

## Schizotypal traits in painters: Relations with intelligence, creativity and creative productivity

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In the present research we explored the presence of schizotypal traits in painters. Furthermore, the relations of schizotypy and creativity-related variables (intelligence, creativity and creative productivity) were analyzed. Study participants were divided into the criterion (132 students of art academy and art high school) and control group (119 psychology students and members of grammar school). Two hypotheses were set: 1) schizotypal traits are more pronounced in painters than in control group; 2) schizotypy is more closely associated with the creativity-linked variables in the criterion than in control group. Schizotypy was operationalized by Disintegration construct and measured via DELTA 10 inventory. Intelligence was assessed by Advanced Progressive Matrices-18; creativity was measured by the same labeled scale from HEXACO-PI-R inventory and creative productivity was explored by a set of questions regarding the frequency of creative behavior. Results showed that Magical thinking, Enhanced awareness, Somatoform Dysregulation, Perceptual distortions and Social anhedonia were the schizotypal traits which were more pronounced in painters as compared to the control group. Factor analyses performed in each group separately revealed a latent component loaded both with schizotypal traits, creativity and creative productivity, but only in the group of painters: schizotypy and creativity were not so closely related in the control group. Thus, the study hypotheses were largely confirmed. Results provide a more detailed understanding of the relations between schizotypy and creativity.

*Keywords:* schizotypy, Disintegration, painters, creativity

### Highlights:

- The relations between schizotypy and creativity are analyzed
- Schizotypal traits are found to be more pronounced in painters compared to controls
- Schizotypy was more associated with creativity and creative productivity in painters
- Enhanced awareness is the crucial schizotypal trait in regard to creative abilities

### **Psychopathology and creative productivity**

The relation between madness and art represents an old topic which is present in layman narratives since the 18<sup>th</sup> century (MacGregor, 1989). The first comprehensive work regarding this topic is probably represented by the book of Hans Prinzhorn: *Artistry of the Mentally Ill: A Contribution to the Psychology and Psychopathology of Configuration*, first published in 1922 (Prinzhorn, 1972). In this manuscript the author pointed out that the creative expressions of mentally ill individuals in fact can have aesthetic characteristics and artistic value; furthermore he linked this art with the production of historical avant-garde, especially expressionism. The madness-creativity link became even more prominent in upcoming avant-garde styles, such as surrealism: surrealists were deeply intrigued by the association between mental aberrations and art, because mentally ill individuals often express unusual associations which they investigated themselves (Constantinidou, 2010). Similar trends can be seen in Yugoslav avant-garde as well. A proto-surrealist group of poets and writers published prose texts and drawings made by the patients of a mental hospital (Sretenović, 2016). In fully developed surrealism, Yugoslav surrealists, besides other approaches, implemented the paranoiac-critical method, developed by Salvador Dali in their work (Ristić, 1932). This method is based on simulating the behavior of a paranoid individual in order to produce novel images or associations from existing objects. The relations between mental illness and creativity continued to draw attention from both artists and scientists in modern times as well. One of the new potentials in this field emerged with the conception of the schizotypy concept; it allowed researchers to approach the topic in a non-dichotomous way, by observing both psychopathology and creativity as continuous phenomena.

### **Schizotypy**

Contemporary research of psychological dysfunction and mental illness show that such characteristics are not distinctively related to certain taxons of individuals. In fact, they show that psychopathological experiences and behavior are present in the general population too, although to a smaller extent. This is true for neurotic characteristics (Spinhoven, Penelo, De Rooij, Penninx, & Ormel, 2014), personality disorders (Fossati, Krueger, Markon, Borroni, & Maffei, 2013) and psychotic experiences (Nelson, Seal, Pantelis, & Phillips, 2013). A continuous trait of psychotic-like experiences is called schizotypy (Meehl, 1962). It represents non-pathological and subclinical levels of experiences similar to ones which appear in psychosis. However, empirical data show that schizotypy is related to various psychological dysfunctions: autistic characteristics (Russell-Smith, Maybery, & Bayliss, 2011), obsessive-compulsive and dissociative symptoms (Chmielewski & Watson, 2008), maladaptive attachment (Želeskov-Đorić & Međedović, 2011) and impaired emotional intelligence (Aguirre, Sergi, & Levy, 2008). Thus, schizotypy is a valid indicator of mental health in general, and highly pronounced schizotypy can indicate problems in overall psychological functioning (Goulding & Odehn, 2009).

## Disintegration

Many models were developed to operationalize and measure schizotypy (for a review see: Mason, 2015). Recently, a new model was proposed with the intention of capturing psychotic-like experiences. It is named Disintegration and represents a broad and comprehensive trait which gathers a wide array of schizotypal characteristics (Knežević et al., 2016). Disintegration was obtained as a result of factor analysis of roughly 2000 items which describe psychotic phenomena. The analysis yielded a hierarchical structure with a global trait at the top of the hierarchy and ten narrow subordinate traits: *General executive impairment* (aberrations in executive functioning), *Perceptual distortions* (depersonalization and derealization), *Enhanced awareness* (synesthesia, responsiveness to aesthetic stimuli), *Depression*, *Paranoia*, *Mania*, *Social anhedonia* (extreme avoidance of social interactions), *Flattened affect* (emotional indifference and numbness), *Somatoform dysregulation* (the impression of a change of internal organs, insensitivity to pain, and the feeling of corporal numbing) and *Magical thinking* (belief in telepathy, illogical thinking, superstition, etc). So far, empirical findings showed that the Disintegration is irreducible to the Big Five personality traits (Knežević et al., 2016), the HEXACO model of personality (Međedović, 2013) and the psychobiological model of temperament and character (Lazarević et al., 2016).

## Schizotypy, creativity and artistic performance

Creativity and artistic productivity have been linked both to mental illness and schizotypy (Barrantes-Vidal, 2004). The results described by Schuldberg (2001) are very informative regarding the link between schizotypal traits and creativity in non-clinical populations. His data shows that hypomania and disinhibition are positively related to creativity, while anhedonia and depression have negative associations with the measures of creativity. Other researchers obtained similar data. Most empirical evidence points to the conclusion that the anhedonic experience decreases creative ability (Batey & Furnham, 2009; LeBoutillier, Barry, & Westley, 2016), while the lack of impulse control is positively related to creativity (Batey & Furnham, 2008; Batey & Furnham, 2009).

Some studies were oriented towards exploring schizotypal traits in creative individuals and artists, with the majority of them focused on visual artists. The findings are similar to the ones previously described: visual artists have a tendency to experience affective disturbances (Nelson & Rawlings, 2010), unusual experiences (Preti & Vellante, 2007), hypomania, cognitive disorganization (Rawlings & Locarnini, 2008) and to express impulsive nonconformity (Burch, Pavelis, Hemsley, & Corr, 2006). On the other hand, visual artists report lower levels of introverted anhedonia (Nettle, 2006).

The results of various studies of the schizotypy-creativity link are probably best generalized by two meta-analyses on this topic (Acar & Sen, 2013; Baas, Nijstad, Boot, & De Dreu, 2016). Both analyses converged to a conclusion that positive schizotypal features (unusual experiences, mania, aberrant thinking) are positively related to creativity, while the opposite stands for negative schizotypal characteristics (physical and social anhedonia, constricted affect).

Some researchers suggested that the crucial underlying mechanism which is responsible for the schizotypy-creativity link is *cognitive disinhibition* (Barrantes-Vidal, 2004). It is based on a poorly-focused attention, which further facilitates free associations and irrational thinking. This process can enable schizotypal individuals to freely associate and activate divergent thinking while avoiding focus on previous experience in an attempt to generate novel responses (Abraham & Windmann, 2008). It could help schizotypal individuals focus on present experience (instead of past) and provide the sense of immersion in the perceived objects, which are the characteristics of the *flow* state, one of the crucial features of creative engagement (Nelson & Rawlings, 2010).

### Goals of the present research

The main advantage of the Disintegration concept, compared to other models of schizotypy is its comprehensiveness. Ten narrow modalities of this trait can provide a detailed description of schizotypal traits related to certain phenomena. The main aim of the present study is to expand previous research of psychotic-like phenomena in painters using the Disintegration trait. In order to further specify the research goal we introduced two hypotheses: 1) positive Disintegration modalities are more pronounced in painters; 2) schizotypy is more highly related to creativity in the group of painters. The second hypothesis implicates qualitative differences within the groups: it suggests that psychotic-like experiences are one of the sources of creative productivity in painters. On the other hand, it implies that participants from the control group are less able to integrate schizotypal characteristics in their creative endeavors.

## Method

### Sample and procedure

Total sample size included 251 participants (68% females). Painters were selected from the population of undergraduate students of the Academy of Arts and the members of Art High School ( $N = 132$ ). Control groups were psychology students and grammar school students ( $N = 119$ ). We used the convenience sampling in selecting the participants and all the subjects participated voluntarily in the research; 31% of participants in the control group and 38% of participants in the group of painters were males. The mean age of the participants in the control group was 20.09 years ( $SD = 2.54$ ) while the average age in the group of painters was 19.17 years ( $SD = 1.84$ ). The measures were administered in faculties/schools. Researchers were present during the data collection accompanied by the school professors. Filling out the questionnaires and tests lasted 40 minutes on average. When the data collection was over, researchers debriefed the participants regarding their research goals.

### Measures

*Schizotypy* was operationalized via Disintegration construct and measured by DELTA 10 inventory. The instrument contains 113 items and besides the total score, it provides the scores on 10 schizotypal modalities: General executive impairment, Perceptual distortions, Enhanced awareness, Depression, Paranoia, Mania, Social anhedonia, Flattened affect, Somatoform dysregulation and Magical thinking.

*Creativity* was measured using the same-labeled four-item scale which represents a facet of Openness to experience in HEXACO-PI-R inventory (Lee & Ashton, 2006). Both DELTA 10 and Creativity scale have responses in the form of a 5-point Likert scale, where 1 stands for “completely disagree” and 5 represents “completely agree”.

*Creative productivity* was measured by three questions which regarded the frequency of creative behaviors regarding visual art (painting, drawing and making art in general). These three items were shown to represent the factor of visual creative productivity in previous research (Dorđević & Međedović, 2012). The response scale contains the frequency of the examined behavior with the following numbers: 1. “never”, 2. “rarely”, 3. “sometimes”, 4. “often” and 5. “very often”.

The Advanced Progressive Matrices-18 (APM-18: Pallier et al., 2002) are used for the exploration of *general intelligence*. This instrument represents a shortened version of the standard Raven’s Advanced Progressive Matrices (RAPM-36: Raven, Raven, & Court, 1993). It contains 18 items representing visual matrices which need to be completed by participants. Several possible solutions are offered for each item, from which only one is correct. The items are arranged in order of increasing difficulty. The total score of correct answers was used in the analysis.

## Results

### Descriptive data, scale reliabilities and normality tests

The first analysis was aimed at providing descriptive statistics and the reliabilities (Cronbach’s  $\alpha$ ) of the administered scales. Furthermore, we examined the skewness of the scales and the deviations from the normal distribution, since previous research (Međedović, 2013) showed that some of the Disintegration modalities are positively skewed. These data are shown in Table 1.

Table 1  
*Descriptive statistics, scale reliabilities and normality tests*

	<i>M</i>	<i>SD</i>	<i>Skewness</i>	<i>Kurtosis</i>	<i>K-S z</i>	$\alpha$
Magical thinking	2.72	0.75	-0.01	-0.07	1.08	.81
Mania	3.35	0.72	-0.41	-0.31	1.00	.82
Flattened affect	2.41	0.59	0.34	-0.40	1.10	.70
General executive impairment	2.41	0.58	0.09	-0.69	1.04	.69
Depression	2.01	0.64	0.90	0.49	1.70**	.78
Enhanced awareness	3.29	0.81	-0.08	-0.20	0.72	.82
Paranoia	2.10	0.51	0.35	-0.34	1.06	.72
Somatoform dysregulation	2.11	0.57	0.59	0.42	1.38*	.76
Perceptual distortions	2.08	0.72	0.45	-0.55	1.43*	.84
Social anhedonia	2.12	0.63	0.84	0.96	1.52*	.76
Disintegration total score	2.46	0.45	-0.14	-0.52	0.75	.87
Creativity	3.50	0.55	-0.88	0.75	2.86**	.68
Creative productivity	3.40	1.26	-0.31	-1.16	2.11**	.73
Intelligence	11.66	2.87	-0.38	1.00	1.50*	.71

Notes. *K-S z* – Kolmogorov-Smirnov z statistic; \* –  $p < .05$ ; \*\* –  $p < .01$ .

As can be seen in Table 1, four Disintegration modalities are significantly positively skewed: Depression, Somatoform dysregulation, Perceptual distortions and Social anhedonia. Furthermore, intelligence, creativity and creative productivity deviate from normal distribution as well. Due to the significant *K-S* statistics of these measures, we normalized all of the variables using the Blom's algorithm (Blom, 1958) and used normalized scores in further analyses. Table 1 also provides information on the scales' reliabilities which are satisfactory for all variables.

### Differences between the painters and control participants on examined measures

In order to examine the differences between the painters and the control group of participants, we conducted Multivariate Analysis of Covariance (MANCOVA). We set group membership as a factor, while all of the administered scales were entered as dependent variables. Participants' sex and age were set as covariates. The effect of group membership on the multivariate composite of examined variables was significant:  $\lambda = .47$ ;  $F_{(13,238)} = 20.20$ ;  $p < .001$ ;  $\epsilon^2 = .53$ . Participants' age was a significant covariate ( $\lambda = .91$ ;  $F_{(13,238)} = 1.89$ ;  $p = .032$ ;  $\epsilon^2 = .10$ ), while sex had a marginal significance ( $\lambda = .47$ ;  $F_{(13,238)} = 1.72$ ;  $p = .058$ ;  $\epsilon^2 = .09$ ). The differences on examined measures are shown in Table 2.

Table 2  
*Group differences in examined variables*

	EMMc(se)	EMMp(se)	<i>F</i>	$\epsilon^2$
Magical thinking	-.16(.09)	.15(.09)	5.67*	.02
Mania	-.07(.09)	.08(.09)	1.44	.01
Flattened affect	-.02(.09)	.02(.09)	0.12	.00
General executive impairment	-.06(.09)	.05(.09)	0.73	.00
Depression	-.09(.09)	.09(.09)	2.00	.01
Enhanced awareness	-.42(.09)	.37(.08)	43.24**	.15
Paranoia	.01(.09)	-.01(.09)	0.02	.00
Somatoform dysregulation	-.17(.09)	.15(.09)	6.02*	.02
Perceptual distortions	-.28(.09)	.26(.08)	19.39**	.07
Social anhedonia	-.32(.09)	.27(.08)	22.68**	.08
Creativity	-.34(.09)	.28(.08)	26.89**	.10
Creative productivity	-.68(.07)	.59(.06)	186.23**	.43
Intelligence	-.40(.09)	.35(.08)	39.92**	.14

*Notes.* EMMc – estimated marginal mean in the control group; EMMp – estimated marginal mean in the group of painters; *se* – standard error of estimation;  $\epsilon^2$  – effect size; \* –  $p < .05$ ; \*\* –  $p < .01$

The major findings regarding group differences are ones obtained on schizotypal traits. As can be seen in Table 2, five Disintegration modalities are

more pronounced in painters than in control participants. The group differences are highest on Enhanced awareness, followed by Social anhedonia, Perceptual distortions, Somatoform dysregulation and Magical thinking. It is notable to mention that the painters are also higher on intelligence, creativity and creative productivity. Total score on Disintegration trait was omitted from the analysis since it represents a linear composite of the ten modalities. We performed the analysis once again with the narrow modalities removed and the total score added instead of them. Painters also had a higher total Disintegration score, compared to controls:  $M_{controls} = -.25$  ( $se = .09$ );  $M_{painters} = .23$  ( $se = .09$ );  $F_{(1, 250)} = 14.50$ ,  $p < .001$ ;  $\epsilon^2 = .06$ ).

### Intragroup relations between examined variables

In order to explore the relations between the examined variables we calculated the correlation coefficients between the measures. We analyzed the relations between the variables in each group separately. Furthermore, we calculated the Fisher's z coefficient and its significance in order to obtain the measure of the difference between the correlation coefficients. This analysis is performed on the associations between schizotypal traits and creativity-linked measures, since these associations are in focus of the present study. In order to save space, we did not show the Fisher coefficients themselves, but only marked the correlations with significant differences between the groups. The matrix of these correlations is shown in Table 3.

Table 3  
Correlations between the examined variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Magical thinking		.41**	.12	.31**	.29**	.36**	.38**	.53**	.51**	.15	.64**	.03	.04	-.08
2. Mania	.58**		.02	.29**	.00	.67**	.27**	.41**	.47**	-.09	.55**	.22*	.16	.02
3. Flattened affect	.35**	.49**		.49**	.50**	-.03	.32**	.33**	.31**	.42**	.51**	-.21*a	-.18*a	.04
4. GEI	.39**	.52**	.58**		.50**	.26**	.37**	.62**	.57**	.31**	.70**	-.06	-.15	-.11
5. Depression	.22*	.14	.49**	.42**		-.03	.41**	.58**	.47**	.48**	.62**	-.16	-.26**a	-.03
6. Enhanced awareness	.63**	.61**	.48**	.60**	.22*		.18*	.45**	.57**	.12	.60**	.36**	.38**a	.16a
7. Paranoia	.49**	.50**	.53**	.51**	.54**	.52**		.46**	.46**	.18*	.57**	.06	-.07	-.06
8. SoD	.50**	.49**	.49**	.64**	.53**	.55**	.60**		.76**	.33**	.83**	.01	.04	-.05
9. Perceptual distortions	.65**	.64**	.61**	.65**	.45**	.72**	.65**	.72**		.41**	.87**	.09	-.04	-.00a
10. Social anhedonia	.22*	.09	.36**	.33**	.46**	.17	.32**	.35**	.27**		.52**	-.06	-.19*	-.02
11. Disintegration total	.70**	.71**	.75**	.77**	.60**	.76**	.77**	.79**	.88**	.46**		.07	-.02	.01
12. Creativity	.13	.15	.04a	-.07	-.02	.24**	.06	.10	.11	.05	.10		.21*	.06
13. Creative productivity	.20*	.09	.06a	.00	.05a	.17a	.08	.01	.06	.01	.09	.25**		.15
14. Intelligence	-.22*	-.18*	-.02	-.08	-.02	-.14a	-.16	-.10	-.21*a	.07	-.16	.01	.05	

Notes. GEI – General executive impairment; SoD – Somatoform dysregulation; \* –  $p < .05$ ; \*\* –  $p < .01$ ; a – correlations with significant differences between the groups (Fisher's z is significant at least on the level of  $p < .05$ , one-tailed); Correlations in the control group are shown below the diagonal; correlations in the group of painters are shown above the diagonal

The measures of schizotypal traits are positively related in both groups, as expected. However, there are some differences between the groups in relations between schizotypy and measures of creativity. One of the major differences is obtained on the schizotypal trait of Enhanced awareness. The associations between this trait, Creative productivity and Intelligence are higher in the group of painters. Depression is positively related to Creative productivity in the control group, while it has a negative association with this measure of creativity in painters. Flattened affect is negatively associated with the measures of creativity in painters; these links are positive in the control group and there is statistical difference between the correlation coefficients in the groups. Finally, there is a difference between the association of Intelligence and Perceptual distortions in two groups: these two measures are more negatively related in the control group. We also searched for the quadratic relations between the measures of schizotypy and creativity in both groups separately and in a whole sample; however, no quadratic relations were found.

Since both schizotypy and intelligence/creativity measures inter-correlate, we decided to explore their relations in a multivariate analysis, as well. We chose Principal Component Analysis (PCA) as a method for analyzing the relations between the variables. PCA was conducted in each group separately. Guttman-Kaiser criterion and parallel analysis converged to the three-factor solution in both groups. Latent components were then rotated in promax position. The pattern matrix of extracted components is shown in Table 4.

Table 4  
*Principal component analysis of schizotypy and intelligence/creativity measures*

	Control group			Painters		
	1	2	3	1	2	3
eigen value	5.46	1.57	1.35	4.35	2.36	1.45
% of variance	42.03	11.92	9.84	33.45	18.15	9.68
Magical thinking	.82			.34	.33	-.32
Mania	.88				.73	
Flattened affect	.40	.50		.81	-.30	
General executive impairment	.56	.35		.73		
Depression		.84		.87		
Enhanced awareness	.88				.91	
Paranoia	.56	.36		.52		
Somatoform dysregulation	.56	.39		.71		
Perceptual distortions	.82			.69	.39	
Social anhedonia		.81		.75		.30
Creativity			.74		.60	
Creative productivity			.76		.67	.35
Intelligence	-.58	.50	.30		.35	.91
1	1			1		
2	.47**	1		.27**	1	
3	.01	-.04	1	-.29**	-.32**	1

*Note.* the loadings <.30 are omitted from the table; correlations between the extracted components are shown in the lower part of the table; \* –  $p < .05$ ; \*\* –  $p < .01$



The first component in the control group is heavily saturated by differentially-diagnostic indicators of psychosis and low intellectual abilities. Hence, it can be interpreted as *core schizotypy*. The second one is mostly loaded with neurotic symptoms (Depression and Social anhedonia), with the positive contribution of intelligence. It can be labeled as *neurotic disintegration*. The third component is constituted of intelligence and creativity measures, and can be labeled as *intelligence/creativity*. There is a strong correlation between the first and second component, while the third one is independent from them.

The saturations of the variables in the group of painters are importantly different. The first component is loaded with schizotypy measures and might be labeled as *disintegration*. Measures of creativity and creative productivity have the highest loadings on the second component. However, it is also positively loaded by Enhanced awareness, Mania, Perceptual distortions, Magical thinking and intelligence, and negatively by Flattened affect. Thus, it can be interpreted as *schizotypal creativity*. The third component is almost exclusively saturated by intelligence, with low positive loadings of Social anhedonia and Creative productivity, followed by the negative contribution of Magical thinking; it can be labeled as *intelligence*. The first and second components are positively correlated, while the third one is negatively associated with both of them.

## Discussion

The main goals of the present research were to analyze the levels of schizotypy in painters and the control group, and to explore the relations between schizotypy and intelligence/creativity measures in both groups. Results of the research largely supported both of the proposed hypotheses: schizotypy was more pronounced in the group of painters than in controls; schizotypy was more closely related to the measures of creativity and intelligence in painters.

The deviations of Disintegration modalities from normal distribution are worth mentioning. Depression, Somatoform dysregulation, Perceptual distortions and Social anhedonia had significantly positively skewed distributions. This means that the majority of participants do not have these experiences or have them to a small extent. This result is largely in accordance with the previous research regarding the distributions of Disintegration modalities (Međedović, 2013). It implies that, although schizotypy is a continuous measure (Rawlings, Williams, Haslam, & Claridge, 2008), and its total score is normally distributed, there are schizotypal characteristics which are fairly rare in the general population.

### Schizotypal traits in painters

The study results showed that Disintegration was more highly pronounced in painters generally. Five of its modalities were elevated in painters: Enhanced awareness, Somatoform dysregulation, Perceptual distortions, Magical thinking and Social anhedonia. Regarding the first four traits, results are largely in

accordance with the data obtained in previous research. Earlier studies also found that painters tend to have unusual experiences to a higher degree (Preti & Vellante, 2007), together with synesthesia (Nelson & Rawlings, 2010). The only finding which deviates from previous results is a higher level of Social anhedonia: previous studies found that artists have lower anhedonia regarding social interactions (Nettle, 2006). Social anhedonia could be understood as an extreme (and possibly maladaptive) aspect of introversion (negative pole of Extraversion personality dimension: Međedović, 2013). The data regarding the link between the Extraversion-introversion trait and creativity is ambiguous. The data of personality traits in painters lead to the conclusion that artists are more introverted individuals (Haller & Courvoisier, 2010), which is in accordance with the current research. However, in correlational research it is often found that Extraversion has positive relations with creativity (Wolfradt & Pretz, 2001). It seems that the nature of the research design and the type of measured creativity (e.g. the performing arts are probably positively related to Extraversion) could be an important moderator of the relation between the Extraversion trait and creative behavior.

### **Schizotypy and creativity in painters**

Previous studies of schizotypy in visual artists were focused on differences in psychotic-like traits in artists and some control participants. We expanded this design by analyzing the associations between schizotypy and creativity-linked variables as continuous measures. This allowed us to explore whether there were differences in schizotypy-creativity link among painters and non-painters. Indeed, such differences were found. Different relations were found both in bivariate and multivariate analyses of the schizotypy-creativity link; furthermore, correlational analysis and PCA produced congruent results. When analyzing latent relations between variables, it can be seen that creativity and schizotypy are not related in the control group, or their relations are smaller in magnitude than in the group of painters. PCA provided additional results which suggested that creativity measures were primarily associated with intellectual abilities. This finding replicates previous data of positive relations between intelligence and creativity (Batey & Furnham, 2009; Miller & Tal, 2007).

Correlation analysis showed that the creative potentials in the group of painters are mostly related to Enhanced awareness and Mania as schizotypal traits. However, PCA provided more associations between the measures. The second latent component in painters, which comprised creativity and intelligence, was positively loaded with Enhanced awareness, Perceptual distortions, Magical thinking and Mania and negatively with Flattened affect. Both the data from group differences and associations between schizotypy and creativity are in accordance with the meta-analytical findings on the link between positive psychotic characteristics and creative abilities (Acar & Sen, 2013; Baas et al., 2016).

Our data suggests that enhanced awareness is the crucial psychotic-like trait when it comes to the relations between schizotypy and creativity: the highest

group differences are found on this trait and it had the highest correlations with creativity measures and the highest loading on the *schizotypal creativity* latent component. This trait represents synesthesia, absorption and immersed contact with reality, thus enabling individuals to have heightened awareness of physical objects. Previous research also found that synesthesia is an important source of creativity (Rothen & Meier, 2010; Ward, Thompson-Lake, Ely, & Kaminski, 2008). Synesthesia represents multimodal perception or the unusual link between cognitive processes and perception. It can lead to experiences like seeing color in black and white stimuli or sounds, associating sounds with visual stimuli etc. Creativity is often defined as linking unrelated concepts or generating novel associations and hence the relation between synesthesia and creativity is not surprising (Ramachandran & Hubbard, 2003). Because of cross-modal perception, synesthetes tend to have a particularly rich experience of reality which can represent a motivation for engaging in art (Ward et al., 2008). However, the link between synesthesia and art is probably bi-directional: synesthesia can be a disposition for creating art but it can be generated and triggered by studying and training art, as well (Rothen & Meier, 2010). Synesthesia and absorption facilitate the flow experience which also represents a rich and fruitful base for creative endeavors (Nelson & Rawlings, 2010).

Our data suggest that painters probably use their schizotypal experiences as a creative force in comparison to non-painters. It is interesting to mention that the two analyses conducted in the present study are not completely congruent. Social anhedonia and Somatoform dysregulation were more highly expressed in painters but they are not closely related to creativity and creative productivity. This implies that not all schizotypal features that are more elevated in painters can be transformed into creativity: feelings of body conversion and an inability to enjoy social interactions are not the psychotic-like traits which represent the basis for creative behavior.

### **Entropy, schizotypy and art**

When analyzed from the perspective of systems theory, it is plausible to conceptualize schizotypy as entropy in the psychological system, since it elevates chaos in cognitive and affective processes. Thus, it seems that certain levels of chaos in the system are not detrimental for psychological functioning: in fact, they might produce novel and original responses. Small packages of entropy probably prevent the system from becoming rigid and closed in a relatively low number of responses (Ognjenović, 1997). However, then we could expect that there is a point where levels of schizotypy stop being productive and generate maladaptive behavior. Indeed, previous studies show that the relation between schizotypy and creativity is not linear, but that it has the shape of an inverted U curve (Nelson & Rawlings, 2010). The highest point of such a curve probably represents the threshold, which, if over-stepped, produces dysfunctional cognition, emotional reactions and behavior. Thus, a system marked with creative characteristics is functioning at the “edge of chaos” (Richards, 2000–2001): using entropy

to enhance complexity and produce novel and idiosyncratic behavior. This is the reason why we searched for the quadratic relations between schizotypy and creativity in the present research as well. These relations were not found, however, we should be cautious of this finding because of two reasons: 1) the overall sample size is rather small for analyzing non-linear relations between the variables; 2) it is possible that the quadratic relations could be detected only if there are participants with high levels of schizotypy in the sample (e.g. patients with diagnosis from the psychosis-schizophrenia spectre) which are not present in the current research.

### **Limitations and future directions**

The strengths of the present study are based on integrating a quasi-experimental and correlational approach. Nevertheless, the current research has certain limitations as well. The sample size in each group was not large, which might have facilitated the probability of a type 2 error. This is especially troublesome for the tests of the between-groups correlations differences. Creativity was measured via a single, self-report scale, which cannot provide objective data on creative abilities. Productivity measure was focused on the frequency of creative behavior and not its quality (originality or esthetic characteristics). Using some objective or rating measures in research design would solve another potential problem which is the social desirability of participants' responses. There is a possibility that not only the self report measures of creative potentials can be exaggerated in painters, but the psychotic-like experiences as well: the narrative of the insane genius could motivate some painters to over-represent their psychopathological characteristics, as a part of artistic unconventionality (Murphy, 2009). All of these aspects should be investigated in future research. Future studies should also invest additional effort in defining moderators of schizotypy-creativity link. It would be very informative, both for theory and practice, to identify the conditions which lead some schizotypal individuals to mental illness and others towards creativity and art.

### **Concluding remarks**

The results of the present research further corroborate the evidence of the link between psychotic-like characteristics and creativity. Together with the previous data, it leads to the conclusion that schizotypy can have adaptive features, at least at certain levels (Mohr & Claridge, 2015). The most important schizotypal feature with regards to creativity is Enhanced awareness, depicting synesthesia, absorption and immersion into reality. However, there are other, differentially diagnostic markers of psychosis, which are linked to generating art, like Perceptual distortions, Magical thinking and Mania. These unusual experiences, most often considered pathological and dysfunctional, obviously can lead to novel and original perceptions and understanding of reality, which could further facilitate creative behavior as well. Perhaps these findings can be

implemented in the teaching of art as well. Encouraging students to develop certain non-pathological aspects of schizotypy, such as Enhanced awareness, could lead to novel ways of creative expression and enrich the artistic productivity. It certainly worked in the case of surrealists, who made some exceptional works of art guided by Dali's paranoiac-critical method. Perhaps the methods of surrealists could be readdressed using the novel psychological findings of the structure and content of schizotypal traits.

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