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The Effect of Distraction on Schizophrenic Performance (1) Perception and Immediate Memory

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Introduction

In recent years an increasing number of workers investigating schizophrenic behaviour have concluded that many of the symptoms found in schizophrenia are related to a disturbance in the selective and inhibitory functions of attention. One of the earliest statements of this argument is found in Norman Cameron's (1938, 1939, 1944) concept of "over-inclusion", which he used to describe the schizophrenic patient's tendency to include many elements irrelevant to the central idea in his thinking. Shakow (1962) reached the following conclusions in summarizing his own psychological studies of schizophrenia—"It is as if, in the scanning process which takes place before the response to stimulus is made, the schizophrenic is unable to select out the material relevant for optimal response. He apparently cannot free himself from the irrelevant among the numerous possibilities available for choice." Weckowicz and Blewett (1959), in their studies of alterations in perceptual constancy in schizophrenic patients, interpreted their findings as suggesting that the patient's basic difficulty was that of "an inability to attend selectively or to select relevant information". Venables and his colleagues (1959, 1962, 1963), in a series of studies on the arousal level of schizophrenic patients, also concluded that many of the behavioural abnormalities demonstrated were due to variations in the range of attention. In a series of investigations carried out by Payne and his colleagues (1960, 1961, 1963) to develop Cameron's concept of over-inclusive thinking in schizophrenia, the authors utilized Broadbent's (1958) model of selective attention to postulate that this form of thought disorder is basically due "to a defect in some hypothetical central filter mechanism, the function of which is to screen out irrelevant data both internal . . . and external . . . to allow for the most efficient processing of incoming information".

In a previous study by two of the present authors (Chapman and McGhie, 1962) a battery of tests, designed to assess the effect of distracting stimuli on attentive behaviour, was applied to groups of schizophrenic patients, non-schizophrenic patient controls and normal subjects. The schizophrenic group was differentiated from both control groups by a poor performance on a number of these tests of distractibility. The effect of distraction on schizophrenic performance was found to be maximal in tasks which required the accurate perception and immediate recall of information, and also on tasks involving psychomotor skill. Both of these aspects of schizophrenic performance have been subjected to further experimental study, but the present report deals only with the influence of distraction on perception and recall.

The findings of the previous investigation suggested, not only that schizophrenic patients were abnormally distractible, but that this defect varied with the sensory modalities involved in the task, distraction appearing to be more marked with auditory input. However, since auditory, as opposed to visual, distraction was examined more extensively in the battery of tests used, this conclusion was tentative and emphasized the need for further examination of modality differences in selective attention. Most of the tests in the previous battery involved two sensory modalities, the subject being required to inhibit distraction in one modality while concentrating on information on the alternative modality. It appeared necessary to include in a subsequent investigation tests of distraction which were similar in form but in

which the subject had to deal with information in only one sensory modality. Further analysis of the distraction scores made by schizophrenic subjects in the previous investigation indicated that the disturbance in selective attention was particularly marked in the case of the hebephrenic patients. As this suggestion of a different response to distraction within the schizophrenic group seems important and at variance with reports of some other workers in this field, it seemed necessary to repeat the investigation with a larger number of schizophrenic subjects. Some other workers (e.g. Venables, 1962) in this field have suggested that the high degree of distractibility shown by schizophrenic patients is confined to the acute phase of the illness and that this factor does not operate in the more chronic stage of the psychosis. The schizophrenic patients included in our previous investigation had a mean duration of illness of approximately 4 years. It was therefore decided that in subsequent investigations, the range of patients should be extended to include patients whose illness was of a longer duration and who could be unequivocally regarded as chronic schizophrenics.

The main aims, then, of the present investigation were to bring under inspection a number of variables neglected in the previous study, to re-assess the relationship between hebephrenic and experimentally measured distractibility and finally, to ascertain whether there was any change in the attentive disorder as the schizophrenic illness progressed into its chronic stage.

Selection of Subjects

Four groups of subjects were included in the present investigation. The main experimental group consisted of 36 schizophrenic patients. The patient control group was composed of 20 non-schizophrenic psychotic patients, of whom 10 had a depressive and 10 a paranoid psychosis. The normal control group included 40 subjects recruited mainly from the nursing staff of the hospital. The distribution of age and sex and the current verbal level, as assessed by the Mill Hill Vocabulary Scale, is stated for each group in Table I below:

Although the subjects in both patient control groups had a somewhat higher mean age than that of the schizophrenic group, the schizophrenic patients had an illness of considerably longer duration, the majority being chronic patients. If we accept an illness lasting over 5 years as a standard of chronicity, 23 of our 36 schizophrenic patients would be characterized as being chronic.

Method

Each subject was initially interviewed and given the Mill Hill Vocabulary test before being presented with any of the tests. Testing was subsequently carried out during two 1-hour sessions for each patient. The tests and the scoring procedures involved are described below:

1. *Auditory Distraction Test*

The basic task required the subject to listen to sequences of 6 digits or letters recorded by a female voice and to report each sequence in the correct order immediately after completion. There was a 1-second interval between successive items in the sequence. The complete test consisted of 16 sequences of this type, each sequence being followed by a rest interval of 10 seconds. In 8 of the 16 sequences the interval between the items in the sequence was filled by

Table I

	No.	Age Range (years)	Mean Age (years)	Sex		M.H.V. Score	Mean Duration of Illness (years)
				M	F		
Schizophrenia	36	20–45	33	29	7	49 (Grade III−)	9·1
Paranoid psychosis ..	10	32–46	38	8	2	64 (Grade III+)	3·9
Depressive psychosis ..	10	31·47	37	8	2	60 (Grade III+)	1·7
Normal subjects ..	40	18–44	29	32	8	58 (Grade III)	—

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an irrelevant number or letter recorded in a male voice. The subjects were instructed to ignore the male voice and to report only the information spoken by the female voice. Several practice trials were first given to accustom the subject to the nature of the task, and the test was begun only after it was clear that the subject appreciated the nature of the task. Each sequence was scored out of a total of 6, one point being deducted for each error, whether of omission, addition or order. The difference between the subject's basic score without distraction and his score on the sequences containing irrelevant material was expressed as a proportion of the basic score. The resultant "distraction index" $\left(\frac{1-2}{1} \times 100\right)$ thus represented the extent to which the subject's performance was affected, either positively or negatively, by distraction.

2. *Visual Distraction Test*

This test was a visual equivalent of the first test, the subject having to perceive and report visually exposed sequences of 6 letters or numbers projected one at a time on a screen. The exposure time for each item was 0·5 seconds with a 1-second interval between items. The total presentation time for each sequence ($7\frac{1}{2}$ seconds) was the same as in the previous test. Visual distraction was in this case provided by irrelevant numbers or letters which appeared around the periphery of the central relevant item. A distraction index was compiled for each subject, indicating the influence of extraneous visual input on visual attention.

3. *Auditory-Visual Distraction Test*

This test consisted of four separate tasks. In the first task the subject was asked to attend to and report a number of visual sequences, each composed of 6 rapidly presented letters or digits. The second task required the subject to respond in a similar manner to sequences of aurally presented letters or digits. In the last two parts of the test the subject was presented with auditory and visual sequences simultaneously. He was required to report only the visual sequences, the auditory sequences acting as a distraction. Finally, the instructions were reversed so that the visual sequences became the distracting stimuli. In this test two distraction indices were calculated, one representing the influence of visual distraction on auditory perception and recall, and the other the effect of auditory distraction on the recall of visually perceived information.

4. *Auditory-Visual Integration Test*

The subject was asked to perceive and report sequences of 6 letters or numbers, the individual items of which were presented alternately in the auditory or visual channels. This task thus demanded the integration of information derived from two sensory channels. Apart from the subject's total score on the test as a whole, his recall score for the auditory and visual parts of each sequence was calculated separately.

Results

As our main interest in analysing the test scores was to distinguish the tests which differentiated the performance of the schizophrenic group from all other groups, "t" tests were performed on the mean scores. An analysis of variance, while in some ways a more appropriate statistical tool for this type of comparative analysis, would merely have indicated differences among the scores of the various groups, and would not have shown where this difference lay. In cases where the variance of the two groups was significantly different, the procedure recommended by Edwards (1960) was applied. The results of the analysis of the data are indicated in the following tables, showing the mean scores, standard deviations and significant levels reached in contrasting the performance of the schizophrenic group with each of the other control groups (N= normal group; D=depressive group; P= paranoid group; C=combined non-schizophrenic patient control groups; S=schizophrenic group).

Table II represents the results of those tests in which the main task was that of perceiving and recalling auditory information.

On the basic task of perceiving and accurately reproducing sequences of auditory information, the schizophrenic group are poorer

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TABLE II

Effect of Distraction on Auditory Attention

Mean Scores	Basic Performance		Distraction Index			
			Auditory		Visual	
	M	SD	M	SD	M	SD
N	44·78	4·14	6·62	7·93	−1·89	10·69
D	45·50	1·43	9·23	7·36	−1·33	4·27
P	44·70	2·80	1·55	9·05	0·78	4·36
C	45·10	2·24	5·39	8·25	−0·28	4·31
S	42·56	3·98	18·00	15·97	11·76	16·71
"t" Values						
S *v.* N	2·38*		3·87†		3·60†	
S *v.* D	3·67*		2·48†		4·22†	
S *v.* P	1·93		4·21†		4·45†	
S *v.* C	3·06†		3·89†		4·08†	

* Significant at 5 per cent. level
† Significant at 1 per cent. level

in performance than the control groups, although this difference does not reach a satisfactory level of significance in the comparison between the schizophrenic and paranoid groups. With the introduction of auditory distraction, there is a falling off in the performance of all the subjects, but this is much more pronounced in the schizophrenic group, whose mean score on this task with auditory distraction differentiates their performance from that of the normal, and both patient control groups. Visual distraction has little or no effect on the performance of any of the subjects apart from the schizophrenic group, whose performance is again significantly lowered by the introduction of the extraneous visual material. It would appear, then, that in a task involving selective attention to auditory information the performance of schizophrenic patients is markedly affected by both auditory and visual distraction.

A comparative analysis of the data on the tests where the main task was that of selectively attending to visual information is indicated in Table III.

Again it can be seen that the basic performance in the absence of distraction is poorer in the schizophrenic group, although the difference between this group and the paranoid group is not statistically significant. The introduction of auditory distraction has a marked effect on the schizophrenic group, who produced the only positive mean distraction index. Visual distraction had apparently no particular effect on any of the subjects, the majority tending to improve their performance slightly with the introduction of visual distraction. It would thus appear that the ability of the schizophrenic patient to attend selectively to visual information is affected by auditory distraction, but not by distraction in the visual modality. The negative results of the test which assessed the effects of visual distraction on visual performance is, however, possibly an artifact based on the nature of this test. The irrelevant distracting visual stimuli were spatially separated in location from the relevant information and peripheral rather than central attentive adjustments would tend to figure more prominently in this task. In the current stage of our investigations we have modified the test to obviate this factor and it remains to be seen whether this will alter the findings.

The results of the Auditory-Visual Integration Test, in which the subject was required to integrate and report information presented in two sensory channels, are presented in Table IV.

It can be seen from these results that although the overall performance of the schizophrenic

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TABLE III

Effect of Distraction on Visual Attention

Mean Scores	Basic Performance		Distraction Index			
			Auditory		Visual	
	M	SD	M	SD	M	SD
N	44·93	3·73	−0·94	7·77	−1·67	7·27
D	44·40	2·46	−0·50	7·09	−0·64	6·03
P	42·20	3·66	−4·95	16·32	−7·16	16·91
C	43·30	2·96	−0·44	12·58	−3·90	12·70
S	38·97	5·46	11·34	20·90	0·64	12·69
"t" Values						
S *v.* N	5·48†		3·38†		0·96	
S *v.* D	4·54†		2·62†		0·45	
S *v.* P	1·58		3·21†		1·60	
S *v.* C	2·96†		2·63†		1·28	

† Significant at 1 per cent. level

TABLE IV

Integration of Auditory and Visual Information

Mean Scores	Total Score		Auditory Component		Visual Component	
	M	SD	M	SD	M	SD
N	113·40	5·29	56·08	3·93	57·33	2·37
D	111·60	4·67	54·20	3·76	57·40	1·50
P	110·70	4·60	53·80	3·46	56·90	1·81
C	111·15	4·64	53·97	3·61	57·17	1·66
S	100·41	16·29	50·78	7·80	47·83	12·88
"t" Values						
S *v.* N	4·79†		3·72†		4·08†	
S *v.* D	3·55†		1·16		3·81†	
S *v.* P	3·82†		1·31		4·07†	
S *v.* C	3·91†		1·70		4·00†	

† Significant at 1 per cent. level

patients on this test was significantly poorer than that of all other groups their errors tended to be confined to the visual component of the test. In other words, when asked to perceive and recall a sequence comprising auditory and visual stimuli, the schizophrenics have particular difficulty in responding to the visual elements in the sequences. The order of presentation between the two modalities appeared to have no effect on the results.

These findings substantiate and add to those reported in our previous experimental study of the effect of distraction on schizophrenic performance. An additional finding of the previous study was that the hebephrenic patients in our schizophrenic group demonstrated the most marked degree of distractibility. In a similar attempt to relate test performance with the clinical picture, we used our interview material to rate each patient on a scale dealing with the following items: premorbid personality, precipitating factors, onset of the psychosis, affective flattening or incongruity, thought disorder, and hallucinations. These ratings were subsequently used to extract from the schizophrenic group those patients whose psy-

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chosis had taken a more severe and malignant form. The clinical characteristics of this subgroup are detailed in Table V below:

TABLE V

1. Markedly schizoid pre-morbid personality.
2. No evidence of any precipitating factors.
3. Long and insidious onset of illness.
4. Marked flattening and incongruity of affect.
5. Thinking markedly diffuse and bizarre.
6. Frequent hallucinations which influence behaviour.

The majority of the schizophrenic patients in this group had been diagnosed as hebephrenic and closely conformed in their clinical state to Kraepelin's original picture of dementia praecox. For convenience of classification this group of patients will be referred to simply as Hebephrenics. The remaining schizophrenic patients, who are better preserved in their personality, will be termed simply "Others". The mean scores of these two schizophrenic subgroups are presented in Table VI, where it is evident that it is the "hebephrenic" subgroup who tend to show the higher degree of distractibility.

Finally, the performance of the more chronic patients was examined, using the cutting-off point of 5 years duration of illness as a standard of chronicity. The scores for this comparison are presented in Table VII. It can be seen from these figures that there are no distinct differences in the distractibility scores between the chronic and the remaining schizophrenic patients. There is a slight tendency for the chronic patients to be more distractible, but the differences between the two groups is by no means marked and in no case statistically significant.

The results of the present investigation confirm our earlier findings (1960) that, in a situation where performance is dependent on accurate perception and recall of information, the schizophrenic patient is abnormally vulnerable to experimental distraction. It is difficult to ascertain whether distraction inter-

TABLE VI

Mean Scores—Hebephrenic and Non-Hebephrenic Patients

	Auditory Selection		Visual Selection	
	Auditory Distraction	Visual Distraction	Auditory Distraction	Visual Distraction
Hebephrenic	22·14	14·86	15·88	1·33
Others	13·86	8·67	6·79	−0·06
("t" Values)	1·98	2·59*	3·61†	1·01

* Significant at 5 per cent. level
† Significant at 1 per cent. level

TABLE VII

Mean Scores—Duration of Illness Dichotomy

Duration of Illness	Auditory Selection		Visual Selection	
	Auditory Distraction	Visual Distraction	Auditory Distraction	Visual Distraction
Over 5 years	22·12	15·44	15·32	1·09
Under 5 years	16·66	7·35	7·20	0·31
("t" Values)	1·32	1·68	1·84	1·11

rupts the process of perception or exerts this effect in the short interval between perception and subsequent recall. In our studies it appeared that the main effect of distraction consisted of an overloading of the short-term memory of the schizophrenic patients.

There is some indication that schizophrenic patients are particularly poor in the short-term retention of visual information. This modality difference is evident in the performance of schizophrenic patients on the Auditory-Visual Integration Test, used in the present study, and it has been further demonstrated in other tests being used in current studies. The studies of Sperling (1960) and Conrad (1964) have suggested that visual information is normally recorded into aural information before storage. Where the information to be dealt with is visual, this translation into aural information before storage appears to create a further source of error and causes the schizophrenic patient to be particularly poor in his performance on visual tasks.

Most other workers who have investigated perceptual and cognitive changes in schizophrenia have commented on the wide scatter in performance within the schizophrenic group. The heterogeneity of schizophrenic scores suggests the possibility that the disturbances of attentive behaviour noted may be limited to certain forms of schizophrenia. The majority of workers who have compared experimental measures of attentive behaviour among the different sub-types of schizophrenia have concluded that patients falling into two of the subtypes, the paranoid and the hebephrenic, tend to form discrete and homogeneous groups whose performance on tests is strikingly different. Our findings suggest that it is the more disordered hebephrenic patient who demonstrates a marked impairment in selective attention. It is of interest here that the small group of 10 patients comprising our control group of patients with a paranoid psychosis are on the whole less influenced by distraction than are normal subjects.

Another question raised by other workers in this field concerns the relationship between distractibility and the level of chronicity of the schizophrenic illness. If we measure chronicity by the actual duration of the illness and take 5 years duration as a cutting-off point, there is a slight but non-significant tendency for the chronic schizophrenic patients to be somewhat more distractible on the tests used in this study.

Summary

A group of 36 schizophrenic patients, 40 normal controls and 20 non-schizophrenic psychotic patients were compared in their performance on some tests examining the effect of distraction on perception and immediate recall. It was demonstrated that the schizophrenic patients were on the whole more distractible than the normal and patient control groups. The tendency was observed for the effects of distraction to be more marked in the case of hebephrenic patients, and also to increase with the chronicity of the schizophrenic illness.

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