THE RELATIONSHIP BETWEEN PSYCHOTICISM, TRAIT-CREATIVITY AND THE ATTENTIONAL MECHANISM OF COGNITIVE INHIBITION

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Summary—The present study was designed in order to test the hypothesis that there is a link among psychoticism, cognitive traits associated with creativity (i.e. Divergent Thinking), and the attentional mechanism of cognitive inhibition. A sample of 37 subjects was tested using the Eysenck Personality Questionnaire, the Wallach–Kogan Divergent Thinking (DT) tests and a 'negative priming' experimental task as a measure of cognitive inhibition. It was hypothesized that subjects who score highly on the psychoticism scale of the Eysenck would perform better on the creativity tasks compared with low-P scorers. In addition, it was hypothesized that high-P scorers and also high DT scorers would both show a reduced negative priming effect, i.e. reduced ability to inhibit stimulation from the environment. The correlations of P-scores with the creativity scores were positive and most of them significant, indicating that subjects who score highly on psychoticism also produce a larger number of responses and give more unique answers on the DT items. In addition, high-P scorers showed a reduced negative priming effect compared with low-P scorers, and this difference was statistically significant. Finally, subjects who scored highly on the DT test showed a smaller negative priming effect compared with low-creativity scorers, but this effect did not reach statistical significance. Copyright © 1996 Elsevier Science Ltd.

INTRODUCTION

There is a great deal of disagreement and confusion in the literature surrounding the term 'creativity'. As Hudson (1970) pointed out, creativity has come to refer to everything from performance on a psychological test, to one's relationship with one's spouse! Several authors who have tried to categorize the definitions cited in the literature (Torrance, 1988; Taylor, 1988) have come to the conclusion that 'creativity is almost infinite' (Torrance, 1988). Four major approaches to the study of creativity can be clearly identified: (1) The creative process approach, which focuses on the cognitive factors underlying creativity; (2) the creative person approach, which is interested in the personality correlates of creativity; (3) the creative product approach, which emphasizes the importance of the creative products as a defining criterion in the study of creativity; and finally, (4) the creative situation approach, which focuses on the environmental, social and situational factors that might influence creative production (Brown, 1989; Rhodes, 1987). The fact that creativity has been operationalized in so many ways is also mirrored in the diversity of the developed creativity measurements (Hocevar & Bachler, 1989).

Owing to the different ways researchers have operationalized creativity, a major methodological problem has emerged; the 'process vs product criterion issue' (Brown, 1989). A disagreement has been developed around the question of whether creativity should be viewed as a cognitive ability normally distributed in the general population, i.e. as a trait, or whether it should be defined in terms of exceptional real-world creative production, which very few individuals manage to achieve.

The advocates of the trait approach have attempted to discover the essence of the creative process and develop appropriate instruments for measuring it. Several concepts have been introduced as being 'at the heart' of the creative process. Since the early twentieth century, creativity has been viewed as (a) an aspect of intelligence; (b) a largely unconscious process; (c) one of the stages of problem solving; and (d) an associative process (Guilford, 1956; Torrance, 1974; Wallach and Kogan, 1965). 'Divergent thinking' (DT), a construct originally presented by Guilford (1956), was considered by the trait approach such as the basic thinking style that characterizes creativity, consisting of abilities such as 'fluency', 'originality', 'flexibility' and 'elaboration'. Several DT tests...
have been constructed and used as measures of trait-creativity. However, at best, DT tests could be considered estimates of the potential for creative thought.

Authors supporting real-world achievement as the criterion for creativity, believe that creativity has no meaning except in relation to the creative product (Runco, 1992; 1994). They criticize the trait approach on both methodological and theoretical grounds. Commenting on the value of DT tests, Brown (1989) argues that: (a) the tests are so closely related to particular theoretical viewpoints that criterion and construct validity are interwoven; (b) any process that increases productivity in general, will increase the scores on DT tests; (c) extraneous factors may determine performance on DT tests, and (d) there is little evidence of criterion validity.

Measures of real-world creativity may be of four kinds: (a) eminence based on overt production criteria, such as patent awards and number of publications; (b) eminence based on professional recognition criteria; (c) judgments of products; and (d) social recognition criteria, such as judgments by peers and supervisors (Hoeveau & Bachelor, 1989; Eysenck, 1992, 1995, Fox, 1963).

Eysenck (1992; 1995) pointed out that the criterion–conflict (trait vs achievement creativity) is partly reinforced by the fact that there is a discrepancy between the shape of the distribution of creativity when measured by tests of divergent thinking, compared with when measured as unique real-life achievement. Creativity as a trait measured by DT tests, shows a normal, Gaussian type of distribution. This of course is not surprising, as the construction of DT tests was based on Guilford's (1950) theoretical approach, an integral part of which was the idea that creative abilities are continuously distributed in the general population. Creativity as achievement, however, shows a skewed (J-shaped) type of distribution which follows the Price (1963) Law. The latter states that if \( A \) represents the total number of contributors to a given field, the \( \sqrt{A} \) will be the predicted number of contributors who will generate half of all the contributions. This means that most of the creative achievements in a field are made by just a few individuals. Eysenck (1992) pointed to the similarity of this distribution discrepancy to the one between intelligence and income. Just as intelligence is a necessary but not sufficient causal condition for high income, in the same way trait-creativity (fluency, originality, etc.) is a necessary but not sufficient condition for achievement creativity.

Eysenck (1992; 1995) further suggested a model in which, apart from trait-creativity, many other factors (cognitive, environmental and personality) are acting synergistically, in a multiplicative way, to give rise to real-life creative achievement. This model is able to explain why DT tests do not correlate highly with achievement criteria. A similar model that also synthesizes a variety of previous research in the field, was presented by Amabile (1983). She argued that creativity can best be conceptualized as a behaviour resulting from particular constellations of personal characteristics, cognitive abilities and social environments. Within models such as the aforementioned, trait-creativity can be seen as one of the important cognitive aspects of creative performance and as such, it is an interesting and promising construct on its own that deserves attention and study.

For over 30 years studies have examined the relationship between creativity and psychopathology (Cattel & Drevdahl, 1995, MacKinnon, 1962, Gough & Heilbrun, 1965, Della & Gaier, 1970, Barron, 1972; Andreasen & Canter, 1974; Goertzel, Goertzel & Goertzel, 1978; Jamison, 1988; Prentky, 1989). Most of these studies concluded that there are clear signs of psychopathology (especially psychoses) among famous creators and they pointed to a link between creativity and psychopathology, a link sometimes considered so powerful that it can almost predict abnormal personality for all creative geniuses (assuming one direction of effect). Richards (1981) has done an excellent review on the link between creativity and psychopathology. Eysenck (1992; 1993; 1995) pointed out that much of the debate about creative geniuses being or not being psychotic, could easily be aborted by disregarding the false assumption that psychiatric abnormality is categorical rather than dimensional. According to Eysenck and Eysenck (1976), psychopathology can be conceptualized as an exaggeration/extension of underlying personality traits. Accordingly, psychosis lies at the extreme end of the distribution of 'psychoticism', a hypothetical dispositional personality trait which is conceived as a continuum 'ranging from normal to psychotic'.

Summarizing, Eysenck's (1992; 1995) position is as follows: Provided that: (a) there is a link between psychosis and creativity, and (b) psychoticism taps a unitary dimension underlying susceptibility to psychotic illness, then it is hypothesized that the important personality factor which acts synergistically with trait-creativity (originality) and may, under favourable environmental conditions, lead to real-life creative achievement, is psychoticism. In fact, there are numerous studies
that have found a correlation between psychoticism and trait-creativity (Farmer, 1974; Woody & Claridge, 1977; Getzels & Jackson, 1962; Kidner, 1976; Rawlings, 1985), and between psychoticism and achievement-creativity (Gotz & Gotz, 1979a, 1979b; Mohan & Tiwana, 1987; Rushton, 1990).

Which is then the common factor (or factors) that underlie this relationship between psychoticism and the creative process? It could be argued that common information processing patterns can be found in both creative people and psychotics. Close examination of the theories developed in order to explain the cognitive deficit in psychotics (Cameron, 1938; McConaghy, 1961; Frith, 1979; Hemsley, 1991) and those referring to the cognitive aspects of creativity (Spearman, 1931; Mednick, 1962; Wallach & Kogan, 1965; Rothenberg, 1976; Martindale, 1981; Martindale & Hines, 1975; Toplyn & Maguire, 1991; Smith & Carlsson, 1989; Richards, 1990; Wehner & Magyari-Beck, 1991), reveals many similarities.

Most of the theories on the cognitive deficit in schizophrenia seem to propose that there is a deficit in selective attention mechanisms that makes schizophrenics unable to inhibit irrelevant information from entering consciousness (Frith, 1979; Hemsley, 1991). Consequently, many unrelated ideas become interconnected, resulting in a ‘widening of the associative horizons’ (Eysenck, 1993) of schizophrenics. Evidence that schizophrenics as well as normals who obtain high scores on psychoticism scales are characterized by ‘wide associative horizons’, i.e. they produce more unusual associations between words and ideas compared with normals and low-psychoticism scorers, comes from a significant number of studies (Kent & Rosanof, 1910; Johnson, Weiss & Zelhart, 1964; McConaghy & Clancy, 1968; Andreasen & Powers, 1974; Miller & Chapman, 1983; Upmanyu & Kaur, 1986).

Many studies have directly examined the hypothesis that a mechanism of reduced cognitive inhibition occurring during selective attention is responsible for ‘widening’ of associative connections. Most of these studies have used a ‘negative priming’ (Tipper, 1985) paradigm to measure inhibition. Negative priming refers to the delay in responding to a current target object when this object has been a distractor to be inhibited on a previous display. In other words, if an ignored object on a prime display is the same as the object to be named on a subsequent probe display, naming latencies are impaired.

Bullen and Hemsley (1984), using a word negative priming task and the EPQ as a measure of psychotic tendencies, found a significant negative correlation between psychoticism and the size of the inhibitory negative priming effect. High-P scorers showed reduced cognitive inhibition compared with low-P scorers. No other correlation between the negative priming task and the rest of the personality scales of the EPQ was obtained.

Beech, Baylis, Smithson and Claridge (1989), studied the effect of chlorpromazine (a drug routinely administered to reduce schizophrenic symptomatology) on negative priming. They found that, although negative priming was observed in both the drug and the placebo conditions, the effect was stronger in the drug condition. A drug that reduces the symptoms of schizophrenia was found to increase cognitive inhibition. Finally, a number of other studies also demonstrated similar effects (Oltmanns, 1978; Beech & Claridge, 1987; Beech, McManus, Baylis & Tipper, 1991; Jones, Gray & Hemsley, 1992).

Turning now to theories developed to explain the creative process, many similarities with the theoretical views about schizophrenia can be found. A number of authors have conceptualized the creative process as being an associative one (Spearman, 1931; Mednick, 1962; Wallach & Kogan, 1965). Mednick (1962) proposed that persons of low creativity have a small number of strong, stereotyped associative responses to a given stimulus, compared with the highly creative individuals. Wallach (1970) suggested that what is important in creativity is the generating of associates and that attention deployment is the process underlying this generation. Creative individuals are able to attend to many aspects of a given stimulus and thus produce more and more varied associations. The similarity of the theories mentioned above, to the notion of ‘wide associative horizons’ that characterize schizophrenics is more than clear. Martindale (1981) hypothesized that creative people have a high resting level of activation and that they are oversensitive to stimuli. However, they also have a low level of inhibition so that the more they are stimulated the more their level of arousal drops, favouring creative performance. Again, the notions of reduced inhibition and mood fluctuation (arousal levels rising and dropping) are common notions in the schizophrenia literature.

A number of studies have found results supporting the above theories. MacKinnon (1962), in his
study of architects, found that rated creativity correlated 0.50 with a measure of unusualness of mental associations on a word association test. Similarly, Gough (1976) reported that the scores on two word association tests, a general one and a scientific word list, correlated with rated creativity on a sample of engineering students and industrial reward scientists (cited in Eysenck, 1993). Andreasen and Powers (1975) administered the Goldstein–Sheerer Object Sorting Test to a group of highly creative writers and found them to be ‘overinclusive’.

Finally, there is a small number of studies that contrasted the attentional and information processing strategies of both schizophrenics (and high-P scorers) and creative individuals. Rawlings (1985) used the EPQ, two subscales of the Wallach–Kogan (1965) creativity test and a dichotic shadowing task (as a measure of cognitive inhibition) with a group of 30 undergraduate students. The dichotic shadowing task consisted of two conditions: the ‘Focused Attention’, in which subjects were instructed to shadow the information given to one ear and focus on the other, and the ‘Divided Attention’, in which they were asked to shadow with one ear but also try to remember as many words as possible from the secondary channel. Inhibition was measured in terms of number of errors (omissions and intrusions). The author found that performance on the shadowing task was positively correlated with creativity scores and with psychoticism scores in the Divided Attention condition. The pattern of results was, however, reversed on the Focused Attention condition and moreover, the correlation between psychoticism and creativity was not significant.

Dykes and McGie (1976) administered two object-sorting tasks and a dichotic shadowing task to a group of schizophrenics and a group of highly creative students (as rated by Cropley’s paper and pencil test). They found that both the schizophrenics and the highly creative groups produced more unusual sortings compared with the conventional sortings of the low-creativity group.

So far, studies have separately examined the relationships between cognitive inhibition and psychoticism, cognitive inhibition and creativity, and between trait or achievement creativity and psychoticism. The few studies that examined the link between all the above three concepts at the same time (Rawlings, 1985; Dykes & McGie, 1976) often presented contradictory results (see end of previous section).

In the following study, two hypotheses were tested. (1) P-scores would be positively correlated with creativity scores. (2) Both psychoticism and creativity scores should be negatively correlated with cognitive inhibition. High-P scorers and high-creativity scorers would show a reduced negative priming effect (indicating reduced cognitive inhibition), compared to low-P and low-creativity scorers respectively.

**METHOD**

**Subjects**

Thirty seven subjects (Ss), 21 females and 16 males, aged between 19 and 42 yr (with a mean age of 26.7 yr, SD = 5.14 yr), participated in the study. All Ss were undergraduate and postgraduate students from several faculties of University College London who replied to an advertisement asking for paid volunteers. They all had normal or corrected to normal vision, as well as normal colour vision. Ss were paid £5 for their participation in the study.

**Tests and questionnaires**

1. The Eysenck Personality Questionnaire (EPQ version 1975) was administered as a measure of psychoticism. The EPQ consists of 90 forced-choice (‘Yes’/‘No’) items, loading on four factors (dimensions): Extraversion–Introversion (E, 21 items), Neuroticism (N, 23 items), Psychoticism (P, 25 items), and a Lie scale (L, 21 items). Data concerning the validation of the EPQ can be found in Eysenck and Eysenck (1975).

2. The Wallach–Kogan (1965) creativity test was administered as a measure of creativity. It consists of five subtests: (a) Instances, which includes questions such as ‘Name all the round things you can think of’; (b) Alternate Uses, which asks for alternate uses of objects; (c) Similarities, which asks for similarities between objects; (d) Pattern Meanings and (e) Line Meanings, both of which present abstract lines and shapes and require the subject to apply a meaning to them. Each S is evaluated in terms of two related variables: (a) the total number of responses produced by the S
which, for the purpose of the present study will be referred to as 'fluency scores'; and (b) the number of unique responses produced by the S (relative to all the responses of the sample), which will be referred to as 'uniqueness score'. Previous studies have demonstrated that the Wallach–Kogan DT tests show internal consistency, independence of IQ scores and reasonable validity among university students (Wallach & Kogan, 1965; Dykes & McGie, 1976; Woody & Claridge 1997). In this study, two judges independently rated five randomly selected questionnaires (13.8%) and correlations between their judgements were 0.99 (P < 0.001) for fluency and 0.97 (P < 0.001) for uniqueness scores.

Materials and apparatus

The stimuli used in the negative priming task were as follows: four white crosses (+ + + +), five colour-words printed in white letters (the words RED, BLUE, GREEN, YELLOW and PINK), and five Stroop (1935) words printed in five different colours (red, blue, green, yellow and pink). The words were written in uppercase letters, each extending to an area of 1 cm in height and 0.5 cm in width. The crosses occupied the same total area as the letters.

The stimuli were presented on a 386 IBM compatible computer. The program that controlled the experimental trials was written in Q-Basic language. A button controlling the reaction times' clock, was connected to the computer.

Design

A within-subjects design was used. There were three conditions (three types of trials): the Neutral, the Matching and the Random. In the Neutral trials, the subjects were first presented with four white crosses, immediately followed by a Stroop-word (in such words a colour-name is presented, printed in a different colour from the one the word refers to). In the Matching trials, subjects were first presented with a colour-word printed in white letters, immediately followed by a Stroop-word the colour of which always matched the colour-name in the white colour-word. In the Random trials, the white colour-word was followed by a Stroop-word, the colour of which was always different from the colour-name of the white colour-word. The amount of priming is the difference in RTs between the Random and the Matching conditions. A positive value indicates negative priming, whereas a negative value indicates facilitation. The Neutral condition was included in the study to make the procedure comparable with previous studies using the negative priming paradigm, but the data for this condition, while presented here for completeness, are not further analysed as they are related to a different effect—namely the Stroop interference effect. The order of presentation of the three trial-types was randomized with the restriction that no more than three trials of the same type could be presented in a row. Each S saw a different random order.

Procedure

Each session lasted approximately 1 hr and 30 min. At arrival, half the Ss, randomly selected, began with filling in the questionnaires and then they proceeded to a laboratory cubical for the computerized negative priming task. This procedure was reversed for the other half Ss. The purpose of this was to control for possible fatigue that could affect Ss' performance towards the end of the session.

Specific instructions were given for the completion of each test. Ss were instructed to answer the EPQ items spontaneously, without spending too much time over each question. In contrast, the Wallach–Kogan test was administered under the relaxed, untimed conditions required for good performance (Wallach & Kogan, 1965), and the Ss were encouraged to spend as much time as they wanted on each question.

The computerized task was as follows: Ss entered a dimly illuminated laboratory cubical and sat in front of the computer, facing the screen from approximately 40 cm distance. They were then given the instruction sheet that informed them about the nature of the task. At the beginning of the session, the Ss had the chance to look at the colours used in the experiment and they were also given five (or, if necessary, more) practice trials. After making sure that the Ss had understood the task, the main session began. First, a 'prime' stimulus was presented in the middle of the screen, which consisted of either the four white crosses, or a white colour-name word. Ss were instructed to completely ignore this prime stimulus that remained on the screen for 3000 msec. After a 1000 msec interval, a 'target' stimulus appeared, which consisted of a Stroop-word the colour of which
Table 1. Pearson correlation coefficients between P and the creativity scores

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>AU</th>
<th>S</th>
<th>PM</th>
<th>LM</th>
<th>T.Ve.</th>
<th>T.Vi.</th>
<th>Total</th>
</tr>
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<tbody>
<tr>
<td>Fluency</td>
<td>-0.02</td>
<td>0.27</td>
<td>0.15</td>
<td>0.25</td>
<td>0.14</td>
<td>0.12</td>
<td>0.19</td>
<td>0.17</td>
</tr>
<tr>
<td></td>
<td>(-0.22)</td>
<td>(0.21)</td>
<td>(-0.00)</td>
<td>(0.23)</td>
<td>(0.06)</td>
<td>(-0.07)</td>
<td>(0.12)</td>
<td>(0.01)</td>
</tr>
<tr>
<td>Uniqueness</td>
<td>0.49**</td>
<td>0.49**</td>
<td>0.51**</td>
<td>0.44**</td>
<td>0.33</td>
<td>0.54**</td>
<td>0.40*</td>
<td>0.51***</td>
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<tr>
<td></td>
<td>(0.33)</td>
<td>(0.50**)</td>
<td>(0.41*)</td>
<td>(0.15)</td>
<td>(0.21)</td>
<td>(0.43**)</td>
<td>(0.19)</td>
<td>(0.34**)</td>
</tr>
</tbody>
</table>

** P < 0.01; *** P < 0.001; ( ) partial correlations, partialling our age, sex, E, N and L; I, Instances; AU, Alternative Uses; S, Similarities; PM, Pattern Meanings; LM, Line Meanings; TVe, Total verbal score; TVi, Total visual score.

either matched or was different from the white colour-name word presented in the prime stimulus. The Ss' task was to name, as quickly as possible, the colour in which the Stroop-word was printed. They were to answer verbally by stating the colour and, at the same time manually, by pressing the reaction-time key. When subjects answered, the experimenter who was sitting behind them and was also facing the screen, coded the answers as 'correct' or 'wrong' on an answering sheet. As soon as the RT button was pressed, a new trial began. There were 60 trials (20 in each condition) and the procedure was completed in approximately 5 min time.

Results

One subject was dropped from the analysis, because his illegible handwriting made it impossible to compute his creativity scores. The following analyses refer to 36 subjects.

Correlations between the experimental variables. Table 1 presents the correlations between Psychoticism, the 10 creativity scores and six total scores: two (fluency and uniqueness) computed for the verbal tasks (Instances, Alternate Uses and Similarities), two for the visual tasks (Pattern and Line Meanings), and two for all the tasks together. As can be seen from the table, in line with the first hypothesis, P-scores were positively correlated with the creativity scores (except in the case of Instances-fluency score where the correlation was negative but not significant). The correlations of P with the fluency scores ranged from 0.12 to 0.27 but only two of these correlations (with the Alternate Uses and Pattern Meanings tasks) were marginally significant (at $P < 0.10$). Moreover, when partial correlations controlling for age, sex and the other three personality factors of the EPQ were computed, the correlations between P and the fluency scores were significantly reduced. The correlations between P and the uniqueness scores were higher (ranging from 0.33 to 0.54) and were all significant (at least at 0.05 level). These correlations remained significant even after sex, age and the other personality factors (E, N, L) were controlled for, except in the case of the visual tasks and the total visual creativity score. Possible explanations for the above effects are given in the discussion.

Most of the correlations of the creativity scores with E, N, and L were not significant. More specifically, all the correlations between the Lie scale and the creativity scores were not significant. In fact, only two of the 32 correlations between E, N and the creativity measures were significant. Correlations of E with the Pattern Meanings scores. E correlated 0.26 (marginally significant) with the fluency and 0.36 ($P < 0.01$) with the uniqueness scores. Similarly, the creativity scores appeared to be independent of Neuroticism with the exception of Pattern Meanings fluency score, which was negatively ($-0.36, P < 0.01$) correlated with N. Possible accounts for the above effects will be given in the discussion.

Finally, it should be mentioned that the intercorrelations among the creativity tasks were all positive (ranging from 0.28 to 0.85) and highly significant, indicating that the tasks were tapping a unitary factor. None of the correlations of sex and age with the creativity tasks or the P-scores were significant.

Psychoticism and negative priming. The sample was divided into two extreme groups on the basis of psychoticism scores, which are highly skewed in a normal population. The high-P group (12 subjects) had a mean score of 8.16 (SD = 1.64). The low-P group (12 subjects) had a mean score of 1.08 (SD = 0.80). The negative priming effect is the difference in reaction times between the Matching and the Random conditions. The raw data for the three conditions are presented in Table 2. As noted in the design section, the analysis reported here concerns the negative priming data only. The number of errors for all subjects were small (2.9% for high-P scorers and 2.5% for low-P scorers) and there were no differences between conditions within each group. Therefore, the error data were not further analysed.
The RT data for the 'negative priming' conditions were analysed using a two-way mixed design ANOVA consisting of group (high-P versus low-P scorers) × condition (Matching vs Random trials), with repeated measures on the condition factor. Only the RTs for correct responses were used in the analysis. There was an overall significant negative priming effect \( F(1,22) = 8.24, P < 0.009 \). No significant differences were found between the groups \( F(1,22) = 1.35, \text{ n.s.} \). However, the interaction term was highly significant \( F(1,22) = 8.07, P < 0.009 \), indicating a differentially negative priming effect across the two groups. As can be seen from Table 2, low-P scorers were significantly faster in the Random compared with the Matching condition, showing evidence of a negative priming effect. In contrast, for high-P scorers the effect was significantly smaller, indicating reduced cognitive inhibition in that group.

\textit{Trait-creativity and negative priming.} The total sample was also divided on the basis of the total fluency and uniqueness scores obtained in the creativity tests, in order to look at the relationship between creativity and negative priming. On the basis of fluency scores, two groups were compared: The high-fluency group (12 subjects) with a mean score of 295.5 (SD = 76.68), and the low-fluency group (12 subjects), with a mean of 159.75 (SD = 29.84). The raw RT data for the three conditions of the experiment in the high-fluency and low-fluency groups are presented in Table 3.

The number of errors for the two groups was again small (4.16% and 3.3% for high and low fluency scorers respectively) and within the groups the same number of errors was found in both conditions. The RT data for the correct responses were analysed using a two-way mixed design ANOVA consisting of group (high-fluency vs low-fluency scorers) × condition (Matching vs Random trials), with repeated measures on the condition factor. A significant overall negative priming effect was obtained \( F(1,22) = 11.47, P < 0.003 \). However, the effects of group, and the group by condition interaction term were not significant \( F(1,22) = 0.00, \text{ n.s.}, \) and \( F(1,22) = 0.63, \text{ n.s.} \) respectively. As can be seen from Table 3, the negative priming effect for the low-fluency group was slightly bigger than the one for the high-fluency group, but this difference, although in the right direction, was not significant.

A similar analysis was performed on the RT data of two extreme groups divided on the basis of the total uniqueness scores. The high-uniqueness group (12 subjects) had a mean score of 74.33 (SD = 30.04) and the low-uniqueness group (11 subjects) had a mean of 18.54 (SD = 5.78). Table 4 presents the raw data for the three experimental conditions in the high and low uniqueness groups. A two-way mixed design ANOVA consisting of group (high vs low uniqueness scorers) × condition (Matching vs Random trials), with repeated measures on the condition factor was conducted. Once again, the errors were few (4.02% and 3.33% for the high and low uniqueness scorers respectively).
and there were no differences in errors between condition within each group. Only the RT data for correct responses were included in the analysis.

The main effect of group, as well as the interaction of group by condition were not significant \( [F(1,21) = 0.01 \text{ n.s.}, \text{ and } F(1,21) = 0.31, \text{ n.s. respectively}] \). The overall negative priming effect was only marginally significant \( [F(1,21) = 3.61, P < 0.071] \).

**DISCUSSION**

The results reported here generally support the idea that there is a link between the personality trait of psychoticism and cognitive traits generally thought to be involved in the creative process, such as fluency in the production of ideas and ability to produce a large number of unique, unusual responses.

The correlation coefficients between P and both the fluency and uniqueness scores of the creativity tasks were all positive and in the case of uniqueness scores highly significant. The finding that P is more related to uniqueness scores than to fluency scores is in accordance with previous findings (Woody & Claridge, 1977). It might be suggested that 'uniqueness of responses', being a qualitative rather than a quantitative measure of creative performance, is more 'central' to creativity than fluency is. Many authors have proposed that fluency may be more related (compared with uniqueness) to traditional measures of intelligence (Haensly & Reynolds, 1989). An excellent recent review may be found in Runco (1992).

In the present study, no overt measurement of intelligence was obtained because it would further increase the length of the already long experimental session. An attempt to control for intelligence was made by using a homogeneous students' sample that hopefully had a high level of IQ, above which intelligence and creativity are thought to be independent (Guilford, 1981). However, IQ may have influenced the present correlations and especially the ones with the fluency scores.

In addition, fluency scores were found to be related to other personality factors of the EPQ and this would explain why the correlations of P with the fluency scores dropped significantly when the effects of the other personality factors were controlled for. More specifically, the fluency scores on the two visual creativity tasks (Pattern Meanings and Line Meanings) correlated 0.26 \( (P < 0.10) \) and 0.13 respectively with Extraversion and \(-0.36 (P < 0.01)\) and \(-0.18\) respectively with Neuroticism. However, the above effects could be attributed to the nature of the particular two tasks, as significant correlations between the visual tasks and the various personality factors were found also for the uniqueness creativity scores and were not confined to the fluency scores. More specifically, the uniqueness scores on the Pattern Meanings and Line Meanings tasks correlated \(0.36 (P < 0.01)\) and \(0.10\) respectively with extraversion. This would explain why, when partial correlations were calculated controlling for the other personality factors of the EPQ, the only correlations of P with the uniqueness scores that fell out of significance were the ones with the two visual tasks.

Whether there is something specific to performance on the visual tasks or whether the above correlations with the various EPQ factors were simply an effect of the order of presentation of these two tasks, is difficult to say. The visual tasks were presented last on the test and the significant negative correlations with the Neuroticism scores may simply indicate fatigue or stress on the part of high-N scorers. In the case of high-E scorers, the positive correlations may reflect a renewal of interest on the test as at the end of the testing session the subjects were faced with a new kind of material (figural instead of verbal).

The present results strongly supported the hypothesis that high-P scorers show reduced cognitive inhibition. A significant overall negative priming effect was obtained, which was caused by the large negative priming effect for the low-P group, compared to the nearly flat difference in RT between the Matching and the Random conditions for the high-P group. This effect is in line with previous findings showing reduced, absent or even reversed negative priming effect (facilitation) in high psychoticism scorers (Beech et al., 1989; Beech & Claridge, 1987).

The present finding is of particular importance, because the negative priming paradigm used in this experiment was somewhat different, and in many ways more strict compared with previously used ones. The following differences should be highlighted.

First, in all previous negative priming tasks, the 'prime stimulus' (the first one that is presented
to the subject in each trial), always consisted of pairs of objects, one of which was to be attended to and the other was to be ignored. This is done in order to make sure that there is something to which attention is directed and something that is suppressed or inhibited (Neill, 1977; Tipper, 1985; Tipper, MacQueen & Brehaut, 1988; Neumann & Deschepper, 1992). In the present task, the prime stimulus contained only one object (the crosses or the white colour-words) and inhibition was effectively obtained by just instructing the subjects to ignore the primes. It appears that one of the conditions considered by Allport, Tipper and Chmiel (1985) as critical for producing the negative priming effect — namely, simultaneous selection of an attended stimulus against an ignored one, may not be absolutely necessary. It appears that inhibition in selective attention is a very active and conscious process if instructions are a sufficient condition for obtaining inhibitory effects. Second, the prime-stimulus presentation time was 3000 msec, much longer than the 250 msec above which the relationship between psychoticism and negative priming has been shown to diminish (Beech et al., 1989, exp. 3). Finally, the interval between the ‘prime stimulus’ and the ‘target stimulus’ presentation was also very long (1000 msec). As Neill and Valdes (1992, exp. 1, 2) have shown, the negative priming effect decreases pronouncedly between 500 and 1000 msec.

The same experimental design may have prevented the obtainment of a negative priming effect when the sample was divided in terms of the creativity scores. In the cases of both fluency and uniqueness sample divisions, the interaction between group and condition, although in the right direction, did not reach significance. An overall negative priming effect was obtained for the fluency groups, but in the case of the uniqueness groups the effect was only marginally significant. Therefore, the link between creativity and cognitive inhibition does not appear to be very strong in the present study.

In conclusion, the present results generally supported the existence of the hypothesized link between psychoticism, creativity and cognitive inhibition and they are in line with Eysenck’s (1993, 1995) model. Future research should examine the generality of the above effects using several tests and experimental paradigms and also different samples (psychotics and eminent creators).

REFERENCES


Psychoticism, trait-creativity and attentional mechanism of cognitive inhibition


