



# Psychopathology, creativity, and aggression: The power of an Eysenckian-informed discriminant analysis

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*We investigated the predictive power of Psychoticism in distinguishing among five groups of individuals whose behavior should be reflective of Psychoticism: those presenting with psychopathology, creativity, or aggression. These five groups comprised: a group of 27 individuals suffering from mental disorders without a history of aggression, compared to a group of 23 individuals suffering from mental disorders with a history of aggression; our third group comprised 27 individuals who scored in the highest 10% on an Aggression Questionnaire; our fourth group comprised 26 creative individuals who studied in recognized institutions of fine arts and music or worked in creative fields; a control group of 27 participants having no psychiatric past, no indication of aggression, and who did not work in creative fields, comprised our fifth group. A discriminant analysis supported a model employing five predictors (Psychoticism, Neuroticism, Lie Scale, Schizotypy, and Absorption) and two interactions (Neuroticism × Psychoticism, and Neuroticism × Absorption). The individual group hit rates ranged between 35% and 65%. All groups had a higher level of Psychoticism (P) compared to the control group, which supports the Eysenckian view of a P-psychosis relationship, a P-psychopathy relationship, and a P-creativity relationship.*

**Keywords:** psychoticism, psychosis, psychopathy, creativity, neuroticism

While celebrating fifty years of the Eysenckian Big Three (Knežević et al., 2019; Ruch et al., 2021; Zuckerman & Glicksohn, 2016) –namely Extraversion (E), Neuroticism (N), and Psychoticism (P)– it is, nevertheless, clear that these personality trait-dimensions are not of equal status. Both E and N appear prominently in the various models of personality that are promoted in the literature –be this the Big Five (McCrae & Costa, 1997; N incorporating impulsivity), HEXACO (Lee & Ashton, 2004; N being replaced by Emotionality), the ‘alternative’ Big Five of the ZKA-PQ (Glicksohn et al., 2018), or the 5DPT (van Kampen, 2012). P, in contrast, has been replaced by either two traits (Agreeableness [A] and Conscientiousness [C], in both the Big Five and in HEXACO; Aggressiveness and Sensation Seeking, in the ZKA-PQ) or by three traits (Insensitivity, Orderliness, and Absorption, in the 5DPT). Essentially, P has been sacrificed to enable progress to a personality space of higher dimensionality.

But, why P, as opposed to N and/or E? A ready justification for dispensing with P is found in its three problematic characteristics. First, P is positively skewed (Glicksohn & Abulafia, 1998), as to be expected for a normative population—but this is an undesirable quality of a normative personality trait. Second, P has low reliability

(Almiro et al., 2016), implicating low ability to interpret data stemming from P. Third, P combines psychosis and psychopathy, and this amalgamation has been vociferously rejected (Claridge, 1993; Zuckerman, 1989). Hence, to bury P would be an easy option. We, however, prefer the challenge of investigating the predictive power of P in distinguishing among groups of individuals whose behavior should be reflective of P.

Three areas to which P predisposes were examined in this study: psychopathology, creativity, and aggression (Eysenck, 1995). P is a subclinical trait predisposing for psychotic disorders (Eysenck, 1995) – hence, P-psychosis. P also relates to divergent thinking (Eysenck, 1995) – hence, P-creativity. Moreover, the tendency to delinquency, impulsivity, and aggression (Eysenck, 1995) implicates P-psychopathy.

While P-psychosis and P-psychopathy are conflated in the Eysenckian P, this has not prevented productive research using P. Where, theoretically, can one embed P in the Big Five (N, E, A, C, and Openness to Experience [O])? Eysenck and Eysenck (1985, pp. 138-139) write that O “represents possibly the opposite end of a continuum” to P, while “McCrae and Costa ... would seem to deny the likelihood” that O and P are “opposite ends of the same dimension.” McCrae and Costa (1985, p. 590) make a number of suggestions here, first remarking that P should correspond to some combination of O, A, and C, but then stating that O “has no strong correlates among the Eysenck scales” (p. 595). Heaven et al. (2013, p. 481), in contrast, concluded that “P is not merely the opposite of A and C.”

For Knežević et al. (2016), the key trait here is Disintegration/positive schizotypy, and not P, which might well be diametrically opposite to O. This is exactly what DeYoung et al. (2012, p. 65) propose, but with a major caveat: While positive schizotypy should be positively correlated with O, negative schizotypy should be negatively correlated with O (Kemp et al., 2021; Knežević et al., 2016). To further complicate matters, in the O-LIFE (Oxford-Liverpool Inventory of Feelings and Experiences) multidimensional measure of schizotypy, not only are positive and negative schizotypy distinguished, there is also a dimension, largely based on Eysenckian P (Batey & Furnham, 2008), termed Impulsive Nonconformity.

A major problem here is that Disintegration has a zero correlation with O (Knežević et al., 2016, p. 219), plausibly determined by the opposing correlations with O of positive and negative schizotypy, but also because it is Absorption (Tellegen & Atkinson, 1974) which is “a more dramatic form” of O (DeYoung et al., 2012, p. 73) that should be assessed. Absorption “was selected to characterize the normal pole of Eysenck’s normality-psychosis continuum” (van Kampen, 2012, p. 93). Yet, Absorption and P were found to be noncorrelated (Glicksohn & Bar-El, 2004). Therefore, in addition to P, both Schizotypy (S) and Absorption (A) will be investigated in this study.

We recently reported a study investigating perception and aggressive ideation (Yaniv & Glicksohn, 2021) in five groups of participants, chosen primarily with P in mind. These were: Two groups of individuals suffering from mental disorders; one of which had a history of aggression. While both those groups should score high on P due to P-psychosis (Eysenck, 1992), the group having a history of aggression should score even higher, due to P-psychopathy (Zuckerman, 1989). A third group comprised individuals scoring high on aggression, hence should score high on P due to P-psychopathy. A fourth group comprised creative individuals who should score high on P due to P-creativity (Eysenck, 1995). A control group of participants having no psychiatric past, no indication of aggression, and who did not work in creative fields should score relatively low on P.

Our focus was on the observer’s response to a series of blurred images depicting an act of violence. We now address the personality traits distinguishing among these groups. We employ discriminant analysis, which is a useful follow-up to a series of ANOVAs revealing significant group differences on various measures (Betz, 1987), to consider which (linear) combination of these measures best characterizes group membership, and to compare predicted group membership with actual group membership (Betz, 1987). In previous research employing P, E and N, together with other measures, we reported above-chance percentages of total-group (Huberty, 1984) correct assignment of 83% to two groups (Glicksohn & Bozna, 2000), and 44% to five groups (Glicksohn & Naor-Ziv, 2016). Given five groups (with varying though comparable *N*s), the estimated percentage should be compared to a baseline, chance level of 20% for correct group assignment.

In addition to P, we investigate the role that N and E might play (as suggested by Eysenck, 1992, p. 768), together with that of L (the Lie Scale) that completes the EPQ-R-S questionnaire assessing the Big Three. While N and E may be orthogonal in a normative population, as

reported, for example, by Glicksohn and Abulafia (1998), this is usually not always the case. Amongst individuals scoring high on N, there is a negative correlation between N and E (Buckingham et al., 2001). Indeed, the high-N, low-E combination is at high risk for psychopathology (Claridge, 1997).

To tease out P-psychosis from the prominence of P-psychopathy in the P scale of the EPQ-R-S (Knežević et al., 2019), our participants completed both a questionnaire assessing S (Schizotypy), which is a sister trait to P (Claridge, 2016), and one assessing A (Absorption), another sister trait to P (van Kampen, 2009, 2012). S “offers a useful and unifying construct for understanding schizophrenia-spectrum psychopathology...” (Kwapil & Barrantes-Vidal, 2015, p. S366); A may “represent a core predisposition that precedes the onset of acute psychosis” (Rosen et al., 2017, p. 222). We assumed that individuals suffering from mental disorders and those who comprise our creative individuals would score high on S and A, relative to the control group.

More importantly, we decided to go beyond a standard discriminant analysis employing these 6 predictors (P, E, N, L, S, and A), to consider the set of 15 two-way interactions derived from these. Of these, seven interactions were of particular interest, due to their theoretical significance: (1)  $E \times N$  (van Kampen, 2009); (2)  $E \times P$  (Glicksohn et al., 2007); (3)  $N \times P$  (Claridge & Davis, 2001); (4)  $P \times L$  (Glicksohn & Bar-El, 2004); (5)  $N \times A$  (McClure & Lilienfeld, 2002); (6)  $P \times A$  (van Kampen, 2009); and (7)  $N \times S$  (Barrantes-Vidal et al., 2009).

## METHOD

### Participants and design

Participants were those reported elsewhere (Yaniv & Glicksohn, 2021): (1) a group of individuals suffering from mental disorders without a history of aggression ( $N = 27$ ), compared to (2) a group of individuals suffering from mental disorders with a history of aggression ( $N = 23$ )—both groups were recruited from psychiatric rehabilitation institutions, and had a psychiatric diagnosis and a formal recognition as being mentally disable. The participants in the group with a history of aggression had, in addition, a past of criminal and violent behavior. We note that studies engaged with psychiatric populations usually comprise samples of 25-48 participants (e.g., Glicksohn & Bar-El, 2004; Meyer et al., 2018), hence the present study is comparable to those. A third group (3) comprised individuals ( $N = 27$ ) who scored in the highest 10% on the Hebrew version of the Aggression Questionnaire of Buss and Perry (1992) of a sample of 326 first-year students studying in our department. Their mean score ( $M = 89.6$ ,  $SD = 10.7$ ) is higher than that seen in studies employing either non-clinical participants (Killgore et al., 2021) or a clinical group of juvenile delinquents (Ren et al., 2021). A fourth group (4) comprised creative individuals who studied in recognized institutions of fine arts and music, or worked in creative fields (e.g., music, painting and sculpting), with no psychiatric history ( $N = 26$ ). A control group ( $N = 27$ ) of participants having no psychiatric past, no indication of aggression, and who did not work in creative fields, com-

Table 1. Comparison of Groups ( $M \pm SD$ ) for each Personality Measure (P, E, N, L, S, and A)

	1	2	3	4	5	$F(4, 125)$	MSE	$p$	$\eta^2_p$
<b>Psychoticism (P)</b>	2.59 ± 1.45	3.26 ± 1.63	3.08 ± 1.62	2.82 ± 1.80	1.85 ± 1.38	3.10	2.50	.018	0.090
<b>Extraversion (E)</b>	6.63 ± 3.42	7.13 ± 3.79	7.77 ± 3.23	8.22 ± 3.42	8.22 ± 2.47	1.21	10.76	.309	0.037
<b>Neuroticism (N)</b>	7.00 ± 3.27	7.74 ± 3.62	6.46 ± 2.80	8.30 ± 3.14	4.26 ± 2.80	6.61	9.77	< .0001	0.175
<b>Lie Scale (L)</b>	5.85 ± 2.69	4.17 ± 3.03	3.50 ± 2.29	3.19 ± 1.57	4.96 ± 2.71	5.13	6.19	.001	0.141
<b>Schizotypy (S)</b>	18.04 ± 7.29	17.74 ± 7.58	13.35 ± 6.25	16.70 ± 6.40	7.96 ± 4.33	11.43	41.41	< .0001	0.268
<b>Absorption (A)</b>	16.77 ± 8.08	17.91 ± 7.49	20.96 ± 6.36	16.63 ± 7.02	12.30 ± 5.94	5.22	49.15	.001	0.143

Note: Groups: 1. individuals suffering from mental disorders, no aggression ( $N = 27$ ); 2. individuals suffering from mental disorders, aggression ( $N = 23$ ); 3. creative individuals, no psychiatric history ( $N = 26$ ); 4. individuals who scored in the highest 10% on the Aggression Questionnaire ( $N = 27$ ); 5. a control group ( $N = 27$ ) of participants having no psychiatric past, no indication of aggression, and who did not work in creative fields.

prised our fifth group (5). Assuming an effect size using  $\eta^2_p$  of 0.10, a power value of .8, an alpha value of .01, and  $df$  of 4 and 125, in line with the  $F$ -values to be reported here, a minimal total sample size of 130 is required. Note from Table 1, presented above, that of the six effect sizes reported, four of these are higher than 0.10.

In total, 130 individuals (53.8% women) participated; their age ranged between 20 to 67; their mean age was 33.27, and median age was 30 years. As part of the same study (Yaniv & Glicksohn, 2021), which presented the results of a lab experiment, they completed three questionnaires, in the following order: the EPQ-R-S, Schizotypy (STA) and the Tellegen Absorption Scale. The study was approved by the university ethics board. All participants provided written informed consent.

## Measures

### *The Eysenck Personality Questionnaire-Revised, short version (EPQ-R-S)*

The participants completed the Hebrew version of the EPQ-R-S (Eysenck et al., 1985), comprising 48 items assessing E, N, P, and L. Alpha reliabilities for these scales (Glicksohn & Abulafia, 1998) were 0.80 (N, E), 0.71 (L), and 0.56 (P). In the present study, these reliabilities were 0.82 (N, E), 0.72 (L), and 0.37 (P) –which is low, but does match the value of 0.38 reported for a clinical population (Glicksohn & Bar-El, 2004). For a non-clinical population, the reliability of the P scale ranges between 0.55 to 0.66, (Almiro et al., 2016; Costa & McCrae, 1995; Glicksohn & Abulafia, 1998). Ours is certainly not the only recent study reporting low reliability for P while arguing for its continuing importance (Strus & Ciecuch, 2017). As Ruch et al. (2021) have suggested, the P items have been ‘softened’ to enable their endorsement in a non-clinical population.

### *The Schizotypal Personality Scale (STA)*

The participants completed the Hebrew version of the STA (Claridge & Broks, 1984), comprising 37 items. We employed the total score of the STA (S-Schizotypy), in line with previous studies (Claridge et al., 1997). The reliability for this scale in Hebrew was 0.81 (Montag & Levin, 1992). In the present study, the reliability was 0.86.

### *The Tellegen Absorption Scale*

The participants completed the Hebrew version of the Tellegen Absorption Scale (Tellegen & Atkinson, 1974),

comprising 34 items. Glicksohn (1991) reported an alpha reliability of 0.80, and here this was 0.86.

## RESULTS

### Preliminary analyses

We ran a series of six one-way ANOVAs examining group differences for the six measures of this study: P, E, N, L, S, and A (see Table 1). The respective MANOVA, using the Pillai trace test statistic, has a corresponding  $F(24, 492) = 4.34$ ,  $p < .001$ . E clearly has no predictive value here and will therefore be dropped from the subsequent analyses. Relative to the control group, the scores for the other groups are high for N, S, and A.

### Discriminant Analysis

The program for discriminant analysis comprised the following stages. First, only P, N, L, S, and A were considered as predictors, and these variables were centered prior to entry. Second, given that E was dropped from the analysis, both the  $E \times N$  and  $E \times P$  interactions were also dropped. Thus, the interactions that were considered were  $N \times P$ ,  $P \times L$ ,  $N \times A$ ,  $P \times A$ , and  $N \times S$ . Third, the variables were entered in a series of discriminant analyses, beginning with the entry of P as a single predictor. When P is entered as a single predictor, the discriminant analysis allocates the 130 participants to the 5 groups, solely based on P. These expected frequencies can then be compared with the observed frequencies to assess goodness-of-fit of the discriminant function. Fourth, this goodness-of-fit is based on two major criteria: (1) The percentage of correct prediction, or overall hit rate (Betz, 1987), which refers to the ratio of correctly-placed individuals in all of the 5 groups to the total number of 130 participants; and (2) the separate-group hit rates (Huberty, 1984), which refers to the ratio of correctly-placed individuals in each of the 5 groups ( $n$ ), to the size of each of these groups ( $N$ ). Figure 1 presents the change in the classification matrix as more variables are entered. The diagonal cells of each classification matrix indicate the  $n$  used to compute the group classification hit rate (correctly classified  $n$ /actual group  $N$ ). Actual group  $N$ s are seen in the last column of each table (27, 23, 26, 27, 27), and they sum to 130.

When P is entered as a single predictor (Figure 1, top-left matrix), a total of 35 individuals are correctly placed

Predictor: P							Predictor: Predictor: P, L							Predictor: P, L, S						
	1	2	3	4	5			1	2	3	4	5			1	2	3	4	5	
1	0	3	2	9	13	27	1	13	2	2	4	6	27	1	15	2	3	2	4	27
2	0	5	6	5	7	23	2	8	2	4	5	4	23	2	7	3	4	6	3	23
3	0	3	9	3	11	26	3	6	2	4	10	4	26	3	1	2	17	4	2	26
4	0	5	6	3	13	27	4	1	4	6	7	9	27	4	5	5	5	7	5	27
5	0	1	2	6	18	27	5	6	1	2	8	10	27	5	3	0	5	2	17	27
Predictor: P, L, S, A							Predictor: P, L, S, A, N							Predictor: P, L, S, A, N, N x P, N x A						
	1	2	3	4	5			1	2	3	4	5			1	2	3	4	5	
1	16	1	1	3	6	27	1	15	1	3	4	4	27	1	15	3	2	3	4	27
2	9	2	3	7	2	23	2	7	2	4	7	3	23	2	6	8	4	3	2	23
3	4	4	7	7	7	26	3	3	2	16	3	2	26	3	1	1	17	5	2	26
4	5	4	6	7	5	27	4	1	5	5	14	2	27	4	2	4	5	14	2	27
5	3	0	3	2	19	27	5	3	0	3	3	18	27	5	3	1	5	2	16	27

Figure 1. Changes in the classification matrix for the results of the discriminant analysis.

Note: Groups appear in the Rows of the matrices; the columns indicate predicted group. Groups are: 1. individuals suffering from mental disorders, no aggression ( $N = 27$ ); 2. individuals suffering from mental disorders, aggression ( $N = 23$ ); 3. creative individuals, no psychiatric history ( $N = 26$ ); 4. individuals who scored in the highest 10% on the Aggression Questionnaire ( $N = 27$ ); 5. a control group ( $N = 27$ ) of participants having no psychiatric past, no indication of aggression, and who did not work in creative fields.

(see values appearing on the diagonal;  $35 = 0 + 5 + 9 + 3 + 18$ ), which is a 27% ( $35/130$ ) overall hit rate that should be compared to the baseline, chance level of 20% ( $26/130$ ) – namely, an equal allocation of individuals to each of the 5 groups. In particular, the hit rate for the control group (Group 5) is very high (67%;  $18/27$ ). In contrast, the hit rate for Group 1 is 0. On entering L as a second predictor, the hit rate for Group 1 now increases dramatically to 48% ( $13/27$ , compared to  $0/27$  previously), somewhat at the expense of the control group, whose hit rate is now 37% ( $10/27$ , compared to  $18/27$  previously). The third matrix of this first row shows that when S is now entered, the overall hit rate increases dramatically to 45%, and the hit rate of Group 3 increases to 85%, while that of Group 1 (56%) and of Group 5 (63%) remain very high. Turning to the second row, when A is entered, the hit rate of Group 3 now goes down to 27%. In contrast, when N is entered as the fifth predictor, the overall hit rate increases to 50%, and the hit rate for Group 4 increases to 52%. Following a series of explorations in which the interaction terms were selectively entered, the best result was found when  $N \times P$  and  $N \times A$  were entered. In this last classification matrix, the overall hit rate was found to be 54% ( $15 + 8 + 17 + 14 + 16 = 70$  correctly placed, out of 130), and the individual group hit rates were, respectively: 56% ( $15/27$ ), 35% ( $8/23$ ), 65% ( $17/26$ ), 52% ( $14/27$ ), and 59% ( $16/27$ ). Recall that with 5 groups, having roughly the same number of individuals in each, chance level of correct classification is 20%.

## DISCUSSION

A model employing five predictors (P, N, L, S, and A) and two interactions ( $N \times P$ , and  $N \times A$ ) is supported. All groups had a higher level of P compared to the control group, which supports the Eysenckian view of P-psychosis (Eysenck, 1992), P-psychopathy (Zuckerman, 1989), and P-creativity (Eysenck, 1995). Given that P and L are negatively correlated (Glicksohn & Bar-El, 2004-2005), their joint predictive power led to an increase in the hit rate to 48% for membership in Group 1, namely for individuals suffering from mental disorder without a history of aggression. Relative to those suffering from mental disorders, creative individuals had a lower level of S, hence on entering S into the analysis, the resulting predictive power of P, L, and S led to an increase in the hit rate for membership in Group 3 – to 85%. Creativity might act as a shield against psychosis (Claridge & Blakey, 2009), supporting such a low level of S in this group. The inclusion of two interactions,  $N \times P$ , and  $N \times A$  raised the overall hit rate to 54%, with each individual group hit rate being much higher than the chance level of 20% correct classification. In a recent study employing discriminant analysis to differentiate among five groups (Glicksohn & Naor-Ziv, 2016), we reported an overall hit rate of 44%, with individual group hit rates ranging between 31% and 64%. In the present study, the individual group hit rates ranged between 35% and 65%.

The two interaction terms involve N, which acts as an “emotional amplifier” (Claridge & Davis, 2001). What, then, is amplified in P and in A by N? As N increases emotional capacity, it can be seen as a predisposition for the risk of psychotic symptoms in later stages of life (Barrantes-Vidal et al., 2009). This seems to be the essence of the  $N \times P$  interaction, which has previously been found to be of importance in predicting: (1) the incidence of anxiety (Gershuny & Sher, 1998); (2) the expression of verbal aggressiveness (Valencic et al., 1998); and (3) smoking (Parkes, 1984; though not in Glicksohn & Nahari, 2007). In these studies, the relationship between P and the outcome variable (smoking, anxiety, etc.) is found to be stronger amongst high-N individuals (e.g., Gershuny & Sher, 1998), and likewise the relationship between N and the outcome variable is stronger for those scoring high on P (e.g., Parkes, 1984; Valencic et al., 1998).

Given that N amplifies fear, neediness, threat, and negative appraisal (Anagnostopoulos & Botse, 2016), when this interacts with A this might indicate the “tendency to become immersed in emotional experiences” (Benning et al., 2015, p. 1412), and of a disintegrative state of consciousness (Michalica & Hunt, 2013). Indeed, there is an interesting relationship between A and various states of consciousness on the sleep-wakefulness continuum (Glicksohn, 1989); thus, the  $N \times A$  interaction is predictive of negative experiences on this continuum, such as chronic nightmares (Soffer-Dudek & Shahar, 2009).

This study has one major limitation: High variance within the clinical groups. Most of these participants (86%) suffered from psychotic disorders and from mental disorders with psychotic episodes. The remaining 14% suffered from major depressive disorder with a history of disturbance in reality-testing. Although such a group composition can be found in another study regarding psychosis (Lopez-Garcia et al., 2019), perhaps a group composed of individuals who suffer from the same mental disorder could have enhanced the predictive power of P. This is worthy of further study.

## ACCOUNTS

### Conflicting interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

### Data availability

The data reported here will be made available, following such a request to the corresponding author.

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