

Distractibility in Schizophrenia: State and Trait Aspects

BONNIE SPRING, MARTIN LEMON, LISA WEINSTEIN and ALISON HASKELL

Cognitive deficits in schizophrenia can be differentiated into state-linked accompaniments of psychotic episodes and trait-linked signs of a more enduring vulnerability to schizophrenia (Zubin & Spring, 1977; Cromwell & Spaulding, 1978). Elsewhere (Spring & Zubin, 1978) we suggested that a marker of psychotic episodes is one that deviates in highly symptomatic schizophrenic patients and normalises as their florid psychotic symptoms remit. A stable vulnerability marker, in contrast, continues to deviate in remitted patients, their biological relatives, and others who are vulnerable to schizophrenia but not floridly psychotic. In addition, Nuechterlein & Dawson (1984) proposed a mediating vulnerability marker which demonstrates characteristics of both vulnerability and episode markers. On such a marker, asymptomatic vulnerable individuals differ from normal; the advent of psychosis magnifies the deviation.

In the present study, we tentatively examined whether distractibility is a stable vulnerability marker, a mediating vulnerability marker, or an episode marker. Prior findings about the stability of selective attention impairment in schizophrenia have not been entirely consistent. Among schizophrenic in-patients, most (Payne *et al*, 1970; Wishner & Wahl, 1974; Schneider, 1976; Dykes & McGhie, 1976; Wahl, 1976), but not all (Straube & Germer, 1979; Pogue-Geile & Oltmanns, 1980) results indicate disproportionate impairment at making immediate responses in the presence of distraction. A limitation of all these studies, however, is that distractor and non-distractor tasks were not equated for discriminating power (Chapman & Chapman, 1978). It remains possible, therefore, that distractor tasks have elicited greater deficits because of their greater psychometric ability to reveal generalised deficits. A meta-analysis of results for dichotic shadowing (Spring *et al*, in press) indicates that generalised deficits are substantial, leading the average schizophrenic to shadow less accurately than 89% of normal subjects even without distraction. Hence, it remains to be determined whether floridly psychotic schizophrenics manifest differential selective attention deficits on shadowing tasks for which non-distractor and distractor tasks have comparable psychometric power.

Still less clear is whether selective attention impairment characterises remitted schizophrenics

and other vulnerable but non-psychotic groups. Early results indicated that distractibility diminished in parallel with clinical improvement (Blum *et al*, 1969; Pigache & Norris, 1973). Evidence that some degree of selective attention dysfunction might endure past the psychotic episode came from Wohlberg & Kornetsky's (1973) finding that only in the presence of distraction did remitted schizophrenics show deficits in signal detection. Similarly, both Asarnow & MacCrimmon (1978) and Frame & Oltmanns (1982) found some evidence of differential distractibility deficits in clinically improved schizophrenics, but their findings did not reach statistical significance. Results for children of schizophrenics, a potentially vulnerable population, have also been mixed. Both positive (Cornblatt & Erlenmeyer-Kimling, 1984; Erlenmeyer-Kimling & Cornblatt, 1978; Rutschmann *et al*, 1977; Harvey *et al*, 1981; Winters *et al*, 1981) and negative (Asarnow *et al*, 1978; Orvaschel *et al*, 1979; Cornblatt & Erlenmeyer-Kimling, 1984, 1985) results have been reported. The aims of this research were: (1) to develop non-distractor and distractor dichotic shadowing tasks matched on discriminating power, and (2) to assess the status of distractibility as a vulnerability or episode marker by evaluating the selective attention of five samples hypothetically vulnerable to schizophrenia but varying in clinical state.

Test construction and psychometrics

The item pool was 15 word strings accompanied by no distraction (NoD), 15 by unassociated distraction (D1), and 15 by associated (mostly synonym) distraction (D2). Strings presented without distraction were of lower contextual constraint (Miller & Selfridge, 1950) and therefore less predictable than those with distraction. Thus, the procedure tested whether distraction or stimulus unpredictability elicited the greater cognitive deficit.

All items were administered to a sample of 142 normal adults of broadly varying abilities. Data were used to select 10 items from each condition that yielded tests matched on mean item difficulty, item scale correlation, and distribution of item difficulty. Matching, cross-validated for an additional sample of 72 adults, resulted in reliable ($\alpha = 0.90-0.94$)

non-distraction and distraction tests of equivalent difficulty for normal subjects (mean shadowing accuracy = 85.7–87.0%).

Subjects

Table I gives demographic data for the six groups of subjects. Nineteen schizophrenic in-patients (ten paranoid, nine undifferentiated) from a private psychiatric hospital were still in a psychotic episode. Twenty normal controls, lacking a family history of psychiatric hospitalisation, were matched to the in-patient schizophrenic sample. Just emerging from an episode were ten schizophrenic out-patients (six paranoid, four other) tested 1 month after discharge

TABLE I
Sample characteristics

Subjects	Age (years)	Education (years)	Illness duration
In-patient Schizophrenics (n = 19)			
Mean	24.5	12.6	5.0 hospitalisations
(s.d.)	(4.0)	(1.6)	(3.5)
Recently discharged schizophrenic out-patients (n = 10)			
Mean	34.6	11.4	9.7 months in hospital
(s.d.)	(9.8)	(2.8)	(9.0)
Clinically stable schizophrenic out-patients (n = 21)			
Mean	32.2	12.4	7.0 years in hospital
(s.d.)	(6.9)	(2.5)	(5.5)
Relatives of schizophrenics (n = 33 from 15 families)			
Mean	44.7	14.7	
(s.d.)	(14.3)	(2.8)	
Schizophrenic-like students (n = 25)			
Mean	21.1	12.3	
(s.d.)	(2.5)	(1.7)	
Normal controls (n = 20)			
Mean	25.2	14.9	
(s.d.)	(7.0)	(1.8)	

from a state psychiatric hospital. An additional 21 schizophrenics in out-patient treatment at a state facility were judged to be in stable clinical remission. These patients lacked clinically significant psychotic symptoms as evidence by Brief Psychiatric Rating Scale (Overall & Gorham, 1962) conceptual disorganisation factor scores of 0 or 1. All patients were diagnosed on the basis of a semi-structured interview and DSM-III criteria.

Adult first degree relatives of the schizophrenic in-patients constituted a sample never hospitalised for psychiatric disorder but considered to be potentially vulnerable. Scores from 33 first-degree relatives of 15 in-patients were averaged to yield a single score for the non-patient members of each family. This prevented a confounding influence of family size on the data for relatives.

A sample of 25 college students was considered hypothetically vulnerable to psychosis. These subjects scored at least 1.9 standard deviations above the mean for introductory psychology students on a composite questionnaire measure of magical ideation, perceptual aberrations and physical anhedonia (Chapman *et al.*, 1980). The group also manifested clinically significant psychopathology on the MMPI Schizophrenia Scale.

To summarise, one group (in-patients) was in a psychotic episode; one group (recently discharged out-patients) was just emerging from a psychotic episode; three groups (clinically stable out-patients, relatives, and college students) were vulnerable but non-psychotic; a last group (controls) was normal.

Procedure

Main channel and distractor stimuli were delivered via stereo earphones to opposite ears at the rate of 60–75 syllables per minute. Ear of presentation was reversed midway through the test. Items from the three conditions (NoD, D1, D2) were randomised but presented in the same sequence for all subjects. Shadowing responses were tape-recorded, transcribed and scored for accuracy (percentage of main channel syllables repeated correctly) and intrusion errors. One intrusion error was scored for each complete syllable interjected from the distractor channel; 0.5 error was scored for part of a distractor syllable (i.e. a phoneme). Inter-rater reliabilities for accuracy and intrusions were $r = 0.80-0.90$.

Distractibility was quantified in two ways. The degree of performance deficit induced by distraction was measured by the percentage decline in shadowing accuracy when the subject shadowed with distraction as compared to without distraction. The percentage differential deficits induced by unassociated and associated distractor words were computed separately. The summed number of intrusions of distractors indexed the likelihood that the distracting message was being processed.

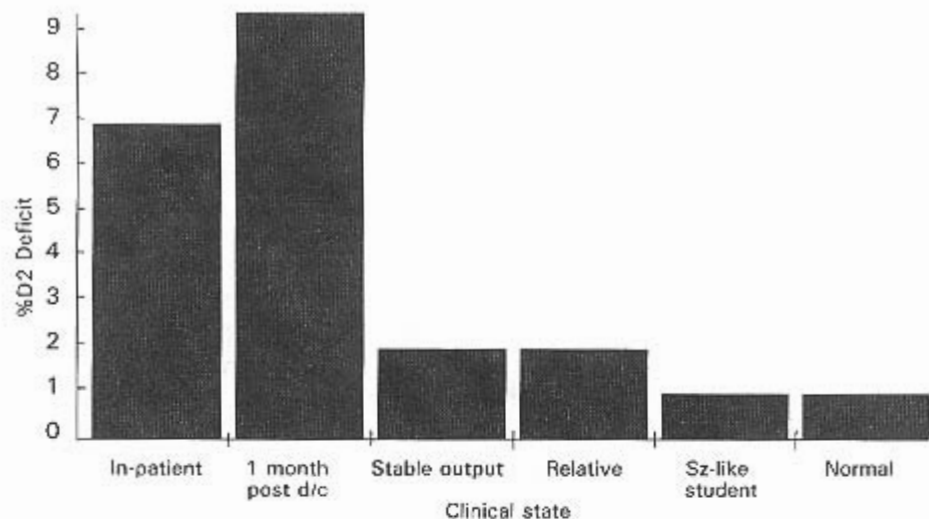


FIG. 1. Average percentage decline in shadowing accuracy induced by associated distractors (%D2 Deficit) in subject groups varying in clinical state.

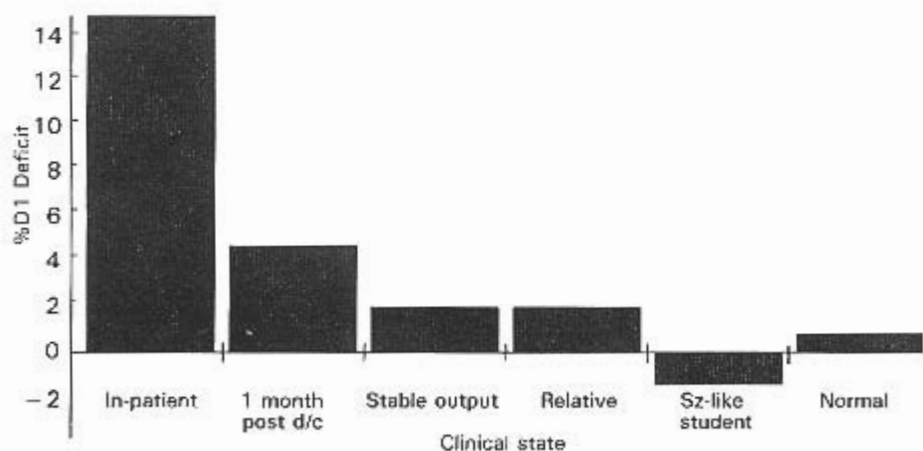


FIG. 2. Average percentage decline in shadowing accuracy induced by unassociated distractors (%D1 Deficit) in subject groups varying in clinical state. %D1 Deficit is computed as:

$$\frac{\left(\begin{array}{c} \text{Mean \%} \\ \text{correct} \\ \text{without} \\ \text{distraction} \end{array} \right) - \left(\begin{array}{c} \text{Mean \%} \\ \text{correct with} \\ \text{unassociated} \\ \text{distraction} \end{array} \right)}{\text{Mean \% correct without distraction.}}$$

Subject groups are schizophrenic in-patients, schizophrenic out-patients tested 1 month after discharge from hospital, schizophrenic out-patients in stable clinical remission, first-degree relatives of schizophrenic in-patients, students who scored deviantly on presumptive tests of psychosis-proneness and normal controls.

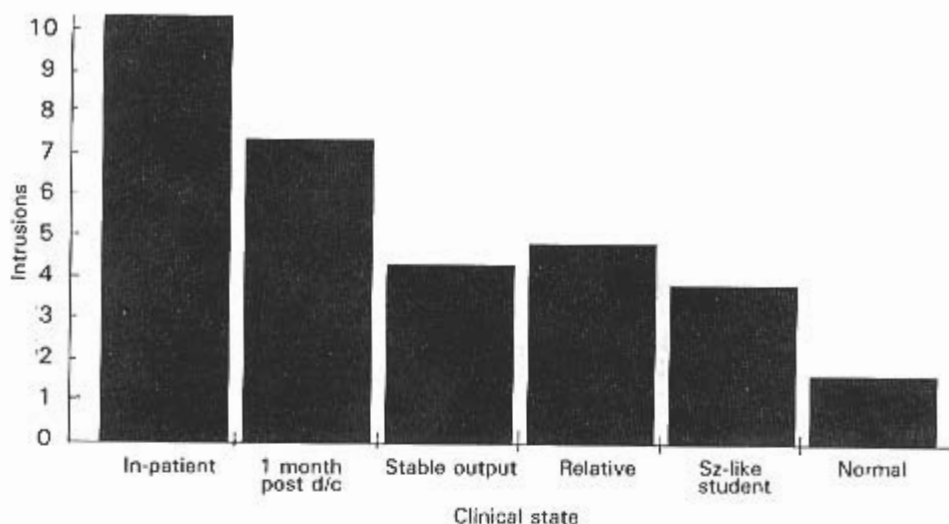


Fig. 3. Average number of errors involving intrusions of distractors in the shadowing responses of subject groups varying in clinical state.

Results

Figure 1 gives the average percentage decline in shadowing accuracy induced in each group by unassociated distractors. Figure 2 gives the comparable information for associated distractors.

Two analyses of variance (ANOVA) were performed to compare the groups on the degree of differential deficit triggered by both kinds of distractors. The subject groups differed significantly on the deficit induced by unassociated distractor words [$F(5,104) = 4.43, P < 0.01$]. A supplementary comparison using the Student-Newman-Keuls test indicated that unassociated distractor words triggered a greater deterioration in the shadowing accuracy of in-patient schizophrenics than in any other group. Planned comparisons were undertaken to see whether the vulnerable groups differed from normal when the variance due to psychosis was removed. None of the vulnerable but non-psychotic groups differed from normal controls. Neither the ANOVA nor the planned comparisons detected significant differences among the groups in the differential deficit induced by associated distractor words.

The groups did differ significantly on the amount of material from the distracting message that they interjected into their shadowing responses [$F(5,104) = 5.04, P < 0.001$]. In-patients and recently discharged schizophrenics both made significantly more intrusion errors than normal controls, but failed to exceed the vulnerable non-psychotic groups on the number of intrusion errors (Student-Newman-Keuls test). Planned comparisons indicated that all of the vulnerable but non-psychotic groups made more intrusion errors than normal controls [clinically stable schizophrenic

out-patients: $t(39) = 3.13, P < 0.01$; relatives of schizophrenics: $t(33) = 4.02, P < 0.001$; and schizophrenic-like college students $t(43) = 2.63, P < 0.05$].

Discussion

An important limitation of this research is that the design was cross-sectional rather than longitudinal. No assessments were made across changing clinical states in the same individuals. Also, it was not feasible to attain all samples from the same clinical setting. Consequently, any potential influences of test site are confounded with those of clinical state in these results. Nonetheless, the consistency of the findings encourages us to offer tentative conclusions in the hope that these will encourage efforts at longitudinal replication.

The results of this study suggest that, even when non-distraction and distraction tasks are matched on discriminating power, schizophrenics in an episode of psychosis exhibit differential performance deficits due to distractibility. Distractors were less likely to trigger additional impairment in the performance of a main task, beyond that due to generalised deficits, in subjects nearing the end of a psychotic episode. For those in this study who were vulnerable to schizophrenia but non-psychotic, distraction failed to additionally impede performance on a primary task. The propensity for distractors to disrupt

performance, then, seems to be a marker of episodes of schizophrenia.

It is unclear why in-patient schizophrenics exhibited differential deficits in selective attention to unassociated but not associated distractor words. One possible explanation is that, because distracting associates were mostly synonyms of simultaneous main channel words, they primed the correct meaning of the main channel target word and facilitated its recognition, rather than impeding it by activating competing associates. A second possible explanation is that because synonym distractors reiterated certain phonetic features of main channel words (e.g. suffixes such as ed, es), they increased the probability that subjects would say these phonemes and receive partial credit for an accurate response.

Not only schizophrenic in-patients, but also out-patients just emerging from a psychotic episode, exceeded normal subjects in their tendency to interject phonemes from the distracting message. Although they made somewhat (non-significantly) fewer intrusion errors than patients in a schizophrenic episode, vulnerable but non-psychotic subjects made more intrusion errors than normals. The tendency to interject distractors, therefore, seemed to be a mediating vulnerability marker; the deviation remained evident in vulnerable groups but was somewhat more marked during a schizophrenic episode.

The mechanism underlying intrusion errors remains unclear. That vulnerable subjects repeated a message nearly as well with distraction as without but nonetheless made intrusions argues against a substrate in the gross breakdown of a perceptual filtering mechanism.* It may be that intrusions reflect disorganised response selection produced by the arousal generated in ignoring distractors. Alternatively the apparent relative stability of intrusions, given the apparent transience of distractibility deficits, may mean that a propensity to divide the allocation of attention is an aspect of an enduring vulnerability to schizophrenia. What may vary episodically is the availability of sufficient functional information processing capacity to successfully process more than one channel simultaneously. If so, then this would constitute evidence for Bleuler's (1911/1950) suggestion that individuals affected by

schizophrenia are unusually adroit at 'splitting' their allocation of attention.

Summary

This report compared the selective attention of 19 schizophrenic in-patients, 10 recently discharged schizophrenic out-patients, 21 schizophrenic out-patients in stable clinical remission, 33 first-degree relatives of schizophrenics from 15 families, 25 students who scored deviantly on questionnaire measures of magical ideation, perceptual aberrations, and physical anhedonia, and 20 normal controls. Results indicated that distractors only disrupted the performance of schizophrenic in-patients, suggesting that differential deficits in selective attention are a marker of episodes of schizophrenia. A propensity to interject phonemes from the distracting message was found not only in patients in or just emerging from a psychotic episode, but also in the remaining vulnerable but non-psychotic groups, suggesting that intrusion errors might be a mediating vulnerability marker. The findings suggest both state and possibly trait aspects to distractibility in schizophrenia.

Acknowledgements

Appreciation is expressed to Althea Wagman, Rose Kurtz, Maria Benet, Maria Levitt and David Briggs for assistance in data collection. Supported in part by grant MH-32355 and awards from Texas Tech University and the Maryland State Psychiatric Research Center.

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*An illustration may clarify how subjects could repeat words nearly as accurately with distraction as without, while still making intrusion errors. Using our scoring system, it is theoretically possible for a subject to repeat all syllables of the main message correctly, and thus achieve 100% accuracy, while inserting additional sounds from the distractor channel and thus making intrusion errors.

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B. Spring, PhD, Professor of Psychology; Martin Lemon, BA; Lisa Weinstein, BA; Alison Haskell, BA, Department of Psychology, Texas Tech University