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Can persons with schizophrenia appreciate visual art?

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Abstract

The way schizophrenia patients perceive the world is largely mysterious. Understanding and appreciating the visual world begins with the perception of basic visual features, which is altered in this mental disorder. Yet, the roles basic visual features play in functional activities such as appreciation of art are unclear. This study examined the effects of visual feature manipulation on beauty perception of art in schizophrenia patients ($n=29$) and in normal controls ($n=30$). Three pieces of art - The Starry Night (Van Gogh), Mona Lisa (Da Vinci) and a natural landscape photograph (anonymous) - were manipulated in terms of their coloration (removal of color), spatial frequency content (low or high-frequency pass) and visual noise level (with added noise). Subjects judged the beauty of the original and visual-feature-manipulated artworks by rating each piece individually (1 to 7) and by ranking all pieces from most to least beautiful. For the three original art pieces, averaged ratings and rankings were similar in patients and controls. However, when the visual features of the original pieces were manipulated, changes in the beauty ratings were significantly smaller in patients. The reduced sensitivity to visual feature manipulations suggests that the modulation of basic visual signals, often used for vivid and dynamic expressions in art, may be under-appreciated in schizophrenia.

Keywords

vision; schizophrenic; painting; aesthetic judgment

Introduction

Art is an essential and unique aspect of human experience, regardless of an individual's psychological well-being. However, the valuation of art and its underlying biological and behavioral processes are likely to differ between healthy individuals and those who have mental disorders. For this reason, the production and appreciation of art may serve as a window into how the brain perceives and values the visual world (Livingstone 1988; Cavanagh 2005). Patients with schizophrenia produce art that contains visual attributes (such as color, form and configuration) of an extraordinary nature (Hacking and Foreman 2001). Yet, the art produced by patients, while appearing different from that produced by healthy individuals, cannot be easily assessed, as was initially thought (Rao and Keshavan 2006).

Appreciation of art remains largely unexplored in schizophrenia. While many levels of information processing - e.g. encoding visual features, integrating perceptual elements,

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attaining concrete and abstract meanings -, contribute to art appreciation (Leder, Belke et al. 2004), the roles of visual features are especially interesting because of their established connections to specific functional units in the brain. As a vision-related cognitive endeavor, appreciation of art inevitably depends upon the processing of visual information.

Visual perception of simple objects is deficient in schizophrenia (O'Donnell, Swearer et al. 1996; Butler and Javitt 2005; Chen, Bidwell et al. 2006). Patients show reduced abilities in contrast detection (Slaghuis 1998; Keri, Antal et al. 2002), motion discrimination (Stuve, Friedman et al. 1997; Chen, Nakayama et al. 1999), spatial integration (Silverstein 2000; Chen, Norton et al. 2008) and depth perception (Schechter, Butler et al. 2006). However, the impact of deficient processing of basic visual features on vision-related daily functions in general, and appreciation of art in particular, is poorly understood. This study focused on one aspect of art appreciation – beauty perception. We evaluated the effects of modulating various visual features on the aesthetical judgments of three pieces of art in schizophrenia patients.

Methods

Subject

Twenty-nine patients and 30 normal controls participated. Eleven patients had a diagnosis of schizophrenia and 18 patients had a diagnosis of schizoaffective disorder. Diagnoses were based on a structured clinical interview (Spitzer 1994) and a review of all available medical records. In the controls, the absence of Axis I psychiatric disorders was assessed using a standardized interview based on the SCID-NC (First, Spitzer et al. 2002). Table 1 and Table 2 provide demographic information for the sample and clinical information for the patients, respectively.

Procedure

Three pieces of art were selected: 1) The Starry Night (Van Gogh), an impressionist production of a natural scene, 2) a landscape photograph (anonymous), a realistic production of a natural scene and 3) Mona Lisa (Da Vinci), an artistic portrait. Visual feature manipulation was implemented via Adobe Photoshop (Ver 5.0, 1998; Adobe Systems Inc.), and consisted of either 1) the removal of color (black/white), 2) addition of noise (noisy), 3) filtering out of high spatial frequency components (low pass), 4) filtering out of low spatial frequency components (high pass), or 5) clumping neighboring pixels into a solid color in polygon form (crystallized). Figure 1 illustrates one piece of original artwork (a landscape photo) and its visual-feature-manipulated corollaries.

Beauty perception of the original and the visual-feature-manipulated images was measured using two types of aesthetical judgments: 1) Rating - After free viewing a particular image, subjects ascribed it a value based on its beauty (1 to 7, one for very beautiful and seven for not very beautiful); 2) Ranking – After free viewing a set of six images, the original art piece and its five variants (each of them containing one visual feature manipulation), subjects arranged the order of each set of the images, based on their relative beauty (1 to 6, one for the most beautiful and six for the least beautiful).

Basic visual processing was assessed using a contrast detection paradigm (Chen, Palafox et al. 1999). Briefly, the task was to detect the presence of low contrast gratings (0.5 c/deg and 6 Hz). The performance was measured by the threshold, or minimum level of visual contrast at which a performance accuracy of 79% correct was achieved.

Results

Patients and controls did not differ significantly in their ratings of each of the three original pieces ($t = 0.96$, $p = 0.34$ for The Starry Night; $t = 0.02$, $p = 0.99$ for the landscape; $t = 1.05$, $p = 0.30$ for Mona Lisa) (Fig 2). The rankings of each original and its visual-feature-manipulated images were also similar between groups (Fig 3).

To test whether the visual manipulations changed beauty ratings, an ANOVA, with artwork (The Starry Night, the landscape and Mona Lisa) and manipulation (original, black/white, high-pass, low pass, noisy, crystallized) as factors, yielded significant effects of 1) manipulation ($F(1,4) = 62.6$, $p < 0.001$ for controls; $F(1,4) = 19.4$, $p < 0.001$ for patients) and 2) artwork ($F(1,2) = 17.7$, $p < 0.001$ for controls; $F(1,2) = 5.2$, $p = 0.006$ for patients). The interaction between manipulation and artwork was also significant ($F(1,1) = 20.2$, $p < 0.001$ for controls; $F(1,1) = 4.9$, $p < 0.001$ for patients).

To test whether the effects of visual manipulations differed between groups, we analyzed the change of beauty rating, i.e. the difference of rating between the original and the visual-feature-manipulated images. ANOVA with group (patient v. control), artwork and manipulation showed significant effects for group ($F(1,1) = 4.9$, $p = 0.027$), artwork ($F(1,2) = 7.01$, $p < 0.001$) and manipulation ($F(1,4) = 65.4$, $p < 0.001$) (Fig 4). The interactions among the three factors were not significant except for the one between artwork and manipulation ($F(1,1) = 25.3$, $p < 0.001$), indicating the effect of visual feature manipulation depended on the selection of artworks. When controls were compared only to patients with schizophrenia ($n = 11$), i.e. excluding those with schizoaffective disorder ($n = 18$), the group difference was highly significant ($F(1,1) = 14.9$, $p < 0.001$).

Contrast detection thresholds were higher (worse performance) in patients ($n = 16$) than in controls ($n = 15$), though the group difference did not reach a statistical significance level ($t = 1.93$, $p = 0.06$).

In patients, the changes of beauty ratings were not correlated with verbal IQ, education, PANSS scores or CPZ level. The changes of ratings were, however, significantly correlated with illness duration ($r = 0.48$, $p < 0.01$).

Discussion

The present study showed that while general aesthetic judgments of art in patients are not abnormal, their perceptual sensitivity to visual feature modulation of art is significantly reduced.

Art and visual feature modulation

The juxtaposed results of similar overall ratings and different rating changes between groups seem paradoxical. To understand this paradox, one must recognize that appreciation of art relies not only on visual information presented but also on the inner workings of the brain beyond the encoding of visual features. If aesthetic judgments in schizophrenia were affected only at a cognitive level, one would predict similarly compromised beauty perception of original and visual-feature-manipulated arts in patients, since the two tasks would differ only in terms of the visual information presented. The mere presence of compromised perception for the visual-feature-manipulated art suggests that basic visual signals play a less significant role in rendering the aesthetic judgments made by patients. Artists often use subtle manipulations of visual features to express vividness and dynamics of the world. Patients' reduced sensitivity to visual feature changes may compromise appreciation of other artworks in which beauty is conveyed more by means of such subtle visual manipulations.

The comparable aesthetical judgments on the original arts may be related to the fact that these selections all contained salient visual features (such as color, contrast and expression of movement). If the external visual input was not as salient, abnormal beauty perception might have emerged in patients. A limitation of this pilot study is that only one fixed (and generally small) magnitude of manipulation was used for each visual feature. The extent to which patients' appreciation of the art depends upon the magnitude of visual feature manipulation should be explored in future studies.

Cognitive functioning with weakened visual inputs

One impact of reduced visual sensitivity is that the information conveyed in subtle visual feature changes may not be adequately appreciated at cognitive levels. This disconnect may relate to the finding that schizophrenia patients have difficulty understanding visual jokes as depicted in cartoons (Corcoran, Cahill et al. 1997). Such a difficulty may arise from impairment in the analysis of mental states of the characters presented in the cartoons. However, the reduced sensitivity to visual feature changes might also play an adverse role in the analysis of physical features of the characters and in understanding the visual humor.

Art is usually meant to influence the perception and perspective of an audience. When producing art, reduced visual sensitivity may lessen patients' desire to incorporate realistic visual elements. Art produced by patients frequently contains odd features and organizations, such as the shifting and flattening of spatial planes, unconventional association of subjects and ideas, and obsessive elaboration of fantasy (MacGregor 1989; Harris 2004). The extraordinary form and content may facilitate or hinder communication through artworks.

Appreciation of art, by its nature, is a reward process which can be framed in terms of 'wanting' and 'liking' components (Berridge 1996). Whether visual processing in schizophrenia is more or less related to one component (e.g. 'wanting') than to another (e.g. 'liking') is a question that merits further investigation.

Appreciation of art and translational neuroscience

Beauty perception involves a series of cortical systems from the occipital to the frontal areas (Kawabata and Zeki 2004). For basic visual processing, this and previous studies (Slaghuys 1998; Keri, Kiss et al. 2005) showed reduced sensitivity to simple objects in patients, consistent with the notion that early visual processing dysfunction in schizophrenia impacts the appreciation of visual feature changes during aesthetical judgment. Similar ratings of the original artworks in patients and controls seem to suggest that, beyond visual processing, the cortical systems involved in beauty perception of art are spared in schizophrenia. One puzzle here is how the putative cognitive processing receives inadequate visual input, but still manages to make comparable aesthetical judgments. A recent study on cortical processing underlying visual motion perception showed that with equivalent perceptual performance to controls' (via adjusting visual signal strength), patients not only had decreased activation in the occipital cortex, as expected, but also increased activation in one prefrontal area, suggesting a differential involvement of cognitive processing (Chen, Grossman et al.). How cognitive processing is involved in aesthetic judgment remains to be explored in schizophrenia.

Another implication of the compromised perception of visual feature change may be found within the domain of affective processing. Perception of geometrically-deviated figures in art is related to attributions of positive and negative emotions (Pavlova M 2005). For this reason, abnormal emotional states (such as anhedonia) and poor emotion recognition in patients (Heimberg, Gur et al. 1992; Hooker and Park 2002; Holt, Titone et al. 2006) could affect aesthetic judgment of beautiful or ugly images, but did not appear to be a significant factor here, as the ratings of original artworks were similar between the groups.

As a disorder of the brain, schizophrenia interferes not only with physical well-being, but also with the mental, social, and spiritual lives of those affected (Green 2006). Art is a means by which we access and convey these dimensions through assimilation of senses, thoughts and passions. For this reason, the appreciation of art is an integral component of one's life quality. Unfortunately, patients do not seem as attune to visual feature manipulations in art. However, by enhancing this perceptual ability it may be possible to enrich patients' representations of the visual world and to improve quality of their lives.

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Original

Crystallized

Low-pass

Noisy

High-pass

Black/white

Figure 1.

An example of an original art piece – a landscape photograph (anonymous) – and its visual-feature-manipulated versions. The same manipulation procedure was applied to the other two art pieces – The Starry Night (van Gogh) and Mona Lisa (Da Vinci).

Figure 2.

Average beauty ratings of the three original arts. The scale for the rating ranges from 1 (not very beautiful) to 7 (very beautiful), and is represented on the ordinate. NC stands for normal controls whereas SZ stands for schizophrenia patients. The error bars indicate ± 1 standard error.

Beauty Ranking

Figure 3.

Average beauty rankings among each original artwork and its visual-feature-manipulated versions. Six items (original, crystallized, low-pass, noisy, high-pass, black/white) were used for the ranking process. The ranking scale for the ranking ranges from one (the most beautiful) to six (the least beautiful). The ordinate represents ranking values whereas the abscissa represents the type of visual manipulations. Note that the ordinate is plotted in a reverse order to show a high ranking (1) at the top and a low ranking (6) at bottom. NC stands for normal controls whereas SZ stands for schizophrenia patients. The error bars indicate ± 1 standard error.

Figure 4.

Rating changes as a function of visual feature manipulations. The rating changes are defined by the difference between the rating of the original piece and that of a visual-feature-manipulated one. The larger a rating change, the greater sensitivity to a visual feature manipulation. The top panels represent results from controls; the middle panels represent results from patients; and the bottom panels represent the difference between the two groups. In the top and the middle panels, a zero indicates no rating change between the original and the visual-feature-manipulated images. In the bottom panels, the horizontal lines (corresponding to the value of zero) indicate no group difference in rating changes. A positive value indicates greater rating change in the controls than in the patients. See legend of Figure 2 for further information.

Table 1

Demographic information of the sample*

Group	Age ^{**} (years)	Sex ^{***}	Verbal IQ ^{****}	Education (years)
Schizophrenia (n=29)	38.1 (10.4)	F - 12 M - 17	100.2 (12.6)	14.1 (1.6)
Normal Control (n=30)	40.5 (11.8)	F - 22 M - 8	111.0 (9.4)	16.0 (2.4)

* Subjects were included based on the following criteria: 1) no history of any neurological disorders (such as seizure or stroke) or head injuries, 2) IQ > 70, and 3) no substance abuse in the six months prior to participation.

** mean (standard deviation)

*** F – female, M – male

**** WAIS – R (Wechsler 1981)

Table 2

Clinical Information of Patients (n=29)

Positive-PANSS [*]	Negative-PANSS	General-PANSS	CPZ ^{**} (mg)	Illness duration (year)
15.5 (7.7)	13.4 (6.7)	29.5 (11.9)	602.4 (414.3)	18.5 (21.5)

* based on (Kay, Fiszbein et al. 1987)

** Among these patients, 23 were on atypical antipsychotic drugs, 2 on typical antipsychotic drugs, and 4 on both types of antipsychotic drugs.