



Brief Report

Dimensional schizotypy, autism, and unusual word associations in artists and scientists

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Abstract

Studies from a range of perspectives provide evidence for a relationship between creativity and the tendency to mental illness. The present study further examined this issue by administering questionnaires measuring the minor features of psychosis and autism to 31 professional “artists” (visual artists and musicians) and 28 professional “scientists” (biological scientists and physical scientists/mathematicians). The Oxford–Liverpool Inventory of Feelings and Experiences (O–LIFE), the Hypomanic Personality Scale, and the Autism-Spectrum Quotient (AQ), were administered, in addition to a shortened form of the Kent–Rosanoff Word Association Scale. The results provided strong support for the connection of artistic creativity to positive schizotypy and hypomania and the tendency to make unusual word associations, and somewhat weaker support for the connection of scientific creativity to certain components of the autism spectrum.

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1. Introduction

Recent scientific research provides substantial support for the centuries-old view that creativity is linked to psychopathology, with research by personality psychologists frequently employing personality scales designed to assess predisposition to psychopathology within the general population. Numerous early studies of this kind used the Psychoticism (P)-scale from the Eysenck Personality Questionnaire, with individuals in a range of

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creative pursuits showing elevated scores on the scale (Merten & Fischer, 1999). The P-scale also tended to correlate with performance on tasks purported to measure associative thinking, such as tests of divergent thinking (Woody & Claridge, 1977) and word association (Eysenck, 1993), supporting Eysenck's (1995) explanation of the relationship as due to the loose, "overinclusive" associative processes characteristic of both schizophrenic thinking disorder and certain aspects of creative thought.

While much of Eysenck's view remains consistent with contemporary viewpoints, the P-scale itself has been criticized from a number of perspectives, particularly its tendency to measure impulsive and aggressive behaviours more adequately than the minor features of psychosis. An alternative approach has been to employ scales of "psychosis proneness" or "schizotypy" (Fisher et al., 2004) developed to measure the minor features of psychosis. When factor analysed, these scales have been found to produce three or four relatively independent components (Bentall, Claridge, & Slade, 1989). In particular, the distinction in the schizophrenia literature between positive and negative symptoms was paralleled in the schizotypy literature by the distinction between positive aspects of schizotypy, including magical thinking and unusual perceptual experiences, and negative aspects, including introverted withdrawal and anhedonia. When correlated with creativity, the results obtained largely reflected the aspect of schizotypy being measured by a scale, showing positive correlations with positive schizotypal features and hypomania and, less frequently, negative correlations with negative features (Green & Williams, 1999; Schuldberg, 2000).

More recent studies have also considered the possibility that there may be differences, in degree or in kind, between the general domains of artistic and scientific creativity. In his review of the empirical literature, Feist (1999) noted both the considerable overlap in the personalities of creators in the two broad domains, and the tendency for artists to be distinguished from scientists by such personality characteristics as "emotional lability, impulsivity, nonconformity, and rebelliousness" (p. 284). Simonton (2004), suggested a continuum from normal, paradigmatic science through revolutionary and non-paradigmatic science to formal and, finally, expressive artistic creativity. The continuum was believed to correspond to increasingly unconstrained cognitive processes, increasing openness to experience, and greater incidence of psychopathology.

In a recent study, Nettle (2006) tested the view that both impulsive, nonconforming behaviour patterns, and the features of positive schizotypy, are more likely to be associated with artistic than with scientific creativity. Groups of poets, visual artists, and mathematicians were given a multi-dimensional schizotypy questionnaire, the Oxford–Liverpool Inventory of Feelings and Experiences (O–LIFE; Mason, Claridge, & Jackson, 1995). This questionnaire includes scales measuring the positive features of schizotypy (called Unusual Experiences), and the negative features of schizotypy (Introverted Anhedonia), as well as a scale measuring attentional difficulties and social anxiety (Cognitive Disorganization). A fourth scale (Impulsive Nonconformity) measures anti-social and impulsive behaviour, and is strongly correlated with Eysenck's P-scale. Nettle's main finding was that, after controlling for age and sex, poets and visual artists were higher on Unusual Experiences and Impulsive Nonconformity than non-poets and non-artists, respectively, whereas mathematicians were significantly lower than non-mathematicians on both the above scales. A first aim of the present study was to confirm these differences between artists and scientists using a different sample.

In addition, we noted Nettle's (2006) argument that the difference between artists and mathematicians on the Unusual Experiences task reflects differences in their "range of associations". We explored this idea by including in our study a measure of word association. It was hypothesized that more uncommon, and less common, word associations would be made by individuals who are high on positive schizotypy than by individuals who are low, and by artists than by scientists.

Finally, we examined Nettle's conjecture that his data are consonant with the ideas of writers such as Baron-Cohen that Asperger syndrome/high functioning autism is connected to the "systematizing" abilities found in mathematics and engineering. Specifically, Nettle notes that the "constellation of autism, systematizing and science" is in many respects the opposite to the "constellation of arts, Unusual Experiences and affective and psychotic disorders..." (p. 887). We employed a measure of Asperger syndrome/high functioning autism developed by Baron-Cohen, Wheelwright, Skinner, Martin, and Clubley (2001) to be suitable for non-clinical samples, the Autism-Spectrum Quotient (AQ). We anticipated that scores on the AQ would be negatively correlated with our measure of positive schizotypy, and that scientists, and particularly physical scientists/mathematicians, would show higher scores on the AQ than artists.

2. Methods

2.1. Participants and procedure

Four professional groups were employed. There were 20 visual artists (5 males, 15 females), 15 musicians (7 males, 6 females), 20 biological scientists (11 males 5 females), and 15 physical scientists/mathematicians (10 males, 5 females). The ages of the groups were, respectively, 35.90 ($SD = 15.13$), 35.69 ($SD = 15.57$), 50.25 ($SD = 16.22$), and 43.20 (19.17).

We selected only professional participants who had produced work of high standard. All scientists had received an award or professional recognition at either a national or international level. Though the criteria for artists were less stringent, all had to have received some external recognition of his or her work by being paid, receiving a prize, or being accepted into a specialist school or professional society. Participants were approached directly or through email by the second author. They received and returned the materials electronically in the order described below.

2.2. Measures

The O-LIFE is a two-choice (YES/NO) questionnaire developed by Mason et al. (1995) to measure four relatively independent components of schizotypy. As noted above, it includes scales measuring Unusual Experiences, Cognitive Disorganization, Introverted Anhedonia, and Impulsive Nonconformity. To reduce the overall test battery to a manageable number of items, a shortened version of the O-LIFE was employed based on the data used by Mason et al. (1995) in producing the original questionnaire. Scales varied in length from 12 to 19 items, with Guttman's Lambda coefficients between, in the present study, .75 and .80. Added to the 60 items of the shortened O-LIFE, and interspersed with them, was a short, 15-item version of Eckblad and Chapman's (1986) Hypomanic

Personality Scale developed by Rawlings and Georgiou (2004). Lambda in the present study was .73.

The AQ (Baron-Cohen et al., 2001) is a 50-item questionnaire containing five sub-scales labelled Attention to Detail, Attention Switching, Communication, Imagination, and Social Skills, with the sub-scales scored such that high scores indicate autistic features. The Lambda coefficient in the present study was .81 for the full scale, and varied between .64 to .83 for the sub-scales.

The Kent–Rosanoff Word Association Test (Kent & Rosanoff, 1910) is an established measure of word association consisting of 100 common, neutral words. In scoring the task, frequency levels were established in the present study using the data given by the participants themselves. We noted also the view of a small number of writers, led by Rothenberg (1973), that highly eminent creative individuals are more likely to make more opposite responses, like “hot” when given the word “cold”. Accordingly, three indices were established: primary responses (“primes”) comprised the most common response for each word among the present participants which were not also opposite responses; “idiosyncratic” responses were given by 1–3% of participants; “opposites” was the number of opposite responses. Because of time constraints, only the first 50 words of the test were presented to participants, who wrote their response beside each word.

3. Results

Table 1 shows the inter-correlations among the various dependent variables, using all 64 participants. It is noted that the inter-correlations between the abbreviated O–LIFE scales produced a substantially similar pattern to those in previous studies using the full scales (Mason et al., 1995; Nettle, 2006). Also noteworthy was the fact that Hypomanic Personality was significantly correlated with all O–LIFE measures, the correlation being negative for Introverted Anhedonia and positive for the other three scales. The anticipated negative correlation between AQ and positive schizotypy was not supported; AQ was significantly correlated only with Introverted Anhedonia.

For word association, it was found, as expected, that individuals scoring high on Unusual Experiences made fewer common responses and more idiosyncratic responses than

Table 1
Inter-correlations among major variables

	1	2	3	4	5	6	7	8	9
1. Unusual Experiences	—	.54***	-.07	.32**	.54***	.05	-.30*	.25*	-.28*
2. Cognitive Disorganization		—	.12	.60***	.35**	.21	-.19	.15	-.16
3. Introverted Anhedonia			—	.04	-.25*	.52**	.16	-.31*	.33**
4. Impulsive Nonconformity				—	.37**	.00	-.16	.09	-.10
5. Hypomanic Personality					—	-.15	-.17	.19	-.28*
6. AQ (total)						—	-.08	-.07	.28*
7. Primes							—	-.68***	.28*
8. Idiosyncratic responses								—	-.76***
9. Opposites									—

* $p < .05$.
 ** $p < .01$.
 *** $p < .001$.

low scorers. Furthermore, the number of opposite responses was associated positively with Unusual Experiences and Hypomanic Personality, and negatively with Introvertive Anhedonia.

Because of the substantial differences in age and sex-ratio in the four groups of participants, analyses of covariance were carried out for the various self-report and word-association measures, where group and sex were separate factors in the analyses and where age was the covariate. Sex produced no significant interaction effects and was excluded from the analyses. Adjusted means after controlling for the effects of age are shown in Table 2. For the first group of scales, the O–LIFE/Hypomanic Personality Scales, it can be seen that significant effects were found for Unusual Experiences, Cognitive Disorganization, and Hypomanic Personality. As indicated by superscripts, pair-wise comparisons (using Bonferroni) revealed that the two artist groups were each significantly higher than the two scientist groups on Unusual Experiences; that musicians were higher than all other groups on Cognitive Disorganization; and that biological scientists were lower than each group of artists, and physical scientists were lower than visual artists, on Hypomanic Personality. We note that the hypothesised connection between group and Impulsive Nonconformity was significant prior to controlling for age, but was not significant following covariation.

When the total score on the AQ was the dependent variable, the obtained effect was non-significant. Physical scientists did not show the anticipated higher scores on this measure. However, significant effects were obtained by the two sub-scales Attention to Detail and Imagination, and approached statistical significance ($p = .073$) for Communication.

Table 2
Adjusted group means on all self-report and word-association measures following covariation for age

	Visual artist	Musician	Biological scientist	Physical scientist	<i>F</i>	η_p^2
O–LIFE scales						
Unusual Experiences	3.86 ^{AB}	5.70 ^{AB}	1.52 ^{ab}	1.97 ^{ab}	6.81 ^{***}	.26
Cognitive Disorganization	4.23 ^a	7.41 ^A	3.45 ^a	3.40 ^a	6.45 ^{***}	.25
Introvertive Anhedonia	6.20	5.65	5.16	6.08	.25	.01
Impulsive Nonconformity	6.11	6.42	4.50	5.47	2.15	.10
Hypomanic Personality Scale	7.61 ^{AB}	7.22 ^A	4.88 ^a	5.47 ^b	3.56 [*]	.16
AQ (total)						
AQ (total)	107.77	107.29	103.83	113.25	1.35	.07
Attention to Detail	26.96 ^A	23.04 ^a	22.61 ^{ab}	25.97 ^B	3.68 [*]	.16
Communication	20.10	20.93	18.29 ^a	22.08 ^A	2.45	.11
Imagination	17.42 ^a	20.01	20.90 ^A	21.47 ^A	2.78 [*]	.13
Attention Switching	23.45	22.83	21.68	21.30	1.05	.05
Social Skills	19.84	20.48	20.36	22.41	.78	.04
Word-Association indices						
Primes	5.31 ^{ab}	5.19 ^{ab}	8.80 ^{AB}	7.83 ^{AB}	3.84 [*]	.17
Idiosyncratic responses	27.39 ^A	30.00 ^{AB}	22.87 ^b	18.82 ^a	4.51 ^{**}	.19
Opposites	5.42 ^a	4.15 ^a	6.08	10.90 ^A	3.55 [*]	.16

Note. Superscripts indicate results of Bonferroni post hoc tests: upper-case superscripts are significantly greater than lower-case superscripts using the same letter.

- * $p < .05$.
- ** $p < .01$.
- *** $p < .001$.

Recalling that high scores indicate greater “autism”, post hoc comparisons indicated that visual artists obtained higher scores than musicians and biological scientists, and physical scientists than biological scientists on Attention to Detail; visual artists obtained lower scores than either of the two scientist groups on Imagination; and physical scientists obtained higher scores than biological scientists on Communication.

All three of the word-association indices produced significant group effects. Post hoc analyses indicated that each group of artists made fewer common responses than each group of scientists; that physical scientists/mathematicians made fewer idiosyncratic responses than either groups of artists, and biological scientists made fewer of such responses than musicians; while physical scientists/mathematicians made more opposite responses than either of the artist groups.

4. Discussion

The findings of the present study support earlier studies indicating higher scores on measures of positive schizotypy in artists than scientists. Our results for Unusual Experiences are in substantial agreement with Nettle’s (2006) findings using poets, visual artists, and mathematicians of different degrees of professional involvement. The data are also in accord with previous studies indicating a relationship between creativity and hypomania.

Further support for the connection between creativity and positive schizotypy was provided by the correlations between the positive schizotypy measure and the psychometric measure of creative potential employed in the study. The finding that individuals scoring high on Unusual Experiences made fewer common, and more idiosyncratic, responses on the word-association task reinforces the findings of earlier studies relating psychometric creativity measures to positive schizotypy. In a single investigation, the present study provides evidence both for the connection between positive schizotypy and artistic creativity, and for the view that this connection may be partly mediated by the loose associative processes common to both.

The results did not support the relationship between impulsive nonconforming behaviour and artistic creativity reported in Nettle’s (2006) study. The difference between the two studies is most likely due to the nature of the respective samples. While the total groups of visual artists and poets in the earlier study had clearly higher means than non-artists and non-poets, respectively, sub-groups of “serious” poets, “serious” visual artists, and “hobbyist” poets, all had higher Impulsive Nonconformity scores than their respective “professional” groups.

The anticipated negative relationship between AQ and Unusual Experiences was not supported in the correlation analysis, and the hypothesised relationship between scientific creativity and the minor signs of autism was given ambiguous support by the data. Whereas physical scientists/mathematicians did obtain the highest AQ total scores, the effect was non-significant and the pattern of results across sub-scales was quite varied. For example, physical scientists/mathematicians did obtain the highest AQ score on three of the five sub-scales, but on Attention Switching they obtained the lowest score (by a small margin) and on Attention to Detail they were outscored by the visual artists, a group which scored highest on two sub-scales and lowest on two sub-scales. This inconsistent pattern may be interpreted to reflect the multi-dimensionality of the scale when used with non-clinical samples, as reported by Austin (2005).

An additional finding of interest was the tendency of the physical scientists/mathematicians to give a large number of “opposite” responses in the word-association data, while the tendency to give opposites was also correlated with several self-report measures. Rothenberg’s (1973) explanation is that eminent individuals are able to show “Janusian thinking” in which an idea and its antithesis are able to be held in the mind at the same time, allowing the occurrence of a creative synthesis. While this view is an idiosyncratic one, the present results do encourage further research using the “opposites” index.

In conclusion, the study adds to the literature supporting the view that the positive features of schizotypy are linked to artistic rather than scientific creativity, and that the relationship is at least partly mediated by common associative processes. The data suggest, more tenuously, a link between scientific creativity and certain aspects of the autism spectrum.

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