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Affective reactivity of language and right-ear advantage in schizophrenia

Joseph P. Rhinewine*, Nancy M. Docherty

Department of Psychology, Kent State University, Kent, OH 44242, USA.

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Abstract

A subset of schizophrenic patients has demonstrated increased language dysfunction in affectively stressful, compared to non-stressful conditions. Affective reactivity of right-ear advantage has been demonstrated in studies of dichotic listening in schizophrenia. The present study assessed whether participants who showed affective reactivity of speech were also those who showed affective reactivity of right-ear advantage. Data from 18 schizophrenic outpatients were analyzed. Affective reactivity of language was associated with affective reactivity of right-ear advantage. Findings should be regarded as preliminary due to the small sample size; however, they may potentially contribute to construct the validity of affective reactivity as a process discriminator in schizophrenia. © 2001 Elsevier Science B.V. All rights reserved.

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Data accumulated from literature suggests that symptoms of schizophrenia worsen in response to stress. Evidence of symptom exacerbation associated with stressful events and negative emotions has been found in several domains of study, including the family environment, life events, psychophysiological arousal, and laboratory induction of negative affect (for review, see Docherty, 1996).

Several studies have demonstrated that a subset of schizophrenia patients show increased language dysfunction in emotionally stressful, compared to non-stressful conditions. Docherty et al. (1994) interviewed patients to elicit two 10-minute speech samples, one in which they were asked to speak about past stressful life events, the other in which they were asked to describe past pleasant life events. Speech in the stressful condition was found to contain more disordered language than in the non-stressful condition. The level of language disturbance correlated positively with the severity of positive, but not negative symptoms. The degree to which language disturbance reacted to the stressful condition also correlated positively with the severity of positive symptoms. Furthermore, Docherty et al. (1996) found increased language disturbance in the stressful condition in patients with a family history of schizophrenia, but not in those without such a family history. This group of findings represents evidence of an affect-reactive subtype within schizophrenia (Docherty, 1996). The affect-reactive subtype apparently tends to show more severe positive symptomatology than the affect-non-reactive subtype, and may represent a more familial, heritable form of the illness.

Schizophrenia patients have shown abnormality of perceptual asymmetry in dichotic listening studies.

* Corresponding author. Address: 295, Bennet Avenue, Apartment 5B, New York, NY 10040, USA. Tel.: +1-212-569-6464.
E-mail address: jpenr@yahoo.com (J.P. Rhinewine).

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Patients fail to show the normal level of right-ear advantage (REA) for processing verbal stimuli on dichotic-listening tasks (Wexler et al., 1991; Bruder et al., 1995). Grosh et al. (1994) found that schizophrenia patients as well as their non-schizophrenic parents showed abnormally low REA, but the patients and not their parents showed further decreases in REA when emotionally negative compared to when positive words were used as the dichotic stimuli.

Diminished REA on dichotic tasks in schizophrenia is presumed to reflect compromised left hemisphere functioning during processing of verbal auditory stimuli. The left hemisphere is specialized for processing language-related stimuli in more than 90% of right-handed individuals (Wexler et al., 1991). In non-patients, REA is thought to exist due to a more direct path of processing of verbal stimuli from the right ear.

If diminished REA for schizophrenic patients results from left-hemisphere deactivation, and if further decreases in REA in the negative-word dichotic tests among these patients then represent further left-hemisphere deactivation, findings from dichotic listening studies may credibly be related to findings from studies of affective reactivity of language. Language anomalies have been shown to increase in schizophrenic patients when they are asked to discuss negative memories (Docherty et al., 1994); it is possible that this effect is due to further deactivation of the (already abnormally deactivated) language-specialized left hemisphere, because of the negative valence of the conversation. If only those patients who show increased language fragmentation when discussing negative topics were to be shown also to have further diminished REAs on the negative-word dichotic tests, a left-hemisphere deactivation model of language disorder would be supported.

If affective reactivity represents a subgrouping, or a dimension of psychopathology in schizophrenia, the same patients should show affective reactivity across those measures of performance that have been shown to be affect-reactive. In the present study, we have attempted to correlate two such performance measures, discussed previously herein: if those patients, and only those patients, who show affective reactivity of language were also to show affective reactivity of perceptual asymmetry on dichotic tests, such a finding would be consistent with a conceptualization of affective reactivity as a process discriminator.

In the present study, we hypothesized first that patients as a group would show affective reactivity of language; that is, they would show a greater degree of thought disorder in the stressful compared to the non-stressful speech sample. Secondly, we hypothesized that patients who showed affective reactivity of language would show greater reactivity of perceptual asymmetry than patients who did not show affective reactivity of language.

1. Method

1.1. Participants

Participants for the present study ($N = 18$) had all been participants in a larger study of reactivity of speech (Docherty and Hebert, 1997). They included 15 males and three females aged 19–44 years ($M = 31.5$, $SD = 6.0$); ages of first hospitalization were 14–34 years ($M = 20.7$, $SD = 4.6$). All participants met the criteria of *Diagnostic and Statistical Manual of Mental Disorders* (fourth edition; *DSM-IV*; American Psychiatric Association, 1987) for schizophrenia but not mental retardation. Patients carrying a current diagnosis of substance abuse were excluded; patients with a history of head trauma or other previous neurological injury or illness were likewise excluded. All had been outpatients for at least three months and had Global Assessment of Functioning scores greater than 35 (GAF; American Psychiatric Association, 1987). GAF scores ranged 35–65 ($M = 47$, $SD = 8.02$). Participants had completed 8–14 years of education ($M = 11.33$, $SD = 2.02$). Seven participants were African–American, nine were European–American, and two were Hispanic. All were assessed using the Schedule for Affective Disorders and Schizophrenia — Lifetime Version (SADS-L; Spitzer et al., 1978), by a clinical psychologist with extensive research diagnostic expertise. All participants were right-handed. All participants were on psychotropic medications, including typical antipsychotics ($n = 16$), atypical antipsychotics ($n = 2$), anticholinergics ($n = 10$), mood stablizers ($n = 7$), and antidepressants ($n = 4$).

1.2. Procedure

1.2.1. Speech samples

Participants provided three 10-minute speech samples, which were audiotaped. The first sample, intended to familiarize participants with the task, concerned interests and everyday activities, and was not included in the analyses. For the second and third samples, participants were asked to speak about the past negative stressful life events on one occasion, and positive, non-stressful events on the other. The order of the negative and positive speech samples was counterbalanced. These two speech samples were collected on separate days. The interviewer spoke minimally as needed to keep participants talking, or to return them to the designated topics. The two speech samples differed only in the affective content elicited by the interviewer. Speech samples were transcribed and rated using a measure of language disturbance.

1.2.2. Language measure

Speech samples were rated for derailment, tangentiality, distractible speech, illogicality, and incoherence using the thought, language, and communication scales (TLC; Andreasen, 1986). Scale scores were summed to yield a global language disturbance score, for each subject in each affective condition. All samples were coded by a single rater trained in the method. A second rater independently rated 20% of the speech samples. Interrater reliability for summed TLC scale scores was assessed and found to be quite good (ICC = 0.87).

1.2.3. Affective reactivity of speech

Language scores in the non-stressful condition were subtracted from scores in the stressful condition for each subject, yielding scores of affective reactivity. Reactivity scores did not correlate with baseline thought disorder scores ($r = -0.05$, n.s.).

1.2.4. Dichotic tests

The fused paired words dichotic listening task (Wexler and Halwes, 1983) was employed as a measure of laterality of processing of verbal auditory stimuli. Subjects were administered four consecutive dichotic tests in a single session, order counterbalanced, with a 2–5 min break between tests.

Of the four tests administered, two are relevant to the present study. The positive/neutral and negative/neutral tests each consist of 11 pairs of single-syllable words; each pair differs only in the initial consonant. One word of each pair in the positive/neutral test had been rated by a group of normal young adults as having a positive emotional valence, while the other was rated as emotionally neutral (e.g. hug-tug). In the negative/neutral test, one word was rated as emotionally negative in the valence, and the other as neutral (e.g. kill-till). Participants' hearing was tested with an audiometer prior to dichotic trials. The functional integrity of each ear was also demonstrated with monaural presentation of each stimulus prior to the administration of each test. Each word pair was then presented eight times, counterbalanced for side of presentation, for a total of 88 trials for each test, or 176 trials for both tests. Subjects indicated the word they had heard by circling the word on answer sheets. Each line of the answer sheet contained four choices: two words from the stimulus pair and two other words differing from the stimulus pair by only the initial consonant. The REA, calculated for each subject on each test, was the number of correct right-ear responses minus the number of correct left-ear responses, divided by the sum of the two: $(R - L)/(R + L)$.

1.2.5. Analyses

Paired t-tests were conducted to establish whether the language ratings differed between affective conditions. Patients were classified as affectively reactive or non-reactive. To test the hypothesis that patients who show affective reactivity of language in the speech samples also show affective reactivity of REA in the dichotic tests, a two-way (group X dichotic task) repeated-measures ANOVA was conducted comparing language-reactive versus language non-reactive participants, with the two dichotic tasks (negative/neutral and positive/neutral, respectively) as the repeated measures and REA as the dependent variable. All tests of significance were two-tailed.

2. Results

Mean and standard deviations of language ratings and REA scores are summarized in Table 1. The

Table 1
Mean and standard deviations of language ratings and REA scores (TLC: thought, language and communication disorder scales; REA: right-ear advantage; +ol: including the outlier; −ol: excluding the outlier)

	TLC		REA	
	Non-stress	Stress	Positive-word	Negative-word
+ ol	2.11±2.78	3.22±3.33	−0.02±0.20	−0.09±0.24
−ol:	1.90±2.70	2.90±3.10	0.02±0.10	−0.05±0.16

outlying REA scores of one participant were excluded from the results and analysis.

2.1. Reactivity of speech

Paired *t*-tests were computed comparing TLC scores in the stressful and non-stressful speech samples. As predicted, patients showed affective reactivity of language using the TLC scales; that is, thought disorder scores were higher in the stressful compared to the non-stressful condition ($t[17] = 2.4$, $p < 0.03$).

2.1.1. Assignment of language reactivity

Participants were divided into an affectively reactive and a non-reactive group based on changes in TLC scores between affective conditions; a subject was classed as affect-reactive if she/he scored 2.0 or more points higher on the TLC in the stressful condition (negative topic speech sample), compared to the non-stressful condition (positive, non-stressful topic sample). A change of 2.0 points indicates a substantial increase on one TLC subscale (e.g. from mild to marked), or a slight increase (e.g. from mild to moderate) in each of the two subscales. By this criterion, five of 18 patients were defined as affectively reactive. The groups did not differ significantly in dosages of antipsychotic medications (that is, they did not differ in chlorpromazine equivalent dosages, $t[10] = -1.5$, $p = 0.16$, n.s.). They also did not differ in proportions of each group on other medications thought to influence cognition. Of these, the largest proportional difference was in the number of patients on anticholinergics; the latter did not differ significantly (chi-squared (df = 1) = 1.68, $p = 0.20$, n.s.).

2.2. Interaction between reactivity of speech and REA

A two-way (TLC affect-reactive/affect-non-reactive X REA affective condition) repeated-measures ANOVA was computed, with REA affective condition as the repeated measure, and REA scores as the dependent variable. This analysis compared changes in REA across affective condition, in patients whose speech was affect-reactive versus patients whose speech was not affect-reactive. The participant with the outlying REA scores was excluded from the analysis, leaving four of 17 patients in the TLC affect-reactive group (note that results were similar and significant when the outlier was included).

As predicted, a main effect was demonstrated for affective valence of dichotic tests; patients showed lower REA scores on the negative-word tests than on the positive-word tests ($F[1,15] = 8.1$; $p < 0.02$). No main effect emerged for affective reactivity; that is, patients who were classed as TLC affect-reactive did not have different REAs across conditions than those who did not show TLC reactivity ($F[1,15] = 2.0$; $p = 0.18$). In accordance with our hypothesis, an interaction between reactivity of language and reactivity of perceptual asymmetry emerged, with patients who showed reactivity of language also showing significantly more reactivity of REA on the dichotic tests ($F[1,15] = 7.9$; $p < 0.02$). This analysis is summarized in Table 2.

Table 2
REA in TLC affect-reactive versus affect-non-reactive patients on affectively positive versus negative dichotic tests (Main effect of group: $F = 2.02$ (n.s.; $p = 0.18$). Main effect of condition: $F = 8.07$ ($p < 0.02$). Interaction effect: $F = 7.86$ ($p < 0.02$))

Group	Affective condition		
	Positive	Negative	Total
TLC reactive	0.02±0.06	−0.19±0.16	−0.08±0.01
TLC non-reactive	0.03±0.11	−0.01±0.15	0.01±0.12
Total	0.02±0.10	−0.05±0.16	−0.01±0.12

Post-hoc analyses were conducted to assess the differences between groups in each dichotic condition; one-way ANOVAs were non-significant ($F[1,15] = 01$; $p = 0.93$) for the positive-word test, and fell just short of significance ($F[1,15] = 4.44$; $p = 0.05$) for the negative-word test.

3. Discussion

Consistent with previous findings, patients as a group showed affective reactivity of language on the TLC, and affective reactivity of REA on the dichotic tasks. Patients who showed affective reactivity of speech on the TLC also showed greater affective reactivity of REA on the dichotic tests. Post-hoc analyses revealed that the significant interaction was due almost entirely to the difference between the affect-reactive and affect-non-reactive groups in the negative dichotic test, rather than the positive-dichotic test. This finding contributes to the construct validity of affective reactivity, since the affect-reactive patients significantly corresponded between two measures that have been shown independently to be affect-reactive.

Decreased REA has been found in schizophrenia patients across studies (Wexler et al., 1991), and is presumably related in some way to schizophrenic pathophysiology. REA has been demonstrated to decrease further in response to affectively negative stimuli (Grosh et al., 1994), and, in the present study, to do so mainly in people who show stress-related increases in language dysfunction. Therefore, it is possible that the decreased REA scores in the negative dichotic test reflect a change in laterality of processing of language that underlies the increased language dysfunction demonstrated in the stressful speech samples. Future studies could further bolster the construct validity of affective reactivity by examining whether performance on potentially language-related cognitive tasks, such as those which involve attention, working memory, and executive functions, show affective reactivity, and whether patients who show such reactivity tend to be the same who show reactivity of language and REA. Reliably identifying such a subgroup of schizophrenia patients, who show increased language dysfunction and language-related cognitive deficits in stressful situations and in response to negative affective stimuli, would amount to the isolation of a process discriminator within the illness.

Several shortcomings of the present study limit the interpretability of its findings. First, the sample size was small. Of 18 participants, only five showed affective reactivity of language; findings are thus to be regarded as preliminary. Secondly, the sample contained few female patients; findings may not generalize to women. Thirdly, only schizophrenia patients were included in the sample; hence, the study did not address the question of diagnostic specificity of the phenomena explored. It is possible, for instance, that bipolar manic patients, or even subjects without a psychiatric illness would show a similar correspondence between affective reactivity of language and REA.

In conclusion, this study explored individual differences in response to negative affect among schizophrenia patients. An association was found between the two forms of affective reactivity examined, those influencing language disorder and those affecting perceptual asymmetry. Findings of the present study should be regarded as preliminary and interpreted with caution due to the small number of participants in the study sample. A future study with a larger sample, including both psychiatric and non-patient controls, could strengthen the present findings and begin to address some of the questions raised pertaining to the import of those findings.

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