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Chapter

Are Neurotics Afraid to Push the Button? – An ERP Study of Neuroticism, Stimulus Evaluation, and Response-selection Time

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Abstract

The speed with which incoming information is processed, and the speed and accuracy of the behavioral responses to this information, may partly depend on differences in personality and cognitive strategies. Event-related potentials (ERPs) can be used to attain online information about neurophysiological processes related to stimulus evaluation. Thus, using ERP measures, it may be possible to disentangle the speed of stimulus evaluation in the central nervous system (CNS) from the time used to select and execute a response to the stimulus. In the present study, the effect of neuroticism on the timing of central nervous potentials (ERPs) relative to motor responses was investigated. The neuroticism facets of the NEO-PI-R were administered to 168 right-handed females aged 19-29, of which the 30 participants with the highest (HN) and lowest (LN) scores

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were selected for further investigations. Of these, 20 HN and 22 LN went through 4 visual ERP tasks of increasing complexity. The results showed that P300 latency was not different in the two groups. However, HN had larger difference between reaction time (RT) and P300 in one task at Cz, indicating that HN use more time from stimulus categorization to execution of responses. At the level of facets, state depression (Beck Depression Inventory), trait depression, and self-consciousness was strongest related to RT and the RT-P300-difference. It is concluded that personality factors may be relevant to questions regarding fundamental information processing, but that the effects are rather small and difficult to establish.

***Key words*:** neuroticism, information processing, NEO-PI-R, ERP, P300, reaction time

Introduction

The speed with which incoming information is processed, and the speed and accuracy of the responses to this information, may partly depend on differences in personality and cognitive strategies (e.g. Barratt, 1959; Brebner, 1990). Event-related potentials (ERPs) can be used to attain online information about neurophysiological processes related to stimulus evaluation. Using ERP measures, it is possible to disentangle the speed of stimulus evaluation in the central nervous system (CNS) from the time used to select and execute a response to the stimulus. If variables such as reaction time (RT) and response accuracy are related to personality factors, ERP measures may define a valuable framework within which such behavioral data may be interpreted. For example, there is behavioral evidence that performance on speeded cognitive tasks differ systematically for HN and LN (e.g. Furnham, Forde, and Cotter, 1998). In principle, this may be due to systematic differences at any level between stimulus input and response, and may reflect sensory capability, stimulus evaluation, response selection, and/or response execution. In the present study, we try to disentangle the two broader stages by separate timing of stimulus evaluation and response execution in participants with high (HN) and low (LN) scores on neuroticism.

Cognition, P300, and Personality

The most widely studied ERP component is the P300. P300 is typically elicited in ‘oddball’ tasks, wherein two types of stimuli of unequal probability are presented, and the participant is asked to attend or respond to the infrequent ones. The component is considered a manifestation of CNS activity (e.g. Donchin, 1981), and a huge amount of literature ties this brain activity to cognitive function (e.g. Fjell and Walhovd, 2001; O’Donnell et al. 1992; Walhovd and Fjell, 2001, 2002). The specific cognitive interpretation of P300 latency is, however, still nopen to debate. Several alternative accounts have been suggested. In this manuscript, we will take as a starting point that P300 latency is related to the relative timing of the stimulus evaluation process, indicating an upper limit on categorization and stimulus evaluation time (Coles et al., 1995; Pritchard, 1981). Within the constraint of this interpretation, measurements of P300 latency provide an opportunity to assess the relative contribution from stimulus evaluation time and the time used to select and execute a response to the stimulus. The time lag from stimulus onset to the P300 peak indexes the stimulus evaluation and categorization time, while the difference between P300 and RT may be regarded as a measure of the time used for response selection and execution (Figure 1).

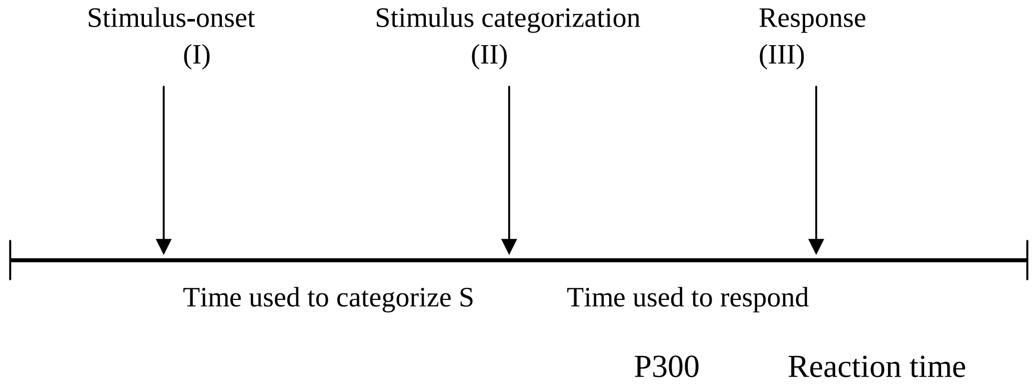


Figure 1. The difference between stimulus onset (I) and stimulus categorization (II), represented by the P300 peak, is regarded an index of stimulus evaluation time. The difference between the reaction time (III) and the stimulus categorization time (II) is held to index the time taken to select and execute a response.

Most previous studies have investigated the introversion-extroversion dimension in relation to P300 (Cahill and Polich, 1992; Daruna et al., 1985; DiTaglia and Polich, 1991; O'Connor, 1983; Polich and Martin, 1992; Pritchard, 1989; Stelmack, Houlihan, and McGarry-Roberts, 1993), often focusing on Eysenck's (1990) theory and its assumed biological bases. Few reports have related P300 to neuroticism. Plooij-van Gorsel (1981) found that participants classified as anxiety neurotic by DSM-III-R had shorter P300 latency than controls. Pritchard (1989) reported shorter P300 latency for participants with high scores on neuroticism (HN), but for male participants only, not for females. The author suggested that the hostility trait of the neuroticism dimension was the main cause of shorter P300 latency. Hansene (1999) explored the relationship between P300, RT, and Cloninger's biosocial model. No relationship between P300 latency and RT was found. Cloninger's model is, however, not easily related to Eysenck's or the five-factor model.

The most systematic study has been done by Stelmack, Houlihan, and McGarry-Roberts (1993). They investigated the relationship between neuroticism, P300, and RT using Eysenck Personality Questionnaire (H. J. Eysenck and Eysenck, 1975), and five different visual ERP paradigms. They found that HN was associated with faster P300 latency and slower RTs in a sample of 30 right-handed young females. The authors propose that the shorter P300 latency for HN participants may emerge because of worry and susceptibility to stress, and the slower RT for HN could be indicative of response inhibition, possibly related to the "immobilizing" effects of anxiety. These are important elements of neuroticism that adversely influence cognitive performance (M. W. Eysenck, 1983), and which may also influence P300 latency. Further, they speculated that the RT-P300 asynchrony reflected a disposition to a fast, or hasty and worried, evaluation of the stimulus that required a check or additional processing before the participants could proceed to initiate the response. However, the pattern was not consistent across the different ERP tasks; only 3 of 11 P300 – neuroticism correlations reached significance.

Rationale and Hypotheses of the Present Study

Shortcomings exist in the body of literature on the relationship between P300 and neuroticism:

(1) With the exception of Stelmack et al., the above-mentioned studies have used a single ERP task. There is a lack of attempts to manipulate stimulus conditions and task complexity to investigate differential effects on HN and LN. Systematic manipulations of task conditions may expose subtle differences in information processing strategies between HN and LN.
(2) There is a lack of studies of personality that relate RT data systematically to neurophysiological measures, with exceptions of Stelmack. et al. (1993) and Hansene (1999). In the present report, we focus on factors that may lay behind both neurophysiological and behavioural differences between HN and LN.
(3) The relationship between electrophysiological processing, RT, and response accuracy may be dependent on differences in personality. By systematically manipulating task demands, we will look at the effects on these three parameters, and see whether they change differentially according to differences in level of neuroticism. In Stelmack et al., the RT was shorter or equal to P300. Given that P300 may be taken as an index of stimulus categorization time, this means that the participants responded to the stimuli before the categorization process was completed. That is, they responded to partially analysed stimuli. We wanted the ERP tasks to be so difficult that RT was longer than P300 latency, so that the stimulus categorization process was finished or almost finished when responses were executed. The time lag from completion of the stimulus evaluation to the initiation and execution of a response may give potentially valuable information about differences in information processing between HN and LN.

In the present study, five research questions were investigated:

(1) P300 latency is shorter for HN

As the literature review above shows, there have been studies demonstrating shorter P300 latency for HN. This is, however, not a very robust finding.

(2) The difference between RT and P300 latency is larger for HN

This builds on the hypothesis that HN are more afraid to make errors than LN. LN may react even on partially categorized stimuli, thus needing short time from the completion of the stimulus evaluation to the execution of a response. HN, on the other hand, rely on ‘secure’ strategies, and seek more information about the qualities of the incoming stimuli. They prefer more time to execute a response, in order to minimize the chance of errors. While these factors do not have adverse effects on the speed of stimulus processing, they will lead to a prolongation of the phase wherein a response is selected and executed.

(3) The difference between RT and P300 latency will increase more with increased task demands for HN than for LN

This hypothesis has not previously been systematically studied. Our reasoning is that increased task demands will increase the error-rate, and reduce the participants' certainty about the accuracy of their responses. If HN are focused on minimizing the error-rate, they may have to use longer time to select and execute responses. We hypothesize that increased task demands will prolong HN's RT substantially, while the prolongation of the P300 peak will be moderate only. Since LN probably are less focused on avoiding errors, the same tendency is expected to a much smaller extent.

(4) The speed-accuracy trade-offs of HN vs. LN will differ systematically, and errors may be predicted by their P300-RT difference

In accordance with the reasoning presented above, HN are expected to focus on making few errors at the expense of longer response selection and execution time. LN are hypothesized to tolerate more errors, and thereby be able to shorten the time used to select and execute a response. This hypothesis has not been investigated earlier.

(5) Analyses at the level of facets

We will look into neuroticism in more detail, and try to disentangle independent contributions from the facet scales. Pritchard (1989) speculated that hostility facet could be a mechanism behind P300 – neuroticism relationship. However, it is difficult to explain this theoretically. A tentative hypothesis may be that because HN generally are more anxious, they may be afraid to perform badly. Since this anxiety is non-pathological, and the ERP-tasks are relatively simple, the result may be a beneficial heightened alertness, and thereby shorter P300 latency. The same may be the case for the self-conscious subjects, who are monitoring their own performance and may be afraid to make a poor impression on the experimenters running the tests. If this is correct, we will expect anxiety and self-consciousness to be correlated with P300. Further, the same facets may have the opposite effect on RT, because of anxiety of making errors. To our knowledge, no previous studies have looked into these questions in detail, and the above are speculations. Because of the modest sample size, our answers must be tentative.

Methods

Sample

The neuroticism items from the NEO-PI-R were administered to 168 female, right-handed undergraduates at the University of Oslo, between 19 and 29 years of age. Of these, the 30 participants with the highest (HN) and the 30 with the lowest (LN) scores on neuroticism were selected for further investigations, with mean scores of 172 and 94 respectively. Participants suffering from illnesses that may affect the central nervous system and participants with another language than Norwegian as primary were excluded, as were participants scoring below two standard deviations from the population mean on the matrix reasoning test. In addition, some of the participants were impossible to reach by phone, some did not have the time, and some had changed their minds. The remaining participants were 20 HN and 22 LN persons. These 42 completed 4 ERP-tasks, matrix reasoning from WASI (Wechsler, 1999), and Depression Inventory (BDI) (Beck, 1996). Matrices were administered to ensure similarity in fluid abilities, since P3 latency is systematically related to this (e.g. Fjell and Walhovd, 2001; Walhovd and Fjell, 2001, 2002). Sample characteristics are presented in table 1.

Table 1. Sample Characteristics

	NEO-PI-R N-score mean (range)	Beck DI[1] mean (range)	Matrix reasoning[2] mean (range)	Age mean (range)	n
Stables	94 (63-104)	0.86 (0-5)	26.2 (21-31)	21.6 (19-28)	22
Neurotics	172 (154-197)	10.6 (2-26)	27.6 (19-33)	22.0 (19-28)	20

[1] Beck Depression Inventory (Beck, 1996)
[2] Matrix reasoning subtest from WASI (Wechsler, 1999)

Personality Inventory

A back-and-forth-translated Norwegian version of the NEO-PI-R, valid in terms of alpha coefficients and factor analyses (Nordvik, 2002), exists. The neuroticism dimension consists of six facet scales, each covered by eight questions, which are rated on a five-point scale. The facets are anxiety, hostility, depression, self-consciousness, vulnerability, and impulsivity.

ERP Tasks

We wanted the tasks to be so complex that RT was later than the P300 and the error rate was substantial, and at the same time provide us with well-defined P300's. To reach these goals, 4 tasks were developed. In all tasks, the participants were instructed to press a button on a standard Neuroscan response pad as quickly as possible when a red circle (the target) appeared in the middle of a rectangular black frame, located at the centre of a 21-inch computer screen. The participants were told to rest their finger on the button, so that no movement besides the button press was required. Whenever another type of stimuli appeared on the screen, the participants were required to press a second button. Before each task, an example task was presented. The participants were told that it was *very important* that they responded as quickly as they could when they saw a stimulus appearing on the screen. This instruction was repeated before each different task:

Task 1: Only targets (red circles) were presented, with different inter-stimulus intervals (ISI), ranging from one to five seconds. 60 stimuli were presented, with 1 second stimulus presentation time (SPT). The rationale task was to get a baseline measure of P300 latency and simple RT.

Task 2: In this task, a red square (standard) was presented in the frame instead of the red circle (target) in 80% of the trials. 180 stimuli (36 targets) were presented, ISI was set to 2 seconds, and SPT was 1 second. The rationale was to get a baseline measure for the difference between RT and P300 latency.

Task 3: In the third task, the number of different non-target stimuli was increased. Now, non-target stimuli appeared both inside and outside the black frame, and included red squares, blue squares, and blue circles, in addition to red circles outside the frame. Participants were told that only red circles inside the frame were targets. All other characteristics were kept identical to task 2. The rationale was to increase the complexity of the task, possibly leading to a larger increase in the difference between RT and P300 for HN compared to LN.

Task 4: This task was identical to the third, but ISI was set to 1 and SPT to 0.5 second. The rationale for this was to increase the degree of stress in the task. It is indicated that (e.g. Furnham, Forde, and Cotter, 1998) HN have relatively more trouble with time-limited tests of cognitive performance. In task 3 and 4 we expected that the number of errors would be large enough to test hypothesis 4.

ERP Procedures

Participants were seated in a reclining chair within a sound attenuating recording chamber. The electrodes were placed in accordance with the international 10-20-system. A total of 3 electrodes (Ag/ AgCl) were used for recording; Fz, Cz, and Pz, referred to the left mastoid. In the present report we will present grand average ERP curves and report statistical analyses for Cz only. The reason for this was that the P300 peak was best defined on this electrode across conditions. A VEOG channel was obtained by placing one electrode above and one below the left eye, and ground was placed anteriorly. Inter-electrode impedance was generally measured to be less than 10 kOhm. For the recording of EEG activity, A/D rate was 500 Hz, and filter-setting was 0.10 Hz (high pass) and 70 Hz (low pass). In addition, a 50 Hz notch filter was applied. The signals were amplified by a SynAmp DC amplifier (Neuroscan Inc.). Epochs were rejected from averaging if amplitude exceeded +/- 110 micro Volt, and eye blinks were corrected for statistically in accordance with Semlitsch et al.'s (1986) recommendations. Averaging was performed for targets and non-targets separately. EEG was segmented in epochs of 1000 ms duration (-100 ms to 900 ms relative to stimulus onset). All average data were digitally filtered (10 Hz low pass) and baseline corrected before statistical measures of component latency or amplitude were made. Neuroscan software was used to present stimuli, record, and analyze EEG-activity.

Data Analyses

ERP Measures

The P3 component was set to the maximum positive point relative to pre-stimulus baseline constituting a peak between 250 and 550 ms at Cz. That is, the peaks were determined algorithmically, in accordance with Pfefferbaum et al.'s (1990) recommendations.

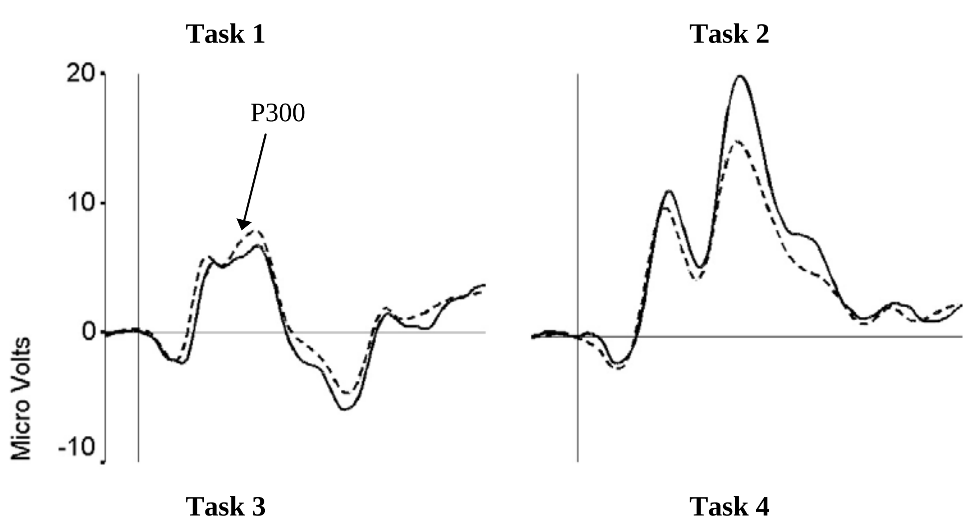
Statistical Analyses

ANOVAs were used to investigate whether P300 latency was shorter for HN than LN across the four tasks, and whether the RT-P300 difference was larger for HN than LN across task 2-4. ANOVA with two groups X 2 types of behavioral measures (speed, accuracy) in tasks 2-4 was used to test whether HN and LN differed in speed-accuracy trade-offs. Greenhouse-Geisser corrections were when appropriate. Finally, we correlated each of the facets and BDI with P300 latency, RT, and the P300-RT differences.

Results

Hypothesis 1: P300 Latency is Shorter for HN

Grand average ERP curves for each group for each of the tasks are presented in figure 2. Mean P300 latency across tasks is presented in figure 3.



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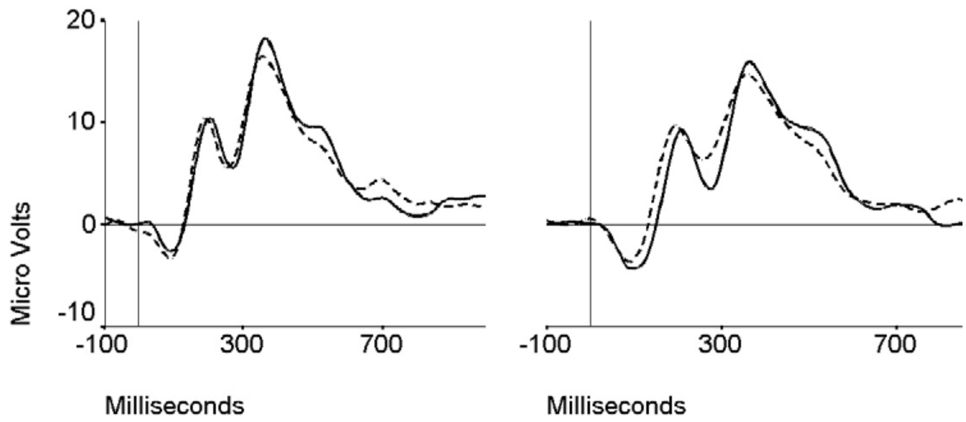

Figure 2. Grand average ERP curves across groups and conditions. The P300 is the large positive peak evident after about 350-450 ms. The component is regarded an index of stimulus categorization time. An arrow indicates the P300 in the first condition.

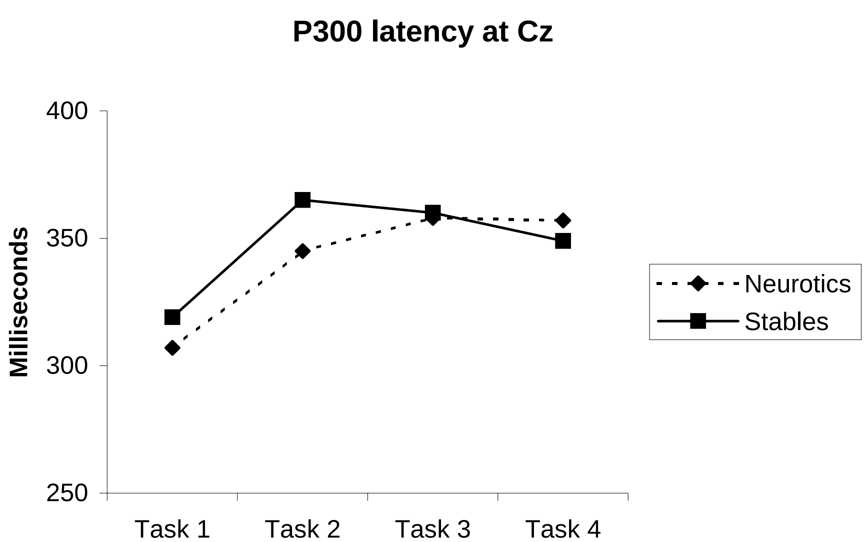

Figure 3. Mean P300 latency across tasks for high and low scorers on neuroticism.

As can be seen from the figures, the differences between HN and LN are not profound, although there is a tendency that P300 is somewhat shorter for HN than for LN in the simple tasks, and that the P300 is relatively more prolonged for HN when the complexity of the task increases. ANOVA with 4 tasks X 3 electrodes (Fz, Cz, Pz) X 2 groups yielded significant main effects of electrode ($F [1.^{503}, 46.582] = 100.237$, $p < .001$) and task ($F [2.047, 63.459] = 189.339$, $p < .001$), and an interaction effect of task X electrode ($F [3.068, 95.101] = 239.883$, $p < .001$,) but no main effects or interaction effects involved group.

Hypothesis 2: The difference between RT and P300 latency is larger for HN

Mean RT for the two groups across tasks is presented in figure 4, and mean RT-P300 difference is presented in figure 5.

As can be seen from figure 4, there are only small differences between the groups with regard to RT, and none were significant. It is evident from figure 5 that the RT-P300-difference is larger for HN than for LN for the first three tasks. Paired samples t-tests showed that for task 2, this difference is significant ($p < .05$) at Cz. However, an ANOVA with 3 tasks X 3 electrodes (Fz, Cz, Pz) X 2 groups yielded no significant results involving group, and the only significant result was a main effect of electrode (F [1.840, 62.547] = 5.160, $p < .05$).

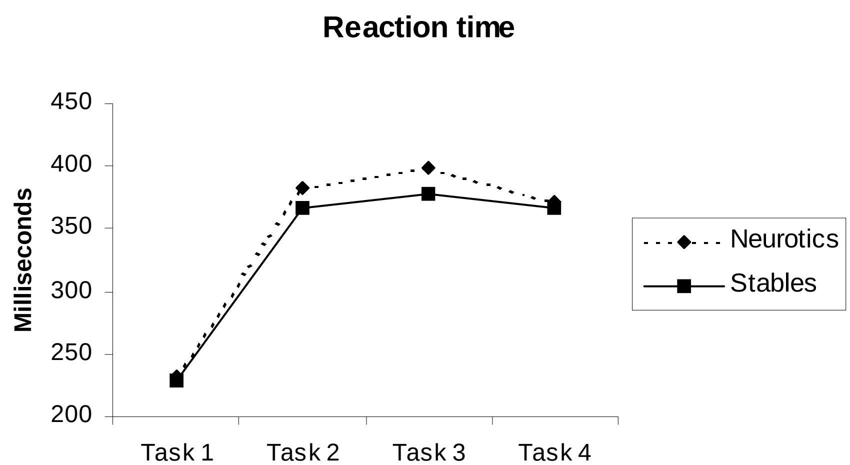

Figure 4. Mean reaction time across tasks for high and low scorers on neuroticism.

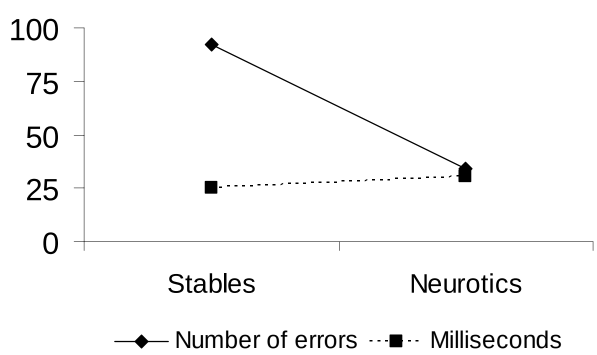

Figure 5. Mean difference between reaction time and P300 across tasks for high and low scorers on neuroticism. This measure is regarded as a measure of the time used to select and execute a response after categorization of an incoming stimulus is completed.

Hypothesis 3: The Difference between RT and P300 Latency will Increase More with Increased Task Demands for HN

As is evident from figure 5, the RT-P300 difference did not increase more for HN than LN. As the 3 tasks X 3 electrodes (Fz, Cz, Pz) X 2 groups described above shows, no interaction effects between group and task were identified.

Hypothesis 4: HN Make Few Errors and have Long RT – P300 Difference, while LN Show the Opposite Pattern

ANOVA with 3 tasks X 2 behavioral parameters (P300-RT differences, accuracy) X 2 groups for each of the three electrodes in turn yielded no significant effects involving group. The relationship between the sum of errors committed in task 2-4 and the RT-P300 difference for HN and LN in these tasks is shown in figure 6. As seen in the figure, there is a clear tendency for neurotics to make fewer errors of commition and use longer time from the P300 peak to the execution of a response. However, as the ANOVA shows, the impression from the figure does not stand a statistical test. Post hoc test showed that for task 3, there was a significant effect of group on rate of error ($t = -2.111$, $p < .05$), in that LN committed more errors than HN.

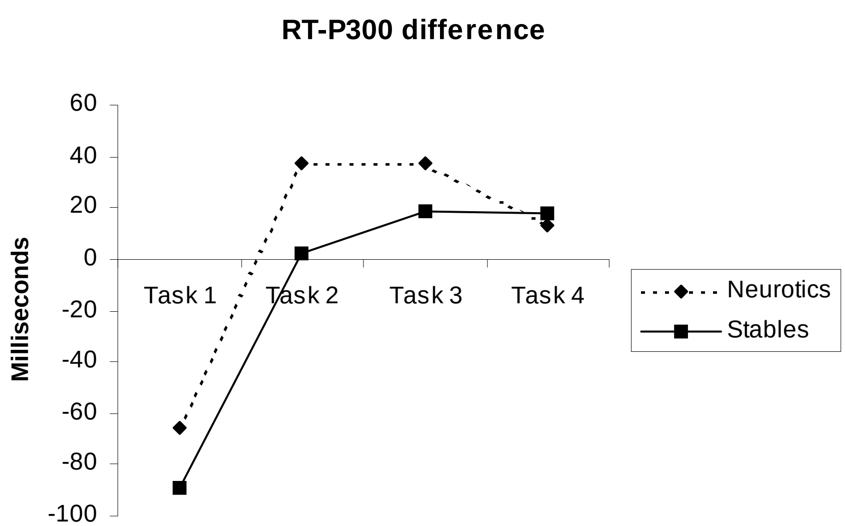

Figure 6. The relationship between RT-P300 difference and accuracy across task 2-3 for high (HN) and low (LN) scorers on neuroticism.

Hypothesis 5: Analyses at the Level of Facets

Correlations between six facets and BDI and P300 latency, RT, and RT-P300 differences are presented in table 2. Since we cannot expect strong relationships with analyses at the level of facets, we have allowed a level of significance of .10 in our modest sample size for exploratory purposes. Of the six facets, depression yielded the strongest correlations with P300 latency. However, BDI yielded the only correlations significant at .05 level. None of the correlations with task 3 and 4 approached significance. Regarding reaction time, the strongest correlations were with self-consciousness. Correlations with task 2 were significant at .10 level (r = .27) and task 3 at .05 level (r = .39). Generally, correlations with task 3 were strongest across facets. Turning to the RT-P300 differences, depression and self-consciousness showed the strongest relationships. Also, BDI showed two correlations at .10 level of significance.

Table 2. Correlations between P300, reaction time (RT), RT-P300 difference, and facet scales of neuroticism

	Task	Anxiety	Hostility	Depression	Self-consciousness	Impulsivity	Vulnerability	Beck DI
P300 latency	1	-.06	-.14	-.23	-.11	-.10	-.17	-.36**
	2	-.16	-.16	-.27*	-.14	-.18	-.19	-.34**
	3	.03	.04	-.06	.06	.06	-.02	-.09
	4	.00	.15	.00	.11	.10	.04	-.00
Reaction time	1	.10	.03	.10	.11	-.02	-.03	-.06
	2	.10	.12	.08	.27*	.16	.05	.04
	3	.25	.05	.24	.39**	.13	.14	.17
	4	.08	.02	.12	.24	.12	.07	.10
RT-P300 dif.	1	.15	.17	.30*	.17	.18	.20	.26*
	2	.11	.18	.14	.20	.23	.08	.10
	3	.23	.02	.31**	.37**	.03	.17	.29*
	4	.06	-.09	.08	.10	-.09	.06	.10

* P < .01.
** P < .05

Conclusion

Overall, the results indicate that there are few differences in individual information processing strategies depending on a person's level of neuroticism, and that those that may exist are hard to identify. In the present study it was not, as in some previous studies, find that HN had significantly shorter P300 latency than LN. Thus, HN did not differ from LN in information processing speed. The reason for the discrepancy between the present study and some previous studies may lie in the type of ERP tasks chosen. Besides Stelmack et al. (1993), previous studies have used auditory stimuli, which are more attention grabbing. It is possible that HN and LN react different to auditory, but not to visually, presented stimuli.

Also, our two last tasks were quite difficult, and it seems like this have prolonged the P300 latency of HN more than LN. Even though these relationships were not statistically significant, LN show a tendency to shortened P300 latency to task 3 and 4, where the stimulus material actually is of a more complex character, while HN prolong their P300's. This hints that LN, but not HN, benefit from the experience in task 1 and 2 with regard to P300 latency.

We hypothesised that HN need more time from completion of the evaluation and categorization of an incoming stimulus to the execution of a response to that stimulus. This turned out to be right in the simple choice-reaction task (task 2) at Cz, a relatively easy task. HN withheld their responses for longer than LN, presumably as a result of fear of making errors. This phenomenon would not have been identified if either measure were used alone. Comparing the two parameters gave information on fundamental differences in cognitive processing strategies in HN and LN: HN are more response-conservative even in a simple choice-reaction task, when they have been told to respond as quickly as possible, and when there are no extrinsic adverse consequences of making errors. Still, the 3 task X 2 groups ANOVA turned out insignificant, both with regard to a main effect of groups and with regard to a group X task interaction effect. Thus, the conclusion must be drawn with reservations. Even though the tendency is that HN have shorter RT-P300 difference, this difference was statistically significant only in task 2. Thus, the phenomenon is not very robust, and cannot be generalised across tasks differing in complexity. This mimics the results of Stelmack et al. (1993), who were able to detect differences between HN and LN only in a few of their tasks. Still, a tendency exists, both across different tasks and samples. The fact that this pattern is eliminated in task 4 is contrary to our expectations. One possibility could be that when the stimulus presentation time and the inter-stimulus interval are sufficiently small, there is no room for any delay of responses, and so the individual differences in information processing strategies diminish. A small prolongation of the RT-P300 relationship will increase the possibility that the response is executed too late, and so even HN are forced to respond with a higher degree of uncertainty. Thus, when tasks require sufficiently complex pattern recognition and speeded processing, individual response strategies collapse, and responses should to a larger extent depend on stimulus evaluation time. However, the latter is not correct. When we correlated P300 latency and RT within each task, the coefficients were not higher in the last task than in task 2 and 3. Even though we are not capable of explaining the cognitive mechanisms behind the fact that HN shortened rather than prolonged their RT-P300 difference in the last condition, it seems reasonable to conclude that increased demands for speeded information processing and responding somehow lead HN to reduce their "safety interval" between the P300 peak and the response.

Generally, HN, besides tending to have longer RT-P300 differences, also made fewer errors. This was as expected. However, only for task 3 was the difference in error rate statistically significant. As for the other analyses, task 4 deviated. In this task, HN had shorter RT-P300 differences and committed more errors than LN, even though the difference was not statistically significant. This is in line with the above reasoning. When the task demands are such that HN are forced to give up their usual information processing strategies, and thereby shorten the interval from completion of stimulus categorization to the end of the response execution, their error rate increases and equals LN error rate.

The six facet scales and BDI illuminated possible mechanisms for the observed differences in information processing between HN and LN. In our study of young females, hostility is not related to P300, RT, or the RT-P300 difference. This means that at least for females, other mechanisms are responsible for the observed relationships, contrary to what Pritchard (1989) found in his mixed-sex sample. Also, it is noteworthy that trait anxiety seems to be unrelated to differences in RT-P300 differences. One of our hypotheses was that anxiety would make HN participants afraid to make errors, and therefore use longer time from completion of stimulus categorization to the execution of a response. As expected, however, self-consciousness showed a relationship with RT-P300 difference, maybe because self-conscious participants are more afraid to make errors and thus “double check” that a response is appropriate. Since P300 latency does not depend on the participants mind set to the same degree as RT does (Reinvang, 1998), the RT-P300 difference thus increases for the self-conscious individuals.

Both trait depression and state depression (BDI) are inversely related to P300 latency, and positively correlated with RT-P300 difference. This was not in accordance with our expectations, and may indicate that depression is a central element in the observed differences in information processing between HN and LN. It may be the case that depression has a beneficial effect on P300 without significantly affecting RT. In this case the RT-P300 difference would increase. An implication is that depression exerts its effect on perceptual processes and stimulus categorization, relatively automatic processes, not response selection and/ or execution, processes voluntarily controlled and consciously monitored. It would have been interesting to know the influence of depression in previous studies. Future research may attempt to address this question about the role of depression vs. neuroticism directly. However, since depression usually is included in the neuroticism dimension, it is difficult to get high and low scorers on neuroticism with comparable levels of depression.

We believe that our data in general support Stelmack et al. (1993), and also extend previous findings. Personality factors, at least when it comes to neuroticism, seem to be relevant to fundamental information processing. When RT is used to draw inferences about cognitive processes, the differences between HN and LN are by and large hidden. As our data show, this does not mean that they may exist. Thus, in clinical neuropsychological and neurophysiological practice, it may be useful to take personality dimensions into account, especially when one is dealing with the extreme scorers. Still, the results from the present study are not strong, and only for one electrode in one task was the expected relationship identified. Thus, even though the present study hints at differences in the way neurotics and stables process information in speeded response-tasks, conclusions must be drawn with caution.

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