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Psychoticism and signalled versus unsignalled reaction time

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Summary—Considering the findings that schizophrenics have been found to show relatively slow reaction times (RTs), and often do not benefit from ordinarily helpful information (e.g. a warning signal), the present study investigated the relationship between these variables and psychoticism (P). One hundred and three male *S*s were administered a questionnaire which provides a measure of P. In addition, all *S*s were tested on an RT task under unsignalled (i.e. no warning signal) and signalled conditions. The results showed that the expected improvement in reaction speed with a warning signal was of a lesser magnitude for those high on P. Furthermore, the difference was due to the faster RTs for high P scorers in the unsignalled condition. The data suggest that high P scorers are like schizophrenics in that they show less benefit from a warning signal, but are dissimilar in terms of reaction speed in an unsignalled task.

INTRODUCTION

Eysenck and Eysenck (1976) have suggested that there exists a dimension of personality, labelled psychoticism, which underlies the disorder exhibited by one who is psychotic. Psychoticism (P) is taken to be a personality dimension that is distributed throughout the normal population. Further, that those with high P scores who 'break down' are more likely to display a psychotic disorder than those with low P scores.

Assuming that psychoticism is related to psychotic breakdown, it would be expected that the information-processing differences found in psychotics may also be present in those with high P scores. the particular aspects of information processing in psychotics that will be examined here are two noted by Rodnick and Shakow (1940). First of all, these investigators found that those conditions which ordinarily reduced reaction times (RTs) in normals, were not nearly as beneficial to schizophrenics. Normally, reactions are faster when a warning signal is presented before the reaction stimulus. Reactions become even faster when the time interval between the two is constant rather than variable. For schizophrenics the reverse was true. More recently, a number of studies, using a variety of RT procedures, have found that information that ordinarily results in improved performance, may not operate in this fashion for schizophrenics (Cromwell, Rosenthal, Shakow and Zahn, 1961; Fedio, Mirsky, Smith and Parry, 1961; Steffy and Galbraith, 1975; Steffy, 1978). Furthermore, Marcus (1970; reported in Nuechterlein, 1977) found that those children high at risk for schizophrenia showed relatively slow RTs, and that they remained impaired even with facilitating information.

Secondly, the reactions of schizophrenics are generally much slower than those of normals. This finding has been replicated by a number of researchers (Shakow, 1946, 1962, 1963; Rosenthal and Shakow, 1963; Shakow and McCormick, 1965; Tizard and Venables, 1956; Czudner and Marshall, 1967). It has been interpreted as a difficulty in preserving set (Rodnick and Shakow, 1940), overinclusive thinking (Payne, Mattussek and George, 1959), distractibility (McGhie, Chapman and Lawson, 1965), information overload (Hendrickson, 1972) and as a factor of drive (Rosenbaum, Cohen, Luby, Gottlieb and Yelen, 1959).

The present experiment tested the hypothesis that: (1) high P scorers have slower RTs than others (note that Hendrickson (1972) found the opposite); and (2) that high P scorers show less benefit than low P scorers due to the addition of a warning signal in an RT task.

METHOD

Subjects

Subjects were 103 males ranging in age from 18 to 31 yr ($\bar{X}$ = 21.0 yr, SD = 2.3 yr). Nearly all were students (dental or medical), with the remainder of the group composed mainly of research and hospital workers. The *S*s were paid for their participation.

Apparatus

Data were collected from each *S* on the PEN (Eysenck and Eysenck, 1968), which is a questionnaire that provides measures of P, extraversion (E) and neuroticism (N).

All *S*s were tested in a completely darkened room. They were seated 1.25 m from the visual stimulus which was set at eye level. Visual stimulation was produced by running a current through a 14 V, 0.75 W, Lilliput-Edison screw bulb. The light was diffused by a white plastic dome (1.25 cm dia) that was placed over the bulb. The light was set at an intensity level of 18 mL.

The auditory warning signal (30, 60 or 90 dB) was produced by an Advance Oscillator and delivered at 1000 Hz through a set of headphones. Auditory intensity was measured with a Dawe audiometer, and visual intensity with an SEI photometer.

Stimulus presentations were controlled by an on-line computer (LINC-8). The computer also recorded the time lapse between stimulus onset and the closure of the *S*'s response switch.

Procedure

Subjects were presented with three blocks of 100 trials each. One of the three warning signal (WS) intensities was used in each block. Ten different preparatory intervals (PIs) were used. PI here refers to the elapsed time between WS onset and the onset of the reaction stimulus (RS). PIs ranged from 50 to 950 msec, in steps of 100 msec. Within each block, 10 trials of each of the 10 PIs were presented. The order of PI presentation was determined with the use of 10 × 10 latin square. Inter-trial intervals were 5, 6, 7, 8 or 9 sec. These were applied randomly to the PIs with inter-trial intervals being equally represented across the 10 PIs. One PI and inter-trial interval ordering was used in all three blocks, and for every *S*.

A 10-trial block of unsignalled stimuli (i.e. without a WS) was given after the first 100-trial block, and another was presented after the second. In the unsignalled blocks, inter-trial intervals again ranged from 5 to 9 secs, and were arranged in one randomly selected order that was used throughout.

The three WS intensities were applied to the three 100-trial blocks such that the six possible orderings were distributed as evenly as possible over the 103 *S*s (i.e. five were presented 17 times, and one 18 times). The duration of the WS was 450 msec beyond the RS onset. The RS was terminated by the *S*'s response if it occurred within 450 msec of onset. If no response occurred within this time, the stimulus was automatically terminated and a missed response was recorded for that trial.

Each *S* began the experiment by completing the questionnaire. He was then seated in the experimental room and the task was explained to him. Five min of dark adaptation were allowed before the RT trials began. The experiment proper was preceded by four practice trials. Instructions regarding the commencement of a new block of trials were transmitted to the *S* by a loudspeaker system. The RT trials took about 40 min to complete.

RT scores used for analysis included those falling above 170 and below 450 msec. Those below were regarded as anticipations, and those above as missed responses. Mean RT scores were calculated for every *S* for each of the 10 PIs at each of the three WS intensities. This provides a total of 30 scores per *S* in the signalled trials condition, each based upon a maximum of 10 responses. Each of these scores was expressed as the percentage decrease in RT from the mean of the 20 unsignalled trials.

For the sake of factorial analysis, three levels of each of the personality measures (i.e. P, E and N) were used. Thus, individuals were grouped into low, medium and high scores on each.

A MANOVA was applied to the RT data using five independent variables. These were P, E, N (between-*S*s), WS intensity and PI length (within-*S*s).

RESULTS

In order to examine the possibility that the evaluation of the effects of P may have been influenced by response styles

Table 1. MANOVA of the effects of P, E, N, WS intensity and PI length on percentage of improvement from unsignalled to signalled RT

Between-Ss		
Source	*df*	*F*
P	2	4.05*
(P linear)	(1)	(7.70**)
E	2	0.76
N	2	0.75
P × E	4	2.08
P × E	4	1.37
E × N	4	0.60
P × E × N	8	1.20
Error	76	—

Within-S	
Source	Averaged *F*
WS	4.94**
P × WS	1.30
E × WS	0.22
N × WS	1.37
P × E × WS	0.35
P × N × WS	0.73
E × N × WS	0.61
P × E × N × WS	0.46
PI	198.49***
P × PI	1.15
E × PI	0.96
N × PI	0.78
P × E × PI	0.63
P × N × PI	0.65
E × N × PI	0.86
P × E × N × PI	0.73
WS × PI	4.33***
P × WS × PI	0.98
E × WS × PI	1.05
N × WS × PI	0.78
P × E × WS × PI	0.76
P × N × WS × PI	1.08
E × N × WS × PI	0.57
P × E × N × WS × PI	0.97

*$P < 0.05$; **$P < 0.01$; ***$P < 0.001$.

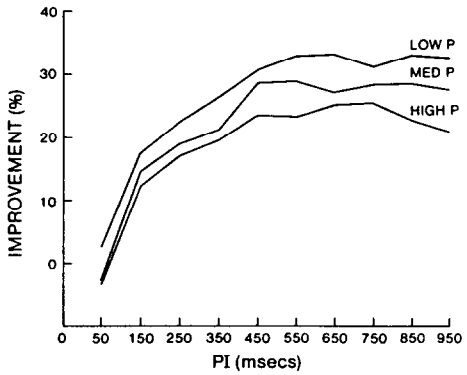

Fig. 1. The effect of P on the percentage of improvement from unsignalled to signalled RT.

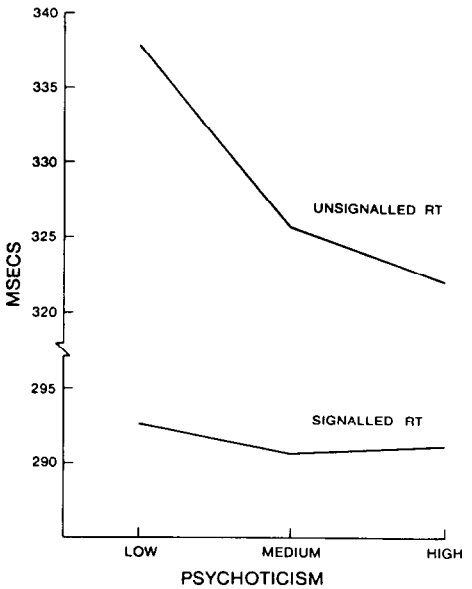

Fig. 2. The effects of P on unsignalled and signalled RT.

associated with the exclusion of high and low reactions from the analysis, the number of anticipations and the number of missed responses were correlated with P. The resulting correlation coefficients were 0.07 and 0.03, respectively, suggesting that these factors can be ignored when evaluating the effects of P on RT.

The MANOVA summary table of the effects of P, E, N, WS intensity and PI length is shown in Table 1. Of interest is the significant main effect attributable to P. This indicates that as the P score increases, the benefit due to the WS decreases. P showed no significant interactions with the other variables, indicating that this effect is independent of PI and WS influences. The significant WS and WS × PI effects are of little interest to the present paper, and will not be discussed further here. The significant PI value indicates that improvement was greater at the longer PIs. Figure 1 shows the effects of P and PI (collapsed across WS intensity). The means are shown in Table 2.

The improvement scores used in this analysis include, of course, two components; unsignalled and signalled RT. It is interesting to note that there was no P effect when only the signalled RT scores were considered ($F = 0.07$, NS). Unsignalled RT, on the other hand, was significantly related to P ($F_{LIN} = 4.72$, $P < 0.05$), with the higher P scorers showing faster RTs. The unsignalled RT means for the low to high P groups, respectively, were 337.9, 325.7 and 322.0 msec. These data are depicted in Fig. 2.

DISCUSSION

The result that, for unsignalled RT, higher P scorers are faster than lower scorers corroborates the work of Hendrickson (1972). This indicates an important difference between the dimension of psychoticism and psychotic disorder. There is as yet, no clear answer to this question regarding the slowness of psychotics (Eysenck and Eysenck, 1976; Nuechterlein, 1977), or the faster speed of those high on P. It follows that one might speculate that it is something associated with the psychotic breakdown that slows the performance of the psychotic patient. It remains a debatable point whether this might be due to the disease state, as such, or to the consequences of breakdown such as medication. In regard to the latter, Braff and Saccuzzo (1982) have provided some evidence that suggests that medication does not result in slower reaction speed in schizophrenic patients. It may be that the processes that predispose one to psychotic breakdown are made less significant or are altered by the onset of the illness.

When the improvement due to a WS is considered, the results of the present study are in line with the common finding that schizophrenics are not greatly assisted, and sometimes hampered, by additional information that ordinarily improves performance (Rodnick and Shakow, 1940; Steffy, 1978; Sutton and Zubin, 1965; Tizard and Venables, 1965).

Considering that the *S*s in the present study were 'normal', well-functioning individuals and considering the similarities between psychotics and those high on P, further investigation of the opposing tendencies on unsignalled RT may well be quite illuminating. Furthermore, studies on schizophrenia using normal controls may benefit by the use of two 'normal' groups; one high and one low on P.

Table 2. Mean percentage improvement from unsignalled to signalled trials for each P and PI level

		PI (msec)									
	n	50	150	250	350	450	550	650	750	850	950
Low P	36	2.4	17.7	22.7	26.1	30.7	32.7	33.2	31.8	33.1	32.4
Medium P	35	−2.9	14.8	19.0	21.6	28.6	28.7	27.1	28.2	28.4	27.8
High P	32	−3.4	12.1	17.2	19.5	23.5	23.5	25.2	25.5	22.9	20.9
Total	103	−1.2	15.0	19.7	22.6	27.8	28.5	28.6	28.7	28.4	27.3

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