PERSONALITY TRAIT CORRELATES OF COLOR PREFERENCE IN SCHIZOPHRENIA

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Abstract

Background: The goal of the present study was to evaluate the color preferences of patients with schizophrenia and their correlations with personality traits. Methodology: Sixty-three patients with schizophrenia and 59 healthy volunteers were asked to undertake the color preference and the Zuckerman-Kuhlman Personality Questionnaire (ZKPQ) tests. Results: The healthy volunteers showed a greater preference for green but a lesser one for brown compared to the patients with schizophrenia. Patients scored higher than the healthy volunteers on the ZKPQ Neuroticism-Anxiety and Activity scales. Moreover, in patients, black preference ranking was associated with the Neuroticism-Anxiety, whereas pink and orange preferences were negatively associated with Activity; white preference correlated negatively with Sociability. Conclusions: Patients with schizophrenia preferred green less but brown more, and displayed their personality correlates of these color preferences. These findings are suggesting that patients with schizophrenia should be encouraged to be more exposed to bright colors such as green and white, and less to dark colors such as black, during therapy and rehabilitation sessions.

Introduction

Schizophrenia is a group of mental illnesses of unknown etiology. There is much evidence to indicate that the biological factors, in particular genetic factors, play an important role in the pathogenesis of schizophrenia, such as heat shock protein 70 and microRNA-137 [1,2]. In addition, some external environmental factors (stimuli) may also be associated with schizophrenia [3,4]. For example, immigration, childhood trauma, urbanization, negative life events, and substance abuse could increase the risk of schizophrenia [5-8].

Color can be a representation of an external stimulus, and research on the relationship between color preferences and schizophrenia has thus far shown inconsistent results. For instance, green generally represents nature, health, safety, and comfort, and thus working in a green building may increase health and productivity; moreover, a green environment can increase the level of physical activity, and reduce fatigue, obesity, cardiovascular disease, etc. [9,10]. Kim et al. [11] found that healthy participants tend to prefer green. Although Holmes et al. [12] found that patients with schizophrenia showed no particular preference

for green, Kuloğlu et al. [13] described a prominent green preference in these patients. Furthermore, some reports showed that there was no difference in the color preferences between schizophrenia patients and healthy people [14,15].

One of the potential reasons for these inconsistent findings of color preferences in schizophrenia might be an underlying correlation with personality traits. For example, introverted people tend to prefer blue, extroverted people prefer red, conceited people are fond of yellow, and aggressive people also prefer red [16,17]. Patients with schizophrenia have particular personality traits [18] such as neuroticism [19,20]. However, no study has examined the correlation between color preferences and personality traits in patients with schizophrenia.

Based on the above findings, we hypothesized that patients with schizophrenia would have specific color preferences, which would be related to their personality traits. Information on the color preference of patients with schizophrenia has applications for ward and household decoration, clothing choices, and pharmaceutical packaging, which could help to strengthen the management of

patients, promote their mental rehabilitation, and restore general social function.

Methods

Participants

Patients with schizophrenia (F20.901): 63 hospitalized patients with schizophrenia, who were diagnosed by a psychiatrist according to the International Classification of Diseases, Tenth Revision (ICD-10) [21] criteria, were invited to participate in the experiment. Among the 63 patients, there were 32 men and 31 women, with an average age of 27.4 ± 9 (mean ± SD) years, and average years of education of 11.1 ± 2.6 years. Fifty-nine healthy volunteers were recruited from hospital staff and residents from the community, including 21 men and 38 women, with an average age of 27.8 ± 7.7 and average years of education of 12.0 ± 2.7. Neither patients nor healthy volunteers were familialy-related. Moreover, all patients were medicated at a regular dose with antipsychotics such as olanzapine, risperidone, and quetiapine, but did not receive other therapies such as social training during the tests.

All participants accepted the color-blindness test before the experiment to

rule out the disorder of achromatopsia or hypochromatopsia. Other exclusion criteria were as follows: organic mental disorders, schizoaffective psychosis, mental disorders due to the use of psychoactive substances, mental disorders due to physical illness, and mental disorders due to other disease.

There was no significant difference in age (t = - 0.22, P = 0.83), gender (Pearson's chi-square = 2.87, P = 0.09), or education (Mann-Whitney test: U = 1497.00, Z = -1.95, P = 0.052) between the two groups. The study was conducted in accordance with the Helsinki Declaration. This study obtained approval from a local ethics committee, and all the participants signed informed consents before experiments.

Measures
Color preference scoring

Participants entered a dark room that was illuminated by 40-Watt fluorescent lamp. Participants sat 50 cm in front of computer monitor (resolution: 1280 × 800 pixels, 75 Hz vertical refresh rate). The background color of the screen was kept constantly in gray (Red: 153; Green: 153; Blue: 153; Hue: 0; Saturation: 0; Brightness: 60). The color was formulated using the Adobe Photoshop CS3 extended edition software (Adobe Systems, San Jose, CA, USA; see Table 1 for red, green, blue, hue, saturation, and lightness parameters of each color). The 11 colors were shown on the display in the form of a 2.5 × 2.5 cm². At the beginning of the experiment, the participants were given 3 min to adapt to the background color, and 3 min later were asked to score the 11 colors from a scale of 1 to 11 according to their degree of preference among the colors. In this assignment, a score of 11 represents the most preferred color, and a score of 1 represents the least preferred color.

Questionnaire

After the color preference test, the subjects entered another room to take the ZKPQ [22] to test their personality traits. The ZKPQ provides five basic normal personality traits measurements: (a) Impulsive sensation seeking (19 items), (b) Neuroticism-Anxiety (19 items), (c) Aggression-Hostility (17 items), (d) Activity (17 items), and (e) Sociability (17 items), as

well as another 10 items to measure the Dissimulation. The structure of the ZKPQ has been proven to be reliable in Chinese culture [23].

Statistics

SPSS statistics 22 software (SPSS Inc., Chicago, IL, USA) was adopted to analyze all data. We used the Mann-Whitney U test to compare differences in color preference between the two groups. ZKPQ scores between the two groups were analyzed by repeated measures analysis of variance (ANOVA); when positive results were found, we used one-way ANOVA to test the differences in scores between groups. Multiple linear regression analysis (step-wise method) was employed to analyze the correlation between each ZKPQ factor and color preferences, age and gender were also included as independent variants. A P value less than 0.05 was considered as statistically significant.

Results

Healthy volunteers preferred green more but brown less compared to the patients with schizophrenia. There were no significant differences in the degree of any other color preferences (Table 2). Repeated measures ANOVA indicated that the two groups differed in their ZKPQ scores ($F_{1,120}$ = 4.47, P = 0.04, the mean square of the error, MSE = 61.55). Subsequent ANOVA showed that the scores of patients with schizophrenia were significantly

higher on Neuroticism-Anxiety (F = 5.74, P = 0.02, MSE = 98.46) and Activity (F = 5.94, P = 0.02, MSE = 43.02) than those of the healthy volunteers, whereas there was no difference in the scores of Impulsive sensation seeking (F = 1.67, P = 0.20, MSE = 18.30), Aggression-Hostility (F = 0.11, P = 0.74, MSE = 0.90), or Sociability (F = 1.74, P = 0.19, MSE = 17.35) between groups (Table 3; also see the last column of Table 2). The multiple linear regression analyses showed that in patients, black preference predicted Neuroticism-Anxiety (n = 63, adjusted R^2 = 0.07, β = 0.29, P = 0.02), but pink (adjusted R^2 = 0.11, β = - 0.26, P = 0.04) and orange (β = - 0.25, P = 0.05) preferences negatively predicted Activity; white preference negatively predicted Sociability (adjusted R^2 = 0.09, β = -0.33, P = 0.01). No significant association between ZKPQ personality traits and color preferences was found in the healthy volunteers.

Discussion

The results of the present study demonstrated that healthy volunteers preferred green to a greater extent but brown to a lesser extent than did patients with schizophrenia. Patients scored higher on the ZKPQ Neuroticism-Anxiety and Activity. Moreover, the patients' black preference positively correlated with Neuroticism-Anxiety, whereas pink and orange preferences negatively correlated with Activity; white preference negatively correlated with Sociability.

Table 1. The chromatic scheme values of Red-Green-Blue and Hue-Saturation-Brightness for the 11 colors used.

Color	Red	Green	Blue	Hue	Saturation	Brightness
Black	0	0	0	0	0	0
White	255	255	255	0	0	100
Grey	153	153	153	0	0	60
Brown	153	0	0	0	100	60
Red	255	0	0	0	100	100
Pink	255	204	204	0	20	100
Orange	255	153	0	36	100	100
Yellow	255	255	0	60	100	100
Green	0	255	0	120	100	100
Blue	0	0	255	240	100	100
Purple	255	0	255	300	100	100

Table 2. Color preference (mean ± SD) in patients with schizophrenia and healthy volunteers. The significant differences are identified in boldface.

Color	Schizophrenia (n = 63)	Healthy volunteers (n = 59)	Mann-Whitney test		Associated personality in patients
			U	P	
Black	5.52 ± 3.43	4.90 ± 3.26	1695.50	0.40	Neuroticism-Anxiety
White	5.75 ± 3.32	5.64 ± 2.83	1858.00	1.00	Sociability (-)
Grey	4.27 ± 2.76	3.93 ± 2.77	1692.50	0.39	
Brown	3.63 ± 2.13	3.00 ± 2.24	1416.50	**0.02**	
Red	7.00 ± 3.20	6.10 ± 3.18	1551.00	0.11	
Pink	5.59 ± 3.15	5.98 ± 3.18	1731.00	0.51	Activity (-)
Orange	6.48 ± 2.99	7.05 ± 2.86	1651.50	0.29	Activity (-)
Yellow	7.00 ± 2.97	7.49 ± 2.71	1681.50	0.36	
Green	7.21 ± 2.80	8.25 ± 2.50	1426.00	**0.03**	
Blue	7.71 ± 2.83	6.88 ± 2.66	1490.00	0.06	
Purple	5.84 ± 2.68	6.78 ± 2.59	1480.50	0.05	

Note: The last column indicates the color-associated personality traits measured by Zuckerman-Kuhlman Personality Questionnaire in schizophrenia patients.

We found that healthy volunteers preferred green, which is consistent with some previous studies. Traditional economists have deemed that green is associated with economy, material comforts, and environmental protection; moreover, status motivation and altruism tend to encourage a preference for green [24]. In addition, patients preferred brown to a greater extent, which might attribute to the frequent comorbidity of depression and schizophrenia [25,26], since the elevated response to brown was linked to depression, dull or other negative emotions [27,28]. The results of Cernovsky and Fernando [14], and Sadr and Mohammad [15], indicated that there is no difference in the color preference between patients with schizophrenia and healthy volunteers, which is inconsistent with our results. This discrepancy is probably due to the difference in testing methods. Both previous studies used the Rosser color test; however, the former adopted the ICD-9 standard, whereas the latter used the DSM-IV standard for a diagnosis of schizophrenia. In addition, the sample size of Cernovsky and Fernando's study [14] was comparatively small (20 patients and 24 healthy volunteers).

Patients scored higher on the ZKPQ Neuroticism-Anxiety and Activity than healthy volunteers. This is consistent with previous findings. Berenbaum and Fujita [29] and Camisa et al. [30] revealed that patients with

Table 3. Scale scores of Zuckerman-Kuhlman Personality Questionnaire (mean ± SD) in patients with schizophrenia and healthy volunteers.

	Patients with schizophrenia (n = 63)	Healthy volunteers (n = 59)
Impulsive sensation seeking	7.32 ± 3.35	6.54 ± 3.27
Neuroticism-Anxiety	7.98 ± 4.13*	6.19 ± 4.16
Aggression-Hostility	5.97 ± 3.09	5.80 ± 2.48
Activity	8.22 ± 2.87*	7.03 ± 2.49
Sociability	7.38 ± 3.15	8.14 ± 3.17

Note: *p < 0.01 vs. healthy volunteers

schizophrenia show characteristics related to Neuroticism-Anxiety. Sotiropoulou et al. [20] demonstrated that the Neuroticism-Anxiety trait of patients with schizophrenia is associated with low levels of brain-derived neurotrophic factor. Moreover, patients with high levels of Neuroticism-Anxiety often have negative emotions that are characteristic of schizophrenic behavior such as nervousness, anxiety, worry, fear, and also seeking to avoid harm, which is related to Neuroticism-Anxiety [31]. In addition, the schizophrenia group scored higher for Activity than the healthy volunteers did, which is also supported by the results of some previous studies. Smits et al. [32] found

that increased activity could reduce anxiety sensitivity in patients with schizophrenia, and Pajonk et al. [33] suggested that increased activity could have a protective effect on neurons in patients with schizophrenia. These findings suggest that high activity may be a self-protective mechanism in patients with schizophrenia.

In the present study, the patients' black preference positively correlated with Neuroticism-Anxiety. Black is considered to be associated with depressive and anxious traits [34,35]; thus, patients with schizophrenia tend to have a higher preference for black and show higher levels of Neuroticism-

Anxiety. Quite the opposite, the white color is usually associated with the clean, pure, harmonious, and refreshing concepts, often being classified into "cool" colors together with green and blue, and preferred in many cultures, including Eastern culture [36]. Schizophrenia patients scored higher on shyness, retrospective inhibition and harm avoidance [37], and reported to prefer green significantly more (although not white) in our study, which might help us to understand the negative association between Sociability and white (a cool color) preference in this disorder. Previous results have shown that pink and orange are generally preferred by the extraverted people [38]. Orange is associated with reports of exciting, stimulating and warm [38,39], yet it is associated with the disturbed/distressed emotion or aggression [40]. As compounds of red and white [41], pink in current study is closer to white than red, which hints inclination of introverted traits. The documentation might help to elucidate the pronounced negative association between Activity and the pink and orange preferences in schizophrenia.

There are some limitations to this study that we acknowledged. First, we did not consider the mood state of participants during the test, and we are still uncertain about whether different mood states could lead to different results. Second, because of the relatively small sample sizes and limitation of color types, we did not detect any relationships between Neuroticism - Anxiety/Activity and the green/brown preference rankings in patients. Therefore, our findings should be confirmed further after expanding the samples. Third, this study was conducted among Han Chinese only, thus the results also need to be confirmed among other ethnicities or cultures. Fourth, we did not control the medication effect on the color preference. Nevertheless, most medications prescribed to patients were second-generation antipsychotics, which would have little effect on cognition [42].

In conclusion, this study found that patients with schizophrenia did not prefer green, and their high level Neuroticism-Anxiety trait positively correlated with black preference (black is regarded as an oppressive and anxious color). These results suggest that patients with schizophrenia should have more contact with green and less contact with black. This study provides experimental evidence for how to design a household environment color scheme for patients with schizophrenia. In the future, we will study how to effectively reduce the Neuroticism-Anxiety of patients with schizophrenia in order to improve their quality of life.

Acknowledgments

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