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Personality and Individual Differences 43 (2007) 2033–2046
PERSONALITY AND INDIVIDUAL DIFFERENCES
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Psychoticism and attentional flexibility

Błażej Szymura [a,*], Kamila Śmigasiewicz [a], Philip Corr [b]

[a] Jagiellonian University, Institute of Psychology, Poland
[b] University of Wales, Swansea, United Kingdom

Received 9 November 2006; received in revised form 18 June 2007; accepted 20 June 2007
Available online 12 September 2007

Abstract

In three separate experiments, we tested the hypothesis that a systematic relationship between psychoticism (P) and visual selective attention is infrequently observed because the tasks typically used to test individual differences in efficiency of attentional mechanisms do not entail attentional flexibility. We manipulated the selection rule of the computerized divided visual attention (DIVA) task to be either (a) a predictable, or (b) a random manner, and a secondary task was added to check the quality of high P scorers' performance in an interference condition; and we also introduced breaks between DIVA tasks to allow for cue utilization. Results revealed that low P scorers outperformed high P scorers in the regular selection rule alternation condition (cue utilization possible), whereas high P scorers performed better in random alternation condition – high P scorers also showed performance superiority in the dual task condition unless stimuli presentation was speeded up. Thus, P does not necessarily impair attentional performance; indeed, our data point to performance advantages of high P, especially attentional efficiency in tasks requiring small demands of attentional control.

Keywords: Psychoticism; Selective attention; Attentional flexibility; Inhibition; Cue utilization; Information acquisition; Divided attention

* Corresponding author. Fax: +48 12 623 76 99.
E-mail address: blazej@apple.phils.uj.edu.pl (B. Szymura).

0191-8869/$ - see front matter
doi:10.1016/j.paid.2007.06.023

1. Introduction

Studies of the relationship between personality and attention are important for several reasons. First, this knowledge would increase our understanding of the cognitive mechanisms of human personality; and second, it would also be helpful in the development of integrated models of attentional performance, which take into account both general mechanisms of attention and their inter-individual variability. Although individual differences in attentional performance are important across many domains of psychology, especially applied ones, the relationship between psychoticism (P) and attentional performance remains unclarified.

In this paper, we focus on the relationship between P and visual selective attention. Our experiments are based on two assumptions (Szymura & Nęcka, 2005). First, individual differences in selective attention appear only in demanding tasks. Second, demanding conditions are individually differentiated: what is demanding for one person may not be demanding for another. Previously it has been shown that the combination of dual task conditions and the level of information processing were sufficiently demanding to impair selective attention of introverts (Szymura & Nęcka, 1998). Time pressure and distraction conditions have also been shown to be sufficiently demanding to impair the attentional selectivity of high neuroticism individuals (Szymura & Wodniecka, 2003).

In these studies the divided visual attention (DIVA) task of selective and divided attention was used. This task was developed to assess various aspects of attention. The first part of the DIVA task is based on the 'filter theory' of attention, namely that a subject's task is to filter out signals from noise in a situation of continuously changing stimulation. The second part of the DIVA task is based on the 'resource theory' of attention, and resembles commonly used dual task procedures. Accordingly, a subject's task is to deal with two problems simultaneously: first, how to detect valid signals embedded in noise; and, second, how to control the moving stimulus. However, so far no difference between low and high P scorers has been reported.[1] It is here hypothesized that the P-selective attention relationship was not observed because attentional performance in previously used versions of the DIVA task did not entail the need for one crucial process, namely attentional flexibility.

Flexibility is a rather neglected aspect of attention. Johnston and Heinz (1978) suggested that the selective attention system shows flexible adjustment in response to demands imposed by the level of information processing (Craik & Lockhart, 1972). They proposed that processing capacity and selection efficiency were interlocked in a trade-off relationship. As the system shifts from shallow to deep level of processing it loses selection efficacy but gains processing capacity.

With the use of the DIVA task, it has also been found that signal detection is faster if selection is based on a physical identity criterion (shallow level of information processing) as compared with a nominal identity criterion (deeper level of information processing). However, in previous studies, the selection criterion in the DIVA task was constant throughout the whole task: attentional flexibility needs to be examined with the use of the selectivity task that demands that the selection criterion changes, requiring a shift from one level of information processing to another. In the present study such a version of the DIVA task was employed.

[1] We were able to show only one significant interaction of psychoticism and the single/dual task variable (Szymura & Nęcka, 1998). This result is described in Section 3.1.2.3.

In relation to P, Eysenck's PEN model is distinctive due to its completeness (the number and quality of the higher-ordered traits) and biological bases (what makes possible the formulation of explanatory hypotheses of personality/cognition relationships). Psychoticism is the most controversial factor from Eysenck's model, although it correlates negatively with agreeableness, conscientiousness (McCrae & Costa, 1985) and sensory sensitivity (Strelau & Zawadzki, 1997) and positively with openness (McCrae & Costa, 1985) and creativity (Rushton, 1997). Eysenck (1992) suggested that P may be associated with diminished inhibition of neural impulses resulting from excessive production of dopamine by the nervous system. Thus, P may be related to ineffective cognitive control caused by poor inhibition processes.

The evidence presented above suggests that, due to poor inhibition, P may be associated with either strength or weakness of selective attention, depending upon the task characteristics (see Rawlings, 1984, 1985; Thompson, 1985). Poor inhibition seems to give high P scorers an advantage in negative priming tasks, but exerts a cost in interference tasks. Subjects scoring high on the P scale also show worse performance in signaled (cue presence) and distracted attentional conditions. Meanwhile, inhibition and information acquisition seem to be the cognitive functions of the greatest importance for attentional flexibility. The turn from one selection criterion to the other requires inhibition of the previously used criterion that is no longer valid in the current task. The acquisition of information about selection rule alternation can help in preparation for a quick activated correct criterion in the current task. Thus, impairment of inhibition and information acquisition of cognitive functions in high P scorers should be reflected in their lowered quality of attentional flexibility.

2. Experiment 1: effects of task arrangement and break duration

2.1. Method

2.1.1. Subjects

One hundred and four first year psychology students (89 females; mean age 19.92; SD = 1.17) served as volunteer subjects.

2.1.2. Materials

2.1.2.1. Psychometric questionnaire. The EPQ-R questionnaire was used to assess the level of psychoticism (P).

2.1.2.2. Attentional flexibility task. The modified version of the computerized DIVA task (Nęcka, 1997) was used. The test consisted of two selectivity tasks with different selection rules. The information about the selection rule was provided by the color of the display. Easy task (easy selection rule; E) was presented in green, whereas difficult task (difficult selection rule; D) in red. In both conditions, a small frame with a target letter inside and several probe letters outside appeared on the computer screen. The task consists in detection of each probe that fulfilled the selection criterion. Under easy (E) experimental conditions, the criterion was physical identity of the target and the probe (e.g., R, R; Fig. 1). In the D-task, the target and the probe had to be semantically the same but to differ in case (e.g., R, r; Fig. 2). Invalid letters (''noise'') were different from the

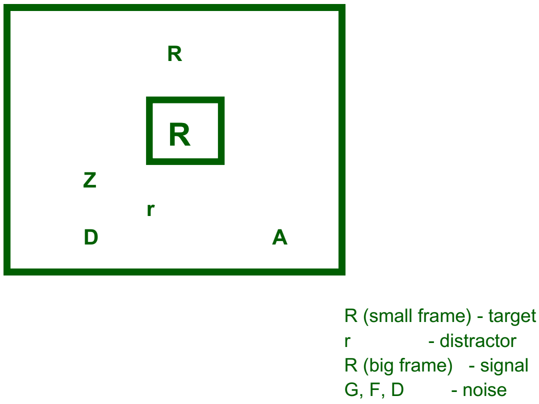

Fig. 1. The computer display of the easy task (E).

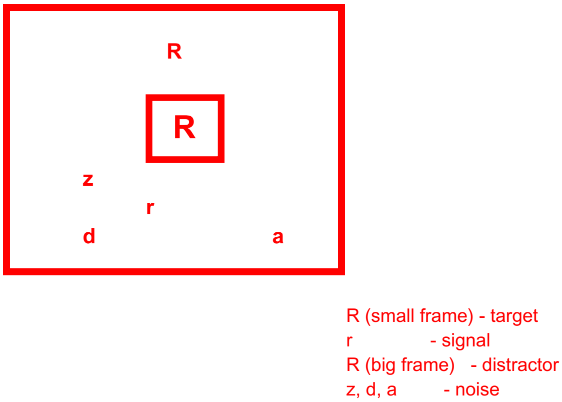

Fig. 2. The computer display of the difficult task (D).

target. Uppercase letters served as noise in the E-task, whereas lowercase letters in the D-task. Distracting letters were semantically the same but differed in case in the easy task, whereas they were semantically and physically identical to the target in the difficult task.

One probe disappeared and another appeared at the rate of one letter per 900 ms. Location of a new probe letter and sequence of the probes were randomized. The target changed every 16 s in an unpredictable way. Overall, there were 36 target letters (36 tasks). In each task, there were 4 signals to detect in random time appearance. There were always 5 (if distraction stimulus absent) or 6 (if distraction stimulus present) letters on the display. Number of both kinds of tasks (E, D) as well as repetition (EE, DD) and switching trials (ED, DE) were equal.

There were two versions of the DIVA task, with either regular (i.e., EEDDEEDDEEDD...) or random (e.g., EDEEDEDDDEED...) task arrangement. Randomized task succession was obtained with the use of the computer RGCalc program. Subjects were not informed about task arrangements. There were also two versions of the DIVA task: (a) with breaks (600 ms) or (b) lack of the breaks between the tasks. Thus, the two experimental manipulations (regular/random and breaks/lack of the breaks) resulted in 4 (2×2) different versions of the DIVA task.

Two measures of the test performance were recorded: reaction times (RTs) and false alarms (FAs). Participants were informed that both RTs and errors would be recorded, so they should react accurately and quickly.

2.1.3. Procedure

Subjects completed the EPQ-R questionnaire during the first session and performed the DIVA task during the second one. First, the three test stages were for training purposes (easy selection rule: 4 tasks; difficult selection rule: 4 tasks; turn of selection rule: 4 tasks). The subjects familiarized themselves with selection criteria and the display colors. The last stage of the test was the experiment proper (turn of selection rule: 36 tasks).

2.2. Results

2.2.1. Personality traits

As expected, correlations between personality variables were modest: E–N = −0.20 ($p < 0.025$); P–E = −0.04 (ns); P–N = −0.10 (ns). Table 1 provides descriptive statistics for the EPQ-R scales. Although the group of subjects consists of mostly females, the mean score of P was comparable with that obtained in the standardized study (Strelau & Zawadzki, 1997). On the basis of the median score (9) on the P scale the subjects were divided into two groups: high scorers (HPSS; 50 Ss, P score median or above) and low scorers (LPSS; 54 Ss, P score below median).

2.2.2. Reaction times

A 2 (*psychoticism*) × 2 (*tasks' arrangement*) × 2 (*breaks' duration*) analysis of variance (ANOVA) was conducted. The *breaks' duration* effect was significant, $F(1,96) = 4.63$, $p < 0.035$, $\eta = (0.05)$, as was the *psychoticism* × *tasks' arrangement* interaction, $F(1,96) = 6.33$, $p < 0.015$, $\eta = 0.06$; (Fig. 3). The *breaks' duration* effect indicated that shorter RTs occurred in the breaks (657 ms) then in the lack of the breaks (681 ms) condition.

The *psychoticism* × *tasks' arrangement* interaction was analyzed using simple main effects analyses. LPSs obtained shorter reaction times (662 ms, in comparison to 690 ms) in the regular task arrangement condition. However, this effect did not reach a formal significance level. On the contrary, HPSs (647 ms) outperformed LPSS (676 ms) in random tasks' arrangement condition, $F(1,96) = 4.60$, $p < 0.035$, $\eta = 0.05$. Thus, subjects scoring low on the P scale obtained non-significantly shorter RTs in regular in comparison to the random tasks' arrangement condition; whereas subjects scoring high on the P scale performed significantly better in the random comparison to the regular tasks' arrangement condition, $F(1,96) = 5.94$, $p < 0.017$, $\eta = 0.06$.

Table 1
The mean scores and standard deviations in EPQ-R scales as obtained in Experiment 1

	Mean	Standard deviation
Extraversion	15.37	4.76
Neuroticism	11.85	5.31
Psychoticism	8.75	3.90

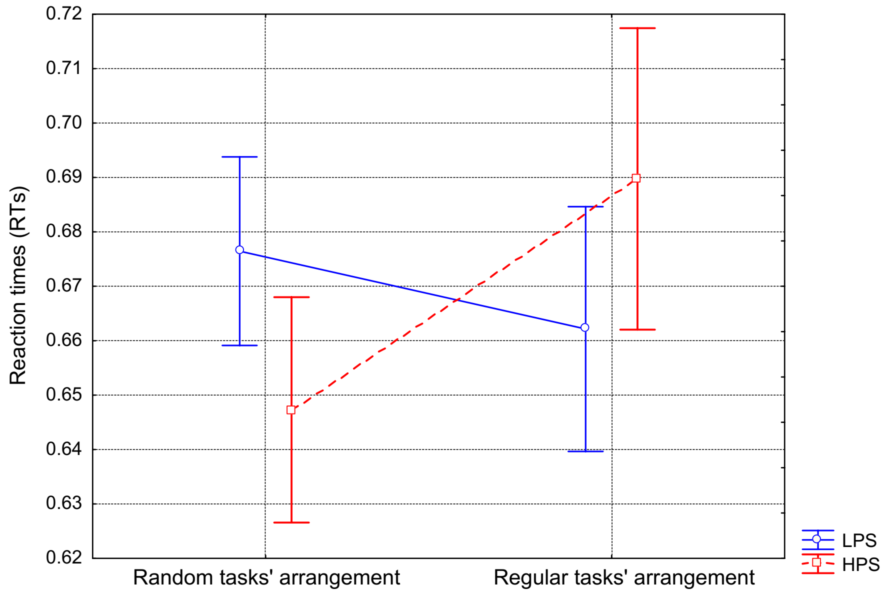

Fig. 3. The reaction times as a function of psychoticism and tasks' arrangement ($F(1,96) = 6.34$, $p < 0.0135$).

2.2.3. False alarms

A 2 (*psychoticism*) $\times$ 2 (*tasks' arrangement*) $\times$ 2 (*breaks' duration*) analysis of variance (ANOVA) was conducted. *Psychoticism* $\times$ *tasks' arrangement*, $F(1,96) = 3.98$, $p < 0.05$, $\eta = 0.02$ (Fig. 4) interaction was significant. Simple effects analyses revealed that in the regular task

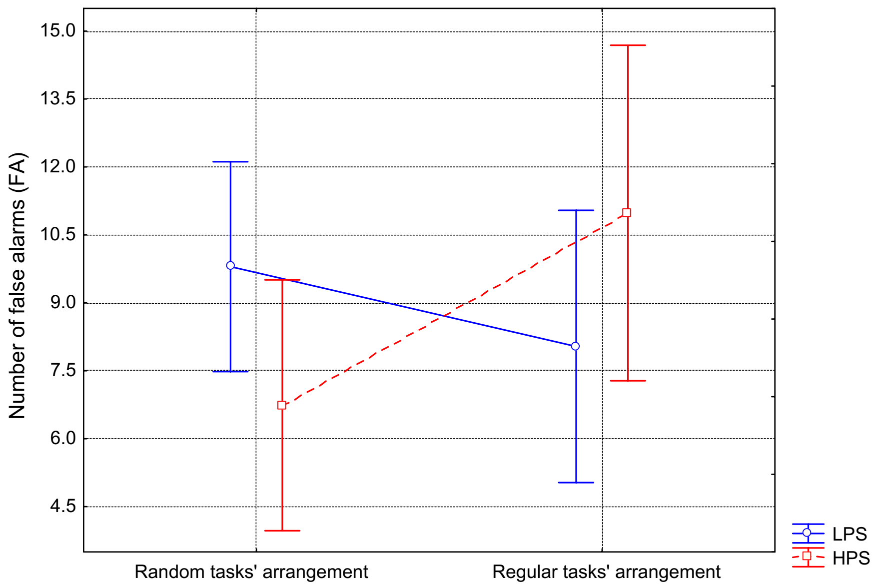

Fig. 4. The number of false alarms as a function of psychoticism and tasks' arrangement ($F(1,96) = 3.975$, $p < 0.049$).

arrangement condition, LPSs (8.04) in comparison to HPSs (10.98), committed fewer FAs, whereas in the random task arrangement the pattern of results reversed (HPSS – 6.74; LPSS – 9.80). However, both these simple effects did not reach a formal significance level. In addition, subjects scoring low on the P scale committed non-significantly fewer FAs in regular in comparison to random tasks' arrangement condition; whereas subjects scoring high on the P scale performed almost significantly better in the random comparison to regular tasks' arrangement condition, $F(1, 96) = 3.32$, $p < 0.071$, $\eta = 0.03$.

3. Experiment 2: effects of secondary task processing

3.1. Method

3.1.1. Subjects

Ninety-three first year psychology students (76 females; mean age 20.22; SD = 1.60) served as volunteer subjects.

3.1.2. Materials

3.1.2.1. Psychometric questionnaire. The EPQ-R questionnaire was used to assess the P level.

3.1.2.2. The modified attentional flexibility task. A modified version of the DIVA task was employed, which included a secondary task. The first part (tasks 1–18) consisted of performance of the main selectivity task only (the single task condition). This task stayed the same as it was in Experiment 1 except for changes in: (a) the speed of stimuli presentation (slowed down to one letter per 1000 ms) and (b) the duration of the breaks (lengthened to 1200 ms). This softening of the selectivity task demands was necessary in order to avoid too strong interference from this task in the dual task condition.

The second part of the task (tasks 19–36) consisted of simultaneous performance of two tasks (the dual task condition). The main selectivity task stayed the same as it was in the single task condition. However, concurrently with the main selectivity task, subjects had to control the position of a "moving bar", which was occurring at one of two additional panels (Fig. 5). Subjects' task was to keep the bar in the middle of the panel. Each panel included a "quiet zone" indicated by the markers. When the bar moved out of the quiet zone, the computer generated

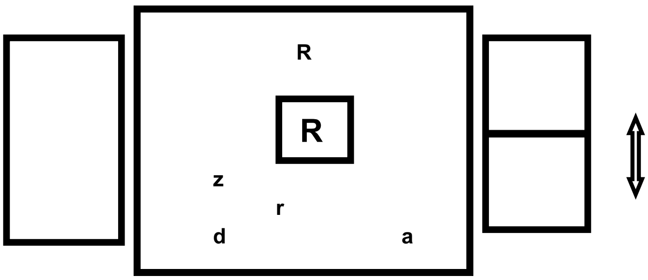

Fig. 5. The computer display of the dual D-task condition.

an unpleasant noise. Subjects were told to avoid the noise by keeping the bar in the middle position.

3.1.2.3. Rationale. The secondary task was added to the DIVA task in order to check the quality of high P scorers' performance in an interference condition. The interference effect in the dual task condition of the DIVA task has already been obtained (Szymura & Nęcka, 2005), showing that the DIVA test is an appropriate tool to assess divided attention. In addition, Corr (2003) showed that implicit learning was impaired in high P scorers in the dual task condition due to simultaneous performance of explicit knowledge task (also, see Rawlings, 1985). However, contrary to these findings, it has been reported that P scorers obtain fewer errors in the dual task condition of the DIVA task (Szymura & Nęcka, 1998). Thus, adding the secondary task we intended to examine HPSs' selective attention flexibility and resistance to interference under the divided attention condition.

There were two between group factors: (1) *tasks' arrangement*, (2) *breaks' duration*, and one within group factor (3) *single/dual task* – either only signal detection or detection with secondary task. Two measures of the test performance were registered: RTs and FAs. Participants were informed that both RTs and errors would be recorded and that none of the tasks had priority in the dual task condition.

3.1.3. Procedure

The experimental procedure was the same as in Experiment 1. The only exception was the course of the training stage. First, two tasks of each stage were performed by the subjects in the single task condition, the last two in the dual task condition. The last stage of the test was the experiment proper.

3.2. Results

3.2.1. Personality traits

Correlations between personality variables were, once again, modest: $E–N = -0.25$ ($p < 0.017$); $P–E = 0.09$ (ns); $P–N = -0.01$ (ns). Table 2 provides descriptive statistics for the EPQ-R scales. Although the group of subjects consists of mostly females, the mean score of P was comparable with that obtained in the standardized study (Strelau & Zawadzki, 1997). On the basis of the median score (9) on the P scale the subjects were divided into two groups: high scorers (HPSS; 49 Ss, P score above median) and low scorers (LPSS; 44 Ss, P score median or below median).

Table 2
The mean scores and standard deviations in EPQ-R scales as obtained in Experiment 2

	Mean	Standard deviation
Extraversion	15.49	4.81
Neuroticism	11.96	5.47
Psychoticism	9.32	4.22

3.2.2. Reaction times

A 2 (*psychoticism*) × 2 (*tasks' arrangement*) × 2 (*breaks' duration*) × 2 (*single/dual task*) analysis of variance (MANOVA) was conducted. *Single/dual task* effect, $F(1,84) = 349.83$, $p < 0.0001$, $\eta = 0.80$, and *single/dual task* × *tasks' arrangement* interaction, $F(1,84) = 6.91$, $p < 0.01$, $\eta = 0.08$, were both significant. Subjects performed the DIVA task faster in the single task (642 ms) than in the dual task (744 ms) condition. The simple effect analyses of *single/dual task* × *tasks' arrangement* interaction revealed that the *single/dual task* variable yielded a strong main effect as well in regular tasks' arrangement, $F(1,84) = 132.64$, $p < 0.0001$, $\eta = 0.61$, as in random tasks' arrangement condition, $F(1,84) = 221.79$, $p < 0.0001$, $\eta = 0.73$. However, the effect of neither the *tasks' arrangement* variable in the single task nor in the dual task condition was significant.

3.2.3. False alarms

A 2 (*psychoticism*) × 2 (*tasks' arrangement*) × 2 (*breaks' duration*) × 2 (*single/dual task*) analysis of variance (MANOVA) disclosed two significant effects: *single/dual task*, $F(1,84) = 14.03$, $p < 0.0001$, $\eta = 0.14$, and *breaks' duration*, $F(1,84) = 6.24$, $p < 0.014$, $\eta = 0.07$. It revealed also four significant interactions: *single/dual task* × *breaks' duration*, $F(1,84) = 5.00$, $p < 0.028$, $\eta = 0.06$, *single/dual task* × *psychoticism*, $F(1,84) = 6.85$, $p < 0.011$, $\eta = 0.08$, *Breaks' duration* × *psychoticism*, $F(1,84) = 4.50$, $p < 0.037$, $\eta = 0.05$, and *single/dual task* × *breaks' duration* × *psychoticism*, $F(1,84) = 5.04$, $p < 0.027$, $\eta = 0.06$.

Subjects committed more FAs in the dual task (14.04) than in the single task (8.67) condition; performance was worse in the lack of the breaks (13.81) than in the breaks condition (8.91). Simple effect analyses of *single/dual task* × *breaks' duration* interaction revealed that in the dual task condition the subjects committed significantly more false alarms in the lack of the breaks (18.10) than in the breaks (10.00) condition, $F(1,84) = 6.87$, $p < 0.01$, $\eta = 0.08$, whereas in the single task the effect of the *breaks' duration* variable was not significant. The manipulation of the *single/dual task* variable was ineffective in the breaks condition, whereas in the lack of the breaks condition the *single/dual task* variable yielded a strong effect (difference 8.58), $F(1,84) = 12.80$, $p < 0.001$, $\eta = 0.13$.

In the single task condition LPSs committed fewer FAs (7.52) than HPSs (9.83), whereas in the dual task condition the pattern of results was reversed (HPSs – 11.45; LPSs – 16.64). The simple effects analyses disclosed that these differences between LPSs and HPSs were not significant. However, the manipulation of the *single/dual task* variable appeared effective, but only for LPSs, $F(1,84) = 19.14$, $p < 0.001$, $\eta = 0.18$. The subjects scoring high on the P scale did not differ at all also with regard to the *breaks' duration* variable (difference 0.79). On the contrary, subjects scoring low on the P scale committed more false alarms in the lack of breaks (16.61) than in the breaks condition, 7.55; $F(1,84) = 10.09$, $p < 0.002$, $\eta = 0.11$.

The simple effect analyses of interaction *single/dual task* × *breaks' duration* × *psychoticism*, $F(1,84) = 5.04$, $p < 0.027$, $\eta = 0.06$ (Fig. 6) revealed that in the single task and the breaks condition LPSs committed fewer FAs than HPSs (6.19 in comparison to 9.45; $F(1,84) = 3.98$, $p < 0.05$, $\eta = 0.04$, whereas in the dual task and the lack of the breaks condition HPSs performed better than LPSs (11.81 in comparison to 24.38), $F(1,84) = 5.92$, $p < 0.017$, $\eta = 0.07$. The lack of breaks impaired attentional performance only of subjects scoring low on the P scale, but that was clearly visible only in the dual task condition, $F(1,84) = 11.88$, $p < 0.001$, $\eta = 0.12$. Meanwhile, the

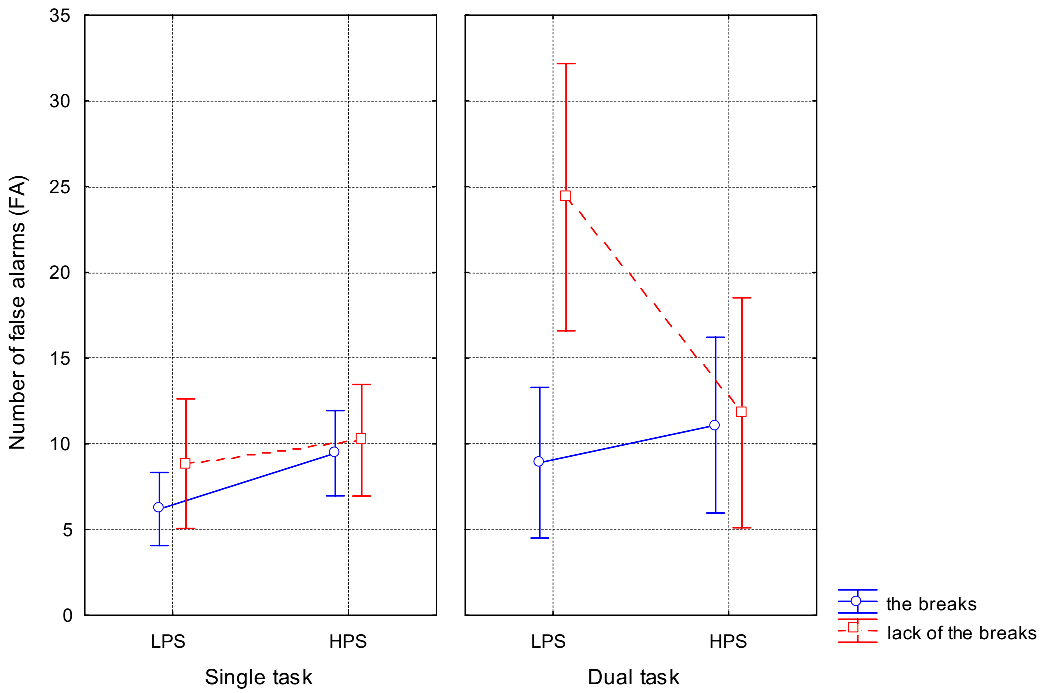

Fig. 6. The number of false alarms as a function of psychoticism, breaks' duration and single/dual task ($F(1,84) = 5.042$, $p < 0.027$).

manipulation of variables: *breaks' duration* and *single/dual task* combination was completely ineffective in HPSs.

4. Experiment 3: secondary task processing and speeded presentation

4.1. Method

4.1.1. Subjects

Eighty-three first year psychology students (69 females; mean age 20.62; SD = 2.06) served as volunteer subjects.

4.1.2. Materials

4.1.2.1. Psychometric questionnaire. The EPQ-R questionnaire was again used.

4.1.2.2. The modified attentional flexibility task. The DIVA task stayed the same as it was in Experiment 2 except for the change in the speed of stimuli presentation (speeded up again to one letter per 900 ms). Secondary task addition to the DIVA task in Experiment 2 allowed for the discovery of an interesting psychoticism – divided attention relationship. However, in Experiment 2, we were not able to replicate the earlier findings of psychoticism and attentional flexibility. Thus, the increase of selectivity task demands seemed necessary. All independent and dependent variables stayed also the same as previously.

4.1.3. Procedure

The procedure was the same as in Experiment 2

4.2. Results

4.2.1. Personality traits

Correlations between personality variables were insignificant: E–N = −0.11; P–E = 0.09; P–N = 0.06. Table 3 provides descriptive statistics for the EPQ-R scales. Although the group of subjects consists of mostly females, the mean score of P was comparable with that obtained in the standardized study (Strelau & Zawadzki, 1997). On the basis of the median score (9) on the P scale the subjects were divided into two groups: high scorers (HPSs; 42 Ss, P score median or above) and low scorers (LPSs; 41 Ss, P score below median).

4.2.2. Reaction times

A 2 (*psychoticism*) × 2 (*tasks' arrangement*) × 2 (*breaks' duration*) × 2 (*single/dual task*) analysis of variance (MANOVA) revealed a significant *single/dual task* effect, $F(1,75) = 53.74$, $p < 0.0001$, $\eta = 0.42$. Subjects performed faster in the single task (625 ms) than in the dual task (678 ms) condition.

4.2.3. False alarm errors

A 2 (*psychoticism*) × 2 (*tasks' arrangement*) × 2 (*breaks' duration*) × 2 (*single/dual task*) analysis of variance (MANOVA) revealed a *single/dual task* effect, $F(1,75) = 18.70$, $p < 0.0001$, $\eta = 0.20$. The same MANOVA analysis revealed also two significant interactions: *tasks' arrangement* × *Breaks' duration* × *psychoticism*, $F(1,75) = 5.96$, $p < 0.017$, $\eta = 0.07$ (Fig. 7); and *single/dual task* × *tasks' arrangement* × *breaks' duration* × *psychoticism*, $F(1,84) = 4.1$, $p < 0.05$, $\eta = 0.05$. In addition, the *tasks' arrangement* × *psychoticism* interaction almost reached a formal significance level, $F(1,75) = 3.10$, $p < 0.08$, $\eta = 0.04$.

Subjects committed fewer FAs in the single task (9.51) than in the dual task (14.28) condition. The analyses of *tasks' arrangement* × *breaks' duration* × *psychoticism* interaction revealed three simple effects. First, the difference between low and high P scorers was observed only in the lack of breaks and random tasks' arrangement condition, $F(1,75) = 3.43$, $p < 0.068$, $\eta = 0.04$ (HPSs – 9.50 outperformed LPSs – 15.94 FA). Although nonsignificant, in the lack of breaks and regular tasks' arrangement condition, the pattern of results reversed (LPSs – 9.12 outperformed HPSs – 14.07).

Table 3
The mean scores and standard deviations in EPQ-R scales as obtained in Experiment 3

	Mean	Standard deviation
Extraversion	16.46	4.36
Neuroticism	10.44	4.96
Psychoticism	9.29	3.98

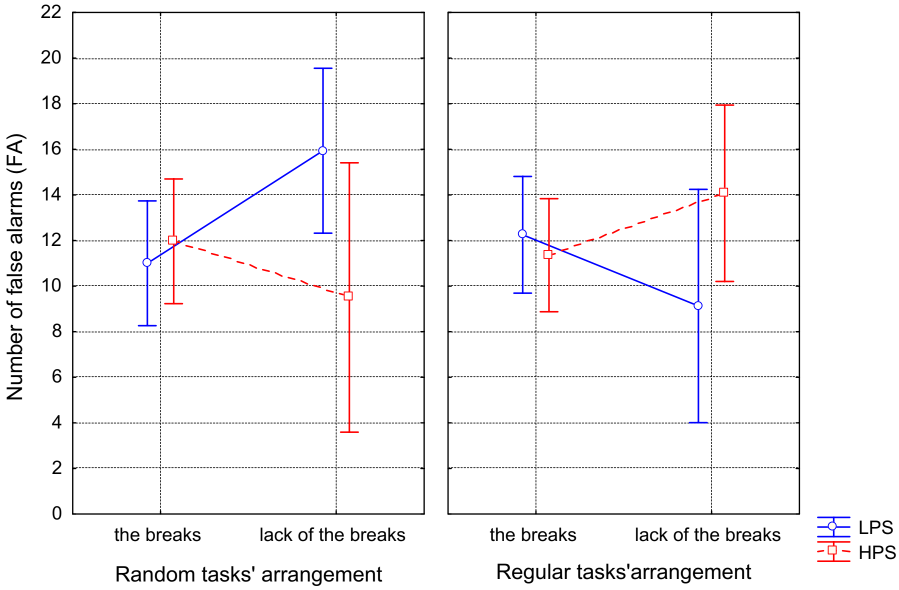

Fig. 7. The number of false alarms as a function of psychoticism, tasks' arrangement and breaks' duration ($F(1, 75) = 5.962$, $p < 0.017$).

Second, the lack of breaks in random tasks' arrangement condition impaired the detection of only LPSs, $F(1, 75) = 4.70$, $p < 0.033$, $\eta = 0.06$). They committed significantly more FAs (15.94) than in the breaks condition (11.00). Third, the species of *tasks' arrangement* influenced the performance correctness of only LPSs, but also only in the lack of the breaks condition, $F(1, 75) = 4.69$, $p < 0.034$, $\eta = (0.06)$. Low P scorers performed better in the regular task arrangement (9.13) than in the random task arrangement (15.94) condition.

The simple effects analyses of *single/dual task* × *tasks' arrangement* × *breaks' duration* × *psychoticism* interaction revealed the significant difference between high and low P scorers only in the dual task, random tasks' arrangement and lack of the breaks condition, $F(1, 75) = 5.70$, $p < 0.02$, $\eta = 0.07$. In such circumstances, HPSs outperformed (7.67; LPSs 20.25).

5. Discussion

High psychoticism (HPSs) scorers performed better in a random task arrangement in comparison to the regular task arrangement (Expt. 1: RT, FA; Expt. 3: FA, but only in lack of the breaks condition). In the random selection rule alternation condition, HPSs outperformed low psychoticism (LPSs) scorers (Expt. 1: RT; FA, but insignificantly; Expt. 3: FA, but only in dual task and lack of breaks condition). These results are explicable if the modified DIVA task is recognized as a negative priming task. With the change of the selection rule, subjects had to detect signals that previously served as distractors. Poor cognitive inhibition thus provides high P scorers with a selective advantage.

As expected, low P scorers performed better (Expt. 1: RT) and outperformed subjects scoring high on the P scale (Expt. 1: FA; Expt. 3: FA) in the regular task arrangement condition. However, none of these effects reached formal statistical significance. These results are contrary to our prediction based on Eysenck's P-theory and his weakness of suppression hypothesis. However, the subjects were not informed about task arrangements. In the regular task arrangement condition, they had to understand the regularity of selection criterion change (i.e., the cue presence). The cue was rather implicit than explicit. Thus, our results are complementary to Thompson (1985) findings: improvement in attentional performance with the cue present is of lesser magnitude for high P scorers, but only if the cue is explicit. Otherwise, if the cue is implicit, no significant differences between LPSs and HPSs are observed. In further work, we intend to inform subjects explicitly about the regularity of the task arrangement. It is hypothesized that LPSs will significantly outperform HPSs in such circumstances.

Surprisingly, in the dual task condition, HPSs performed better than LPSs (Expt. 2: FA, but only in lack of the breaks condition; Expt. 3: FA, but only in lack of the breaks and the random task arrangement conditions). The secondary task was effective mainly for low P scorers (Expt. 2: FA). Our results are not contradictory to these obtained by Corr (2003), because the used tasks in both studies are not really comparable: in the Corr study, dual task performance occurred during the early part of the experiment; in the current set-up all subjects have extensive exposure to single task conditions during the early part of the experiment. These differing results may point to the operation of important variables: the timing of dual task processing in the effects of psychoticism.

The present results are also in agreement with our previous findings (Szymura & Nęcka, 1998). In Szymura & Nęcka's study and in Experiment 2 the speed of stimuli presentation was slowed down to one letter per 1000 ms. The softening of the selectivity task demands probably reduced the magnitude of the tasks' interference effect. However, if dual task coordination is not required, high P scorers can even show superiority in the dual task performance.

Rothbart, Ahadi, and Evans (2000) have suggested two factors of attention: one being more automatic and diffuse (orienting sensitivity), and the other involving effortful control. Orienting sensitivity is positively related to creativity (CR) and openness (O). Thus, this factor could be also positively correlated to the P trait. In consequence, high P scorers can often show their superiority when effortful control is not necessary and orienting sensitivity is sufficient to perform the test (random task's arrangement, dual task without task interference). Whereas they usually show a worse performance when attentional control should be engaged to improve cognitive effectiveness (regular tasks' arrangement, dual task with strong task interference). In conclusion, it can be claimed that selective attention flexibility and dual task coordination appear to be sufficiently demanding for persons who differ in P to reveal individual differences in efficiency of attentional mechanisms.

Acknowledgement

This study has been supported by the Grant No. PB 1H01F001 27 (4103/27) from the Scientific Research Committee (KBN) to Błażej Szymura

References

Corr, P. J. J. (2003). Personality and dual task processing: Disruption of procedural learning by declarative processing. *Personality and Individual Differences, 34*, 1245–1269.

Craik, F. I. M., & Lockhart, R. S. (1972). Levels of processing: A framework for memory research. *Journal of Verbal Learning and Verbal Behavior, 11*, 671–684.

Eysenck, H. J. (1992). The definition and measurement of psychoticism. *Personality and Individual Differences, 13*, 757–785.

Johnston, W. A., & Heinz, S. P. (1978). Flexibility and capacity demands of attention. *Journal of Experimental Psychology: General, 107*(4), 420–435.

McCrae, R. R., & Costa, P. T. Jr., (1985). Comparison of EPI and psychoticism scales with measures of the five-factor model of personality. *Personality and Individual Differences, 6*, 587–597.

Nęcka, E. (1997). Attention, working memory and arousal. In G. Matthews (Ed.), *Cognitive science perspectives on personality and emotion (504–554)*. Amsterdam: Elsevier.

Rawlings, D. (1984). The correlation of EPQ psychoticism with two behavioral measures of impulsivity. *Personality and Individual Differences, 5*, 591–594.

Rawlings, D. (1985). Psychoticism, creativity and dichotic shadowing. *Personality and Individual Differences, 6*, 737–742.

Rothbart, M. K., Ahadi, S. A., & Evans, D. E. (2000). Temperament and personality: Origins and outcomes. *Journal of Personality and Social Psychology, 78*, 122–135.

Rushton, J. P. (1997). (Im)pure genius – psychoticism, intelligence and creativity. In H. Nyborg (Ed.), *The scientific study of human nature: Tribute to Hans J. Eysenck at eighty (404-421)*. Oxford: Pergamon.

Strelau, J., & Zawadzki, B. (1997). Temperament and personality: Eysenck's three superfactors as related to temperamental dimensions. In H. Nyborg (Ed.), *The scientific study of human nature: Tribute to Hans J. Eysenck at eighty (68–91)*. Oxford: Pergamon.

Szymura, B., & Wodniecka, Z. (2003). What really bothers neurotics? In search for factors impairing attentional performance. *Personality and Individual Differences, 34*, 109–126.

Szymura, B., & Nęcka, E. (1998). Visual selective attention and personality: An experimental verification of three models of extroversion. *Personality and Individual Differences, 24*, 713–729.

Szymura, B., & Nęcka, E. (2005). Three superfactors of personality and three aspects of attention. In A. Eliasz, S. E. Hampson, & B. de Raad (Eds.), *Advances in Personality Psychology (75–90)*. Hove: Psychology Press.

Thompson, A. H. (1985). Psychoticism and signalled versus unsignalled reaction time. *Personality and Individual Differences, 6*, 775–778.