Dissimilar Deficits of Facial and Prosodic Emotion Recognition in Patients with Schizophrenia in Taiwan

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Objective: Patients with schizophrenia perform generally worse on various nonverbal emotional measures than healthy participants. But inconsistency of emotion-specific difficulties has been observed among different ethnicities and cultures. Using native stimuli may help minimize these potential confounding factors. Thus, the objective of this study was to apply a culturally suitable, dual modality nonverbal instrument with native stimuli to examine emotional recognition deficits in Han Chinese patients with schizophrenia in Taiwan. Method: We developed the Diagnostic Analysis of Non-verbal Accuracy-2-Taiwan to evaluate nonverbal emotion recognition accuracy. We compared emotion cognition and cognitive reservoir between 26 patients with schizophrenia and 39 healthy study participants. Results: Patients with schizophrenia displayed less accuracy in negative emotion recognition, especially significantly less anger for both facial (\(p < 0.01\)) and prosodic (\(p < 0.01\)) emotions, and significantly less fear expression (\(p < 0.05\)) for prosodic modality compared to healthy study participants. Conclusion: Emotion-specific deficits might present across different cultures. Prosodic emotion recognition deficit, and specifically anger rather than fear or else recognition, may be a more culture-specific deficit for in schizophrenia in ethnic Han population. Culturally suitable stimuli might provide a more delicate measurement of emotion recognition deficits.

Key words: facial emotion recognition, nonverbal emotion recognition deficit, prosodic emotion recognition, schizophrenia

Introduction

Patients with schizophrenia have difficulties in recognizing nonverbal emotions, and perform worse in identifying nonverbal emotions conveyed by facial expressions, vocal cues, and other modalities in comparison with healthy subjects [1]. Previous studies have shown that correlations exist between emotion recognition abilities and clinical symptom severities, particularly negative symptoms of schizophrenia [2]. These defects in emotion recognition may be due to patients’ poor interpersonal and social functioning [3, 4].

The presence of specific deficits in recognizing negative emotions fear, sadness [5, 6] and facial expressions of high intensity anger [7] in patients with schizophrenia has been widely documented. Additionally, persistent deficits of prosodic emotion recognition exist during the disease course of schizophrenia, which is similar to facial emotion recognition deficits. But few studies have been focused on the possible differences of deficits between auditory and visual modalities.

Three issues remain debatable. First, whether facial emotion processing is a differential deficit compared with other cognitive performances (such as face recognition [8] or eye movement deficits) is unclear. The latter may be associated with attention to the salient features of facial expressions [9]. To explore this debate, a cross-modality assessment may provide further information. Consistent finding across different modality, if any, is reasonably to better represent emotion-specific deficits, since those deficits could not be explained only by modality-specific difficulties. Second, whether emotion recognition deficits simply reveal task difficulties, and whether so-called “negative emotion-specific deficits” exist, have been implicated to be associated with limbic system dysfunction [10]. Manipulating the levels of task difficulty of measurement can be a possible approach to the argument. The use of an instrument with stimuli of various emotional intensities may help clarify the potential confounding factors of task difficulty because emotion recognition accuracy is correlated positively with intensity level [11]. And third, most cross-modality studies have suggested that the deficits are similar in visual and vocal modalities in patients with schizophrenia. But few studies have compared the two modalities using the same paradigm in them. All those themes are the primary rationale in this study for developing a nonverbal measure.

Nowick and Duke designed the Diagnostic Analysis of Non-verbal Accuracy-2 (the DANVA-2) to measure accuracy of perception of nonverbal emotions in two (facial and prosodic) expressions [12]. The DANVA-2 has four (happy, sad, angry and fearful) categories of emotions. Each category includes items of two (high and low) levels of emotional intensity with satisfactory reliability and validity [13] in evaluating clinical samples in patients with schizophrenic spectrums, such as chronic schizophrenia [3] and schizotypy persons [14].

The DANVA-2 is used mostly for Western races in English language, yielding limited cultural applicability to non-Western societies. Although schizophrenia is similar across various cultures, some variations in emotion recognition performance exist among different ethnicities [15]. To establish an instrument with native emotional faces and voices, and to investigate the patterns in recognizing native emotional faces and voices in Han Chinese are important. Thus, we proposed to establish a parallel version of the DANVA-2 with pure Han faces and Mandarin language to more accurately simulate the environment in Chinese
society. Such a version may provide a more accurate, culturally sensitive and ecologically valid nonverbal instrument for Han Chinese.

We hypothesized that using culturally sensitive stimuli, differences would exist in patterns of recognition of nonverbal emotions in patients with schizophrenia, and differences might also exist between visual (facial) and vocal (prosodic) modalities. In this study, we intended: (A) to replicate the studies of emotional recognition deficits in patients with schizophrenia in Taiwan with a newly developed culturally suitable nonverbal instrument, (B) to examine whether any specific emotional deficits exist in Han Chinese patients with schizophrenia, and (C) to examine if any differential performance exists on various emotions in the facial and prosodic modalities.

Methods

Participants and procedures

We recruited 25 clinically stable patients with chronic schizophrenia who had show independent community functioning from the psychiatric outpatient clinic or day care rehabilitation program at the National Taiwan University Hospital. We also recruited 39 study participants of the healthy volunteers from the community through local advertisements and a screening interview.

This study was approved by the research review conference at department meeting of the Department of Psychiatry, NTUH, and was conducted between March and June 2003. At that time, the reviewing process for this sort of study on human subjects was not strictly enforced at NTUH. After obtaining informed written consent, each participant was examined individually using a standardized procedure of a diagnostic interview and a series of tests described below.

All participants received individual diagnostic interview according to DSM-IV (American Psychiatric Association, 1994) by two experienced psychiatrists (H. G. Hwu and M. H. Hsieh). Another psychiatrist (H. H. Tseng) reviewed and confirmed the diagnosis independently according to the information in their medical records.

Study measures

Although Ekman et al. have suggested that agreement exists within basic emotions among different races and cultures [16], many other studies have also found that race, culture, gender, and psychiatric illness may considerably affect the accuracy of judging nonverbal emotions [7, 17-19]. No culturally suitable nonverbal measure is available for Han Chinese in Taiwanese populations. Thus, we adapted the conception of the original DANVA-2, and developed a test with Han Chinese faces and voices, i.e., the Diagnostic Analysis of Non-verbal Accuracy 2-Taiwan version (DANVA-2-TW).

Developing such a culturally suitable computerized parallel form of original version of DANVA-2 has been carefully discussed with and obtained the permission from one of the authors (S. Nowicki) [12].

Measures of nonverbal emotion recognitions

We used the DANVA-2-TW in this study to provide overall nonverbal emotion recognition and accuracy of facial or vocal emotion recognition. The DANVA-2-TW was developed through a multi-step procedure, including recruiting ordinary adults as models and generating the facial and vocal items to form an instrument with adequate ecological validity, thoroughly selecting items through classification and ratings by various samples. We excluded items with an agreement
level higher than 90% from the final set to avoid the ceiling effect. A final set was then decided, with each item of at least 70% but no more than 90% agreement rated on the target emotion categories. Differing in the original DANVA-2, the DANVA-2-TW includes neutral faces, which serve as vague stimuli to assess participants’ response style.

The DANVA-2-TW has 30 facial photographs and 30 voice clips representing specific emotions and intensities, including six for each of the four (happy, sad, angry, fearful) basic emotion categories and six neutral stimuli. The DANVA-2-TW is a computerized measure, in that the facial photos are displayed on a computer screen (or notebook) with a full screen size and a resolution of 1024 X 768. The duration of the photo presentation was set at 2 seconds, and the available duration for response was 6 seconds. We asked the study participants to make a quick, forced choice among the four emotional categories. The emotional valence of each photo was rated on a five-point Likert scale. For the prosodic emotion recognition portion, we played the voice clips with computer and delivered to the study participants through an earphone. Because the length of the voice clips is also an important factor in real life for delivering emotions in paralanguage, the duration of the voice clips was set at 2 to 5 seconds, and that for response 8 seconds after the clip started, regardless of that of each clip. We asked the study subjects to respond in the same way as the facial stimuli.

The overall accuracy of facial or prosodic emotion recognition is the average of all emotions of the same modality. The average of overall facial and overall prosodic accuracy represents the total accuracy of nonverbal emotion recognition. The accuracy values are ranged from 0 to 1 (100%). The valence of each emotion is obtained by averaging the intensity assigned by all raters to the same emotion in the pilot study, which may represent an index of task difficulty. Neutral items are those stimuli which most subjects rated as “0-almost cannot feel the emotion” and the average rating is not stronger than “1-weak.”

We indexed the reliability of the DANVA-2-TW with agreement among healthy participants (n = 39), showing satisfactory and high agreement levels in both the facial subtest (Kappa = 0.73) and prosodic subtest (Kappa = 0.81). We examined the test-retest reliability in a sample of college students (n = 35) with an interval of two weeks, indicating good agreement levels for both the facial subtest (Kappa = 0.72) and prosodic subtest (Kappa = 0.83).

Measures of intelligence and psychological symptoms

We administered five (digit span, block design, arithmetic, digit symbol substitution, and information) subtests from modified Blyler’s short form of the WAIS-III for patients with schizophrenia [20] to assess the potential confounding factor of cognitive capacity. We used a 12-item screening form (the session L) which has been adapted from the Chinese version of Diagnostic Interview for Genetic Studies (DIGS) [21] to assess psychotic disorders and their spectrum conditions of the healthy study participants to ensure the absence of schizotypal features. We also administered a self-report symptom checklist, the Brief Symptom Inventory (BSI) [22], to all study participants, to assess potential confounding general psychopathology. All the study assistants were well-trained research workers supervised by a qualified psychologist.

Statistical analyses

We analyzed study data with correlation analyses, univariate analyses of covariance
Table 1. Comparisons on demographic variables and cognitive capacities of patients with schizophrenia and healthy participants

<table>
<thead>
<tr>
<th></th>
<th>Patients with schizophrenia (n = 25)</th>
<th>Healthy participants (n = 39)</th>
<th>Student t test (df = 62)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographic variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>M/F : 9/16</td>
<td>M/F : 16/23</td>
<td>0.16*</td>
<td>0.69</td>
</tr>
<tr>
<td>Current age (y/o)</td>
<td>34.2 (8.42)</td>
<td>43.1 (12.6)</td>
<td>3.44</td>
<td>0.001***</td>
</tr>
<tr>
<td>Education (yrs)</td>
<td>13.0 (1.97)</td>
<td>13.0 (2.54)</td>
<td>-0.02</td>
<td>0.98</td>
</tr>
<tr>
<td>Cognitive capacity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimated VIQ</td>
<td>98.92 (11.64)</td>
<td>102.87 (14.33)</td>
<td>1.09</td>
<td>0.25</td>
</tr>
<tr>
<td>Estimated FIQ</td>
<td>95.69 (9.94)</td>
<td>103.69 (15.84)</td>
<td>2.13</td>
<td>0.03*</td>
</tr>
<tr>
<td>Attention Index</td>
<td>96.11 (13.87)</td>
<td>101.23 (13.02)</td>
<td>1.11</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Abbreviations: SD, standard deviation; VIQ, verbal intelligence quotient; FIQ, full-scale intelligence quotient
* Numbers of gender, using Chi-square test, degree of freedom = 1
* Significant different between patients with schizophrenia and healthy participants (p < 0.05, student t-test)
*** Significant different between patients with schizophrenia and healthy participants (p = 0.001, student t-test)

(ANCOVA), Chi-square tests, t-tests, and regression analyses. In the current study, we entered only accuracy of emotion recognition for the statistical analysis. We also did a series of univariate ANCOVA tests on each emotion separately with age and full scale IQ as covariates. To elucidate the presence of category- and modality-specific category- deficits in schizophrenia, we limited study participants, age not being older than 50 years for further analysis. We chose all patients with schizophrenia and 26 normal study participants and did a repeated-measure ANOVA in the selected subgroup. Correlation analyses were performed among all emotional recognition scores using three global indices (i.e., Global Severity Index, GSI; Positive Symptom Distress Index, PSPI; and Positive Symptom Total, PST) of the BSI to examine if any confounding effect from clinical symptoms existed.

All statistic analyses were computed using Statistical Package for Social Science software version 19.0 (SPSS, Chicago, Illinois, USA) for Windows. The differences between groups were considered significant if p-values were smaller than 0.05.

Results

To investigate potential differences in non-verbal emotion recognition between patients with schizophrenia and healthy groups, we examined the potential confounding variables. Table 1 compares demographic variables and cognitive capacities of patients with schizophrenia and health study participants.

Figure 1 summarizes emotional recognition ability across modality in those two groups. Figures 2 and 3 depict separate facial and prosodic modality, respectively, in recognition ability in those two groups.
Nonverbal Emotions in Schizophrenia

Discussion

Based on our review of the literature, we found that the present study is one of the first studies examining the emotion recognition abilities of schizophrenics using pure native faces and voices as stimuli in a Han population. Our study (Figure 1) showed that Han Chinese patients with schizophrenia exhibited equal recognition rates of positive emotion (i.e. happiness) as healthy study participants for both facial and prosodic expressions, but that they showed significantly lower accuracy in negative emotion recognition, especially for anger ($p < 0.001$) and fear ($p < 0.05$). This study result is generally compatible with previous studies of emotion recognition in patients with schizophrenia in Western and non-Western countries [1, 15] as well as in Taiwan [4].
As shown in Figure 3, the present study also compared emotional prosodic recognition ability between schizophrenics and healthy adults in Han Chinese in Taiwan. The response patterns are quite similar to the results found from those from Western samples [1, 3, 13]. The similar recognition rates between facial and prosodic emotions in each emotion found in our study are consistent with previous findings that emotional recognition ability is manifested in a similar manner in different nonverbal modalities [12]. Moreover, the present study finding supports that this similar relationship can also be found in patients with schizophrenia [1].

Similar patterns of recognition deficits for negative emotions in patients with schizophrenia can be found in different emotional modality as well as in different cultural or ethnic groups [7, 15, 17]. The findings of the present study support the universality of basic emotions, and also support that patients with schizophrenia may have underlying neurocognitive deficits in emotional processing and recognition. The deficits may involve in the dysfunction of the limbic system, especially the amygdala, which has been demonstrated in several functional MRI studies [23, 24].

The most salient finding of our study was the deficits in prosodic negative emotion recognition which was more significantly prominent than facial negative emotion recognition in fear ($p < 0.05$) and anger ($p < 0.01$) in patients with schizophrenia in Han Chinese (Figure 3). The modality and category-specific analysis only showed a trend of category-specific effect on different diagnosis. But the analysis has included all the emotions, we might underestimate the difference of a specific emotion in such a small scale study. A more significant category-specific effect might possibly be expected in the future research with a larger sample size. Since the global response pattern is still similar in both modalities, the culturally suitable prosodic tasks could be more sensitive for detection of emotional recognition deficits in Han Chinese. The reason may be, at least partially, explained by the less expressive nature in Han Chinese society in contrast to Western culture [17, 18].

Another salient finding is that fear identification deficits are the most persistent and congruent deficit in schizophrenia found in other studies using Western faces and voices as stimuli [1]. It is intriguing to consider why angry emotion deficits were more significant across modalities (Figures 2 and 3) for Taiwanese patients. Several studies have reported that anger is the second most frequently mentioned emotion recognition deficit in schizophrenia [1, 11]. Looking into studies on the functional anatomy of anger recognition with healthy participants, the lateral orbitofrontal cortex, amygdala and anterior cingulate cortex have been noted to be the most responsive areas [25]. These areas are closely related to the functional deficit areas found in patients with schizophrenia, and overlap with those inflicted by fearful emotions. Thus, it may be justifiable that the patients with schizophrenia of our study displayed more significant emotional recognition deficits in anger compared to healthy study participants (Figures 2 and 3).

Our present study can partially address whether a general deficit exists in processing either both positive and negative emotions or a negative-only emotion specific deficit. In the DANVA-2-TW, we excluded some extremely agreeable stimuli to prevent the ceiling effect. As a result, the differences in agreement level of recognizing positive and negative emotions would decrease. Yet, patients with schizophrenia in this study still showed specific deficits, which caused significant reduction in negative emotion recognition, espe-
cially anger (Figures 1-3). Thus, the present study results support the hypothesis of negative emotion specific deficit, is consistent with most emotional recognition studies [1].

This study has three major limitations. First, due to the small sample size, the present study could not examine the response patterns of participants with subtypes of schizophrenia. Patients with various subtypes of schizophrenia might perform differently in their emotion recognition. Second, the recruitment of healthy participants was aimed at establishing a norm with wider age range for a better generalization. Although we recruited the healthy participants randomly from the community basing on the distribution of the source population in age and educational level, the representation was still in doubt due to the limitation of the sample size. In particular, the significant difference of age between two groups might obscure the validity of interpretation of our findings. Establishing a norm in different age range in the future may help us consolidate the result. And third, we used the self-rating BSI that might not provide information about specific clinical psychiatric symptoms, especially negative symptoms of schizophrenia, without using clinical rating scales such as the PANSS. Nevertheless, the BSI has at least a moderate correlation with those frequently used general rating scales, the BSRS [26]. Moreover, clustering symptom dimensions of the BSI could adequately classify high versus low scores on PANSS total score and subscale scores [27]. Thus, the BSI could still be an adequate alternative instrument to assess the severity of general psychopathology in patients with schizophrenia.

Deficits for emotion recognition in schizophrenia are universal across races and cultures as well as across perception modalities. But emotion-specific deficits might present differently in different cultures. A test made of pure Han Chinese faces and Mandarin language may simulate the real environment of Han society and provide a more accurate and delicate measurement of emotion recognition deficits. Hopefully, further extension of the current study by including close relatives of patients with schizophrenia and using a standardized psychopathological interview may provide more information to shed light on our understanding of the relationships between emotion processing deficits and the core pathological changes of schizophrenia. Moreover, the present study finding raises the need for social skill training of emotion recognition to improve nonverbal communication.

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References

台灣精神分裂症病人於臉部及音韻情緒辨識能力缺損之異同

目的：精神分裂症病人在各種非語言情緒測量的表現都較健康參與者不佳。然而，在不同種族與文化所觀察到的特定情緒缺失卻是不一致。採用本土化刺激可能有助於減少這些潛在的混淆因素。因此，本研究目的是採用一本土化雙管道非語言工具，以檢驗台灣精神分裂症病人的非語言情緒辨識缺失之特性。

方法：Diagnostic Analysis of Non-verbal Accuracy-2-Taiwan 乃一本土化非語言情緒辨識能力之評估工具，本研究以之評估非語言情緒辨識正確率，比較 26 位精神分裂症病人與 39 位健康參與者在各情緒向度上之差異。

結果：精神分裂症病人比較正常人，在負性情緒的辨識正確度較低，特別是顯著較低的憤怒臉部情緒 \((p < 0.01)\) 與顯著較低的音韻情緒 \((p < 0.01)\)，以及顯著較低的恐懼音韻情緒 \((p < 0.05)\)。

結論：雖然特定性情緒缺失存在於不同文化中，但相對於恐怖或其他情緒，敵意的音韻情緒缺失可能是台灣漢族精神分裂症特有的情緒辨識缺失。本文據此建議，適當的文化刺激工具可提供更細緻的情緒辨識缺失之測量。

關鍵詞：非語言情緒辨識缺失，臉部情緒辨識，音韻情緒辨識，精神分裂症

台灣關於第二代抗精神病劑之文章在國際性期刊的產量：一個書目計量研究

開始：這是一個關於台灣發表與第二代 ( 非典型 ) 抗精神病劑 (SGAs) 相關文章的書目計量學研究。方法：利用 EMBASE 及 MEDLINE 資料庫，我們選擇了所有發表自台灣，內容描述中包括非典型、非典型抗精神病 \(^*\)，SGAs*，clozapine 等的文章。我們使用書目計量學中，關於產量及離散性 (dispersion) 的指標，分別使用 Price 定律，及 Bradford 定律。我們同時也計算了不同國家的參與度指數，並將部分台灣社會及健康資料與本書目計量學的研究結果做相關性的研究。結果：我們下載了發表的 359 篇與 SGA 相關之原始文件。其中 29.53% 的文章與 SGA 臨床療效有關，40.11% 的文章描述 SGA 的副作用。我們的研究結果符合 Price 定律，亦即與雙極性疾患有關的文章數呈現指數性的成長 \((r = 0.960, \text{ 線性校正後 } r = 0.931)\)。SGA 最常被研究的藥物分別為 clozapine (89)，risperidone (82)，aripiprazole (74)，olanzapine (62) 及 quetiapine (22)。利用 Bradford 定律的離散性分析得知，文章發表多集中在 Progress in Neuro-Psychopharmacology and Biological Psychiatry 期刊 (56)。所有來自台灣的文章發表在 90 種不同期刊，而且在前 10 名最常發表的期刊中，有 8 種期刊的影響係數 (impact factor) 大於 2。結論：台灣所發表的 SGA 之文章數量，在本研究的期間內呈現指數性的成長。

關鍵詞：第二代抗精神病剤，非典型抗精神病剤，書目計量學，雙極性疾患，台灣