference between the findings can be ascribed to differences between the populations with respect to the severity of depression, diagnosis, gender ratio, age, N, or perception of emotions from the ambiguous faces. No significant differences between the patient populations were observed. Perhaps differences in not yet studied personality traits or in the preceding duration of the depressive episode may explain the discrepancies in the results. Cognitive functioning may shift while depression takes a more persistent and chronic course (Mathews and MacLeod, 1994). One may speculate that the present inpatient population includes more persistent depression compared to the outpatient population described by Bouhuys et al. (1996). Support for this possibility may be derived from the present study. Our data provide some weak evidence for the suggestion of a different relationship between cognitive processes and nonverbal interpersonal behaviour in patients who improve and those who do not improve: the association between A-neg and Δ attunement tended to be weaker for those patients who did not improve than in those who improved. However, this finding needs to be replicated in larger populations.

**Unique effects in the prediction of the course of depression**

Our findings are in line with previous findings that Δ attunement and E are positively related to a favourable outcome of depression (Clark et al., 1994; Bagby et al., 1995; Geerts et al., 1996; Geerts et al., submitted). Both nonverbal attunement during an interaction and E are related to interpersonal satisfaction (Cappella and Palmer, 1990; Clark et al., 1994). Thus, our results support the suggestion that lack of interpersonal satisfaction may play a role in depression-persistence (e.g. Segrin and Dillard, 1992). In line with previous findings by Geerts et al. (submitted), the present study demonstrates that Δ attunement, A-neg and E contribute to the prediction of the course of depression independently. This may indicate that these factors refer to different aspects of interpersonal processes that are related to the course of depression. One important difference is that E and A-neg refer to the depressed subject’s attitude in interpersonal situations, whereas Δ attunement reflects the actual behaviour during interpersonal interactions. The behavioural manifestation of personality and cognitions during an interaction may be affected by the social context. Also, other’s behavioural responses to the depressed subject may suppress or reinforce the behavioural manifestation of personality traits (Coyne and Whiffen, 1995). Such effects of other's behavioural
responses are incorporated in the ∆ attunement measure.

**Critical remarks**

Our findings should be considered in the light of some limitations. One may argue that our results could be explained by medication effects or by diagnostic features of the depression. Furthermore, our data may be the result of the small population-size. However, given the resemblance between our findings and previous findings in other medication-free populations (e.g. Bagby et al., 1995; Geerts et al., 1996; Geerts et al., submitted) it seems unlikely that medication effects, diagnostic features, and/or group-size account for our results.

The small n did not allow sophisticated structured equation modelling. Therefore, the postulated directions of causality may be reversed. This was not tested in the present study.

**Conclusions and implications**

The present study enlarges our understanding of the links between personality, interpersonal processes, and cognitive processes to the course of depression. Our findings clearly need replication in other longitudinal studies. Extending this kind of research may provide more insight in how these variables cooperate in mechanisms that underlie depression. Such insight may enhance the possibilities to increase the efficacy of (psycho-) therapeutic interventions in the treatment of depression.