Perceptual Organization and Schizotypic Heterogeneity

Steven, M. Silverstein, Michael L. Raulin, James R. Pomerantz,

and James E. Patrey

State University of New York at Buffalo

For the past twelve years a program of research has studied psychosis proneness by selecting individuals who score high on self report measures of schizotypal symptoms and then comparing them to control subjects on various indices relevant to schizophrenia. Two scales in particular, the Physical Anhedonia Scale (Chapman, Chapman, & Raulin, 1976) and the Perceptual Aberration Scale (Chapman, Chapman, & Raulin, 1978) have consistently identified individuals who perform like schizophrenics across a wide range of measures, including: projective and objective psychological tests, social interaction, word association, and eye movements (e.g., Chapman & Chapman, 1985; Edell & Chapman, 1979, Raulin, Van Slyck, & Rourke, 1983; Simons & Katkin, 1985).

One of the more consistent trends in this research has involved findings of similarities between high scorers on the Physical Anhedonia Scale and schizophrenics with a predominance of negative symptoms and/or a poor premorbid history. For example, on several psychophysiological indices (e.g., EEG, heart rate, pulse, etc.) both groups have shown a pattern of reduced responsiveness to novel stimuli which suggests a dysfunction at an early stage of information processing relating to stimulus significance evaluation. Moreover, these manifestations of an orienting deficit are not shown by patients with affective disorders (Bernstein, 1987; Bernstein & Reidel, 1987) or by college students scoring high on the Perceptual Aberration Scale (e.g., Simons, 1981).

This study explored the possibility of a further, and theoretically related, continuity between anhedonics and poor premorbid schizophrenics: the demonstration, among anhedonics, of a perceptual organization deficit. A perceptual organization deficit refers to a dysfunction at the preattentive stage of information processing, i.e., the stage at which the visual field is divided into units or groups. It is at this stage that the elements for a more detailed analysis are set off from background information and in this way made more effective units of information for the later allocation of attentional resources. Manifestations of a deficit at this stage among schizophrenics have included an unresponsivity to grouping of elements in a numerosity task (Place & Gilmore, 1980), several demonstrations of a reduced ability to segregate irrelevant from relevant material in a briefly presented visual display (Cox & Leventhal, 1978), and a heightended vulnerability to patterned masks in a backward masking study (Knight, Elliot & Freedman, 1985).

***Paper presented at the meeting of the Eastern Psychological Association, April, 1988, Buffalo, NY.

The perceptual organizational abilities of anhedonics were assessed by using a modification of the procedure used by Banks and Prinzmetal (1976). In their study with normal college students, a target letter (T or F) was more difficult to detect if it was arranged in good form (i.e., as part of a symmetrical pattern: see slide 1) than it was when the noise elements (hybrid T-F characters) formed their own perceptual group. This effect was found even though the display size in the good form condition (#1) contained fewer elements than in the "grouped" condition (#2). In the other three conditions, target detection was most difficult. Here, subjects' automatic grouping processes interfered with target detection by grouping the target with the noise elements, thus requiring the initiation of a more time consuming sequential search.

In the Banks and Prinzmetal (1976) study, organizational qualities strongly affected recognition performance, even to the point of overriding a display size effect (i.e., performance in condition 2 was superior to that in condition 1, with worst performance on 3-5). Similar performance for controls was expected in this study. For the anhedonics, however, a lessened responsivity to the configural qualities of the noise elements was expected. It was thus predicted that the performance of anhedonics would be characterized by a display size effect (i.e., condition 1 faster than condition 2) and by smaller differences between conditions 2 through 5. Performances of the depressed group (a control for general psychopathology) and the perceptual aberration group (a control for psychosis proneness) were predicted to be similar to that of the control group.

Method

Subjects

Subjects were males in introductory psychology. Four groups were formed comprising individuals who either: (1) achieved a score equivalent to 2 standard deviations above the mean on the Physical Anhedonia Scale (n=17); (2) scored above 2 SD on items from the Perceptual Aberration Scale (Chapman, Chapman, & Raulin, 1978; n=13); (3) scored above 10 on the Beck Depression Inventory (Beck, 1978; n=13); or (4) met none of the above criteria (n=14).

The research assistant was blind to subjects' scores on the screening measures.

Procedure

A card sorting task was used wherein subjects had to sort out cards according to the target letter. Each deck of cards contained arrays corresponding to one of the five conditions of stimulus organization. On any one card the target letter could appear in any of the four corners of the array. Since there were two possible targets, there were eight stimulus arrays for each condition. Each array was included twice in each deck reulting in five decks of sixteen cards each.

Results

A three way analysis of variance (group x deck x trial) with repeated measures on the last two factors revealed a significant main effect of deck, indicating that organizational qualities strongly affected sorting time: $F(4,208)=27.93$, $p<.001$. A significant main effect of trial was also obtained: $F(4,164)=14.26$, $p<.001$. There was no main effect of group.

The group by deck interaction was not significant. For all groups, condition 2 was associated with the fastest performance.

------slide 2 here------

For the controls, anhedonics, and perceptual aberrators, condition 1 was second fastest, with either 3 or 4 next, and 5 last. For the depressed group, the order of the remaining decks was 4, 1, 3, 5. Analyses on the main effect of deck revealed that of the ten possible pairwise comparisons, all mean differences were in the predicted direction and six were significant beyond the .001 level. Three of the remaining four were significant beyond the .03 level (ps =.024, .017, .002). The only comparison that failed to approach significance was between decks 3 and 4. This result was most likely due to two reasons: first, conditions 3 and 4 were the two most similar (being controls for positional redundancy of the target and involving less lateral masking than condition 5) and a small difference was expected; and second, the reversal of the relative order of these means by the anhedonia group reduced the likelihood of an overall significant difference.

In an effort to see if any anhedonic differences may have been normalized by the presence of depressed but "non-schizotypal" anhedonics, the above analyses were carried out again after removing the data of those anhedonics who met the criteria for inclusion in the depression group (e.g., a BDI score of 11 or greater; this left 12 subjects in the anhedonia group). The main effect of condition was still significant. We next looked at the possibility that this smaller anhedonia group may have had a similar pattern of performance, but smaller inter-deck differences, than the other groups, i.e., less sensitivity to the manipulation of the organizational quality of the noise elements. An ANOVA was carried out on the difference scores between decks 3, 4, and 5 and deck 2. Although the anhedonia group had the smallest difference scores for all three comparisons, there was no main effect of group.

Thus, all groups were strongly affected by the organizational qualities of the stimuli. Target detection was either facilitated or impaired in the same way for all groups across conditions.

Discussion

The results of this study suggest that high scorers on the Physical Anhedonia Scale have intact perceptual organization abilities. Their performance was similar to that of the three control groups in the present study as well as being similar to the subjects in the study of Banks and Prinzmetal (1976). This finding is somewhat curious since: (1) poor premorbid schizophrenics have demonstrated a perceptual organization deficit; and (2) anhedonics and poor premorbid

schizophrenics have performed similarly on several measures including indices (e.g., aspects of the orienting response) thought to reflect a dysfunction at an early stage of information processing which would include a perceptual organization deficit. Rather than being inconsistent, however, this set of results may help clarify the nature of the information processing deficit in psychosis prone individuals as well as the relationship between a perceptual organization deficit and schizophrenia. Specifically, it may be that a perceptual organization deficit is found only in cases of poor premorbid schizophrenia, i.e., that this preattentive processing deficit is an aspect of either chronic psychotic disorganization or a severely impaired attentional system.

If this is the case, then the similarities that have been identified between anhedonics and poor premorbids may reflect a more general reduction in information processing capacity. For example, both the deficits in orienting, as well as the findings of reduced amplitude of evoked potentials in other paradigms (e.g., Josiassen, Shagass, Roemer, & Straumanis, 1985) that have been found among anhedonics could be due to a number of factors such as: (1) a preparatory set in which the stimuli presented are not treated as being highly significant (this is especially relevant to the orienting data); (2) less inhibition of other cognitive activity; (3) less focused attention; and (4) less anticipatory mobilization of capacity (see Kahneman, 1973). Thus, while both groups may share a common dysfunction in attentional allocation, a perceptual organization deficit may be a later, or more severe, manifestation of this disturbance which appears only in states where the mechanisms responsible for controlling attention are so impaired that even basic (pre)attentional processes, such as perceptual organization, are no longer intact. Such a possibility is supported by the data of Josiassen et al. (1985) who found reduced amplitude of somatosensory evoked potentials among both anhedonics and schizophrenics but impaired task performance only in the schizophrenic group.

Presumably, such a deficit could result when a channel for processing emergent features or gestalts is not faster than the channels for processing component parts or individual elements. This, in turn, could be due either (1) to a total pool of capacity which is too small to mobilize all aspects of the information processing system (i.e., emergent feature channels would not be faster than component feature channels as they normally may be when a configuration is highly discriminable), (2) from a failure to attenuate information about component parts (see Pomerantz, Sager, & Stoever, 1977); (3) from interference within the emergent feature channel either from component feature channels or other perceptual or cognitive activity; or (4) from a failure to process emergent features altogether.

The possibility must also be considered that anhedonics do possess some form of a perceptual organization deficit, but that this was not detected in this study. For example, past research with both schizophrenics and high scorers on the Physical Anhedonia Scale has shown that making stimuli more salient and/or increasing task engagement leads to normalization of information processing (Cox & Leventhal, 1978; Miller, 1986). Thus, it is possible that the active nature of this task led to a higher degree of preattentive processing than would have been the case in a procedure where subjects were more passive. As more research is done in this area with varying

task parameters, a greater understanding of the nature of cognitive dysfunctions across the schizophrenia spectrum should emerge.

Regarding the high risk approach used here, several general issues need to be addressed. One is that follow up data must be collected to assess the validity of this line of research. If, at some point, highly valid measures of schizophrenia- and/or psychosis-prediction are found, future research using information processing paradigms needs to clarify (1) the ways in which psychosis prone individuals resemble schizophrenics; (2) the deficits associated only with psychotic disorders themselves (which are not due to medication or institutionalization, etc.); and (3) the deficits associated only with active psychotic episodes. Progress in these four lines of research promises to greatly increase our understanding of the etiology of schizophrenia.

References

Banks, W. P., & Prinzmetal, W. (1976). Configural effects in visual information processing. Perception and Psychophysics, 19, 361-367.

Beck, A. T. (1978). Beck Depression Inventory, revised. Philadelphia: Center for Cognitive Therapy.

Chapman, L. J., Chapman, J. P., & Raulin, M. L. (1976). Scales for physical and social anhedonia. Journal of Abnormal Psychology, 85, 374-382.

Bernstein, A. S. (1987). Orienting response research in schizophrenia. Schizophrenia Bulletin, 13, 623-641.

Bernstein, A. S., & Riedel, J. A. (1987). Psychophysiological response patterns in college students with high physical anhedonia: Scores appear to reflect schizotypy rather than depression. Biological Psychiatry, 22, 829-847.

Chapman, L. J., & Chapman, J. P. (1985). Psychosis proneness. In M. Alpert (Ed.), Controversies in Schizophrenia (pp. 157-172). New York: The Guilford Press.

Chapman, L. J., Chapman, J. P., & Raulin, M. L. (1976). Scales for physical and social anhedonia. Journal of Abnormal Psychology, 85, 374-382.

Chapman, L. J., Chapman, J. P., & Raulin, M. L. (1978). Body-image aberration in schizophrenia. Journal of Abnormal Psychology, 87, 399-407.

Cox, M. D., & Leventhal, D. E. (1978). A multivariate analysis and modification of a preattentive, perceptual dysfunction in schizophrenia. Journal of Nervous and Mental Disease, 166, 709-718.

Edell, W. S., & Chapman, L. J. (1979). Anhedonia, Perceptual Aberration, and the Rorschach. Journal of Consulting and Clinical Psychology, 47, 377-384.

Josiassen, R. C., Shagass, C., Roemer, R. A., & Straumanis, J. J. (1985). Attention-related effects on somatosensory evoked potentials in college students at high risk for psychopathology. Journal of Abnormal Psychology, 94, 507-518.

Kahneman, D. (1973). Attention and effort. Englewood Cliffs, New Jersey: Prentice Hall, Inc.

Knight, R. A., Elliot, D. S., & Freedman, E. G. (1985). Short-term visual memory in schizophrenia. Journal of Abnormal Psychology, 94, 427-442.

Miller, G. A. (1986). Information processing deficits in anhedonia and perceptual aberration: a psychophysiological analysis. Biological Psychiatry, 21, 100-115.

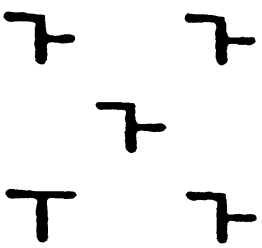
Place, E. J., & Gilmore, G. C. (1980). Perceptual organization in schizophrenia. Journal of Abnormal Psychology, 89, 409-418.

Pomerantz, J. R., Sager, L. C., & Stoever, R. C. (1977). Perception of wholes and their component parts: Some configural superiority effects. Journal of Experimental Psychology: Human perception and Performance, 3, 422-435.

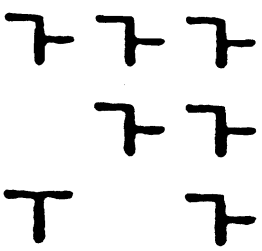
Raulin, M. L., Van Slyck, M. R., & Rourke, P. (1983, April). MMPI correlates of several schizotypy scales. Paper presented at the Eastern Psychological Convention, Philadelphia.

Simons, R. F., & Katkin, W. (1985). Smooth pursuit eye movements in subjects reporting physical anhedonia and perceptual aberrations. Psychiatry Research, 14, 275-289.

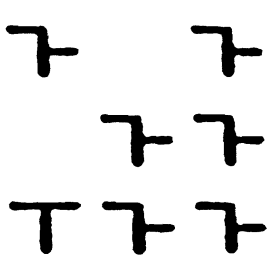
Figure 1



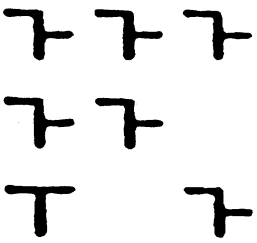
Condition 1



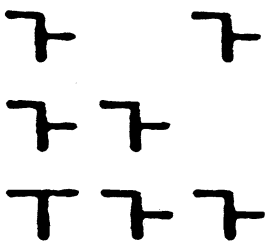
Condition 2



Condition 3



Condition 4



Condition 5

	Depressed	Control	Anhedonic	Perab
Deck 1	16.85	16.10	15.96	17.47
Deck 2	16.55	15.82	15.84	17.36
Deck 3	16.92	16.36	16.09	17.99
Deck 4	16.79	16.25	16.28	17.89
Deck 5	17.37	16.76	16.69	18.90