ABSOLUTE AUDITORY THRESHOLD AND THRESHOLD OF UNPLEASANTNESS OF CHRONIC SCHIZOPHRENIC PATIENTS AND NORMAL CONTROLS

FREDRIC M. LEVINE AND NORMAN WHITNEY

State University of New York at Stony Brook
Xerox Corporation, Rochester, New York

The method of average error was modified for research in schizophrenia and was used in establishing both the absolute auditory threshold and the threshold of unpleasantness. The results showed chronic schizophrenic patients had a higher absolute threshold but a lower threshold for when a tone became unpleasantly loud. The results add evidence that chronic schizophrenic patients find external stimulation aversive; they point out the narrow range of auditory stimuli in which schizophrenics function; and suggest that the same auditory stimuli cannot be considered equivalent for schizophrenic patients and normal controls.

The results of a stimulus-seeking experiment showed that chronic, nonparanoid schizophrenic patients preferred a noise stimulus of varying intensity to be off, while normal controls preferred it on (Levine, 1967). These results were interpreted as indicating a motivational process in which schizophrenic patients avoid external stimulation simply because external stimulation is unpleasant to them. However, another explanation for the findings is that schizophrenic patients have greater auditory sensitivity than normals. If patients were more sensitive, then the stimuli used would not be perceptually equivalent and would tend to be differentially aversive. The patients would then be expected to show the obtained results of preferring the noise off.

Previous research in schizophrenic audition has shown inconsistent results. L. E. Travis (1924) measured auditory thresholds while Ss were in a state of reverie. He induced reverie by having Ss relax and let their minds wander while gazing at a blue light which "gives the appearance of the heavens on a clear, starlit night [Travis, 1924, p. 358]." Dementia praecox patients had higher thresholds than controls during periods of reverie.

R. C. Travis (1926) induced reverie by playing a record of John McCormack singing "Annie Laurie" over and over and also found that the thresholds of schizophrenic patients were higher during the period of reverie. Bartlett (1935), on the other hand, using the method of limits found no threshold differences between recently hospitalized dementia praecox patients and normals. Ludwig, Wood, and Downs (1962), also using the method of limits, found no differences between a randomly selected group of schizophrenic patients and normal controls for tones of 500, 1,000, and 2,000 Hz. It is difficult to determine the precise characteristics of the schizophrenic population used in the previous experiments.

The current experiment had two purposes: (a) to determine again absolute auditory threshold, this time with a diagnostically homogeneous population of chronic schizophrenic patients, using procedures designed to get more precise thresholds by minimizing the general performance deficit of chronic schizophrenic patients; and (b) to determine whether the schizophrenic patients had a lower threshold for when a tone became unpleasant. If the stimulus-seeking results were due to motivation, the patients would find the tone unpleasant at a lower level.

METHOD

Subjects

The 20 male schizophrenic patients were selected from the same group as those participating in the previous stimulus-seeking experiment. They all met

1 The study was supported by United States Public Health Service Grant MH 12556-01. The authors appreciate the technical help given by Jorge Ardila and Bernard Tursky and the comments of Andrew Crider and David S. Emmerich.
2 Requests for reprints should be sent to Fredric M. Levine, Department of Psychology, State University of New York, Stony Brook, Long Island, New York 11790.
the following criteria: unequivocal diagnosis of schizophrenia by three psychiatrists, never married, a history of schizophrenia for at least 4 yr. prior to the experiment, poor psychiatric prognosis, nonparanoid, no known organic brain disease or significant medical illness, and rated as cooperative on the Shakow and Huston (1956) scale. The age range of the patients was 18-35 (M = 28.50, SD = 5.34). The 20 male controls were volunteer students and hospital employees (M = 24.90, SD = 4.12).

Procedure

The procedure was designed to minimize differences due to general schizophrenic performance deficit. The method of average error was chosen because schizophrenic patients show improved performances when they can program their own stimuli (Donahoe, Curtin, & Lipton, 1961; Shakow, 1963; Wohl, 1958). All Ss were seated in a sound-attenuated, temperature-controlled room, in a chair which had a control knob on the right arm. The Ss were told that there would be two parts to the experiment, separated by a brief break. In measuring absolute thresholds, Ss were instructed to either "Turn the knob to the point at which you first hear the tone" or "Turn the knob to the point at which you first stop hearing the tone." The knob controlled a logarithmic potentiometer.

After two practice trials to ensure that the instructions were understood, the Ss were given five ascending and five descending trials. Ascending and descending trials were used to control for errors of habituation and anticipation (Woodworth & Schlosberg, 1954), and the small number of trials was used to avoid boredom. The intensity range of the knob was randomly varied between trials so that position of the knob would not become an absolute reference.

After the 10 trials, Ss were given a brief break. Next, the threshold of unpleasantness was measured with essentially the same procedure except that the Ss were instructed to "Turn the knob to the point at which the tone first becomes unpleasant to you" and "Turn the knob to the point at which the tone stops being unpleasant to you." A total of 10 additional trials, alternating between ascending and descending, were given. A 400-Hz. tone was used for both absolute and unpleasant thresholds.

Results

Table 1 gives the means and standard deviations for the absolute threshold and the threshold of unpleasantness. The absolute auditory threshold of the chronic schizophrenic patients was significantly higher than that of the normals (t = 5.62, p < .001). Because of difficulty in getting standards, the absolute decibel level does not precisely correspond to sound pressure decibel, but the magnitude of the difference between the two S groups is the same. The threshold of unpleasantness was significantly lower (t = 2.04, p < .05) for the patients, as predicted. Within each S group, there was no significant correlation between the absolute and unpleasant auditory threshold.

Discussion

The significant difference in absolute threshold between patients and controls is difficult to explain. It is possible that motivational differences between the groups might account for some of the absolute threshold differences. According to signal detection theory, the higher patient threshold could be due either to lower sensory sensitivity (d') or to a more conservative response criterion (Lc). However, research just completed using a forced-choice technique yielded a mean threshold difference of about 8 db. between patients and controls. Because the forced-choice procedure yields a relatively pure measure of d' uncontaminated by nonsensory factors, it may be concluded that the difference between groups is due to different auditory sensitivity.

Ludwig et al. (1962) reported that with 61% of their schizophrenic sample on medication, mainly phenothiazines, "detailed statistical evaluation revealed that medication effects played no role in the test performance [p. 125]." This suggests that in the present study differences between patients and controls were not due to the effects of drugs.

One explanation of the present absolute
threshold difference from those of Bartlett (1935) and Ludwig et al. (1962) is that different types of schizophrenic patients were used. Previous auditory research included patients who were diagnosed within the broad category of schizophrenia, irrespective of subclassification. As pointed out in the procedure, the current experiment was restrictive in patient selection. In light of the current trend of finding differences in performance between acute and chronic subtypes of schizophrenia (e.g., Silverman, 1964; Venables, 1964), having diagnostic heterogeneity might have concealed auditory differences in previous research.

The predicted finding, which showed chronic schizophrenic patients as having a lower threshold of unpleasantness, was consistent with the stimulus-seeking experiment (Levine, 1967). This, again, points out that this type of patient finds auditory stimulation more unpleasant than controls. The difference in absolute thresholds was in the opposite direction from that which would demonstrate that patients are overly sensitive to auditory stimuli. The results showing that chronic schizophrenic patients had a higher absolute threshold and a lower threshold of unpleasantness were similar to the auditory phenomenon called recruitment (Hirsh, 1952). An example of recruitment would be when someone who is hard of hearing asks one to speak louder and then complains that one is shouting. The intensity of the disorder found in the schizophrenic patients was less than that customarily dealt with by audiologists, but the phenomenon of an abnormally rapid rise in loudness seems comparable. Hirsh (1952) stated that recruitment is due to neural damage, possibly in the cochlea. Equally important is the effect that recruitment has on the intelligibility of speech. Hirsh pointed out that a recruitment type of impairment generally shows a greater loss in the intelligibility of speech than does a hearing impairment without recruitment. Hirsh (1952) cited data that validate the following statement of patients with a recruitment type of hearing loss: “Don’t shout; you’re talking plenty loud but I don’t know what you’re saying [p. 228].” This seems to be consistent with the clinical picture of schizophrenic patients who seem to find auditory interchange as unpleasant and have difficulty in understanding the content of the auditory message.

The restricted auditory range also has implications for experiments which have used auditory stimuli and have assumed that the stimuli were equivalent for schizophrenics and controls. Apparently, this is not the case and may explain why Venables and O’Connor (1959), Venables (1960), and Zahn, Rosenthal, and Lawlor (1962) found an interaction in performance between auditory and visual stimuli and schizophrenic and normal Ss.

The threshold of unpleasantness results again implicate a simple process of motivational differences which can account for a wide variety of performance deficits in schizophrenia: Once a stimulus is intense enough to be perceived, chronic schizophrenic patients tend to find it unpleasant and therefore tend to avoid it.

REFERENCES


(Received August 29, 1968)

---

Manuscripts Accepted for Publication in the *Journal of Abnormal Psychology*


Conscious Control of Dreaming: I. The Posthypnotic Dream: Charles T. Tart*: Department of Psychology, University of California, Davis, California 95616.

Vicarious Conditioning and Sociopathy: Patricia B. Sutker*: Department of Psychiatry and Neurology, Tulane Medical School, 1430 Tulane Avenue, New Orleans, Louisiana 70112.


Disordered Language as Related to Autonomic Responsivity and the Process-Reactive Distinction: Joy K. Rice*: Counseling Center, University of Wisconsin, 415 West Gilman Street, Madison, Wisconsin 53706.

Relative Contributions of Modeling, Informational Influences, and Physical Contact in the Extinction of Phobic Behavior*: Edward B. Blanchard: Georgia Mental Health Institute, 1256 Briarcliff Road N. E., Atlanta, Georgia 30306.


Susceptibility to Social Influence and Retention of Opinion Change in Two Types of Delinquents: Al C. Schmid*: Sacramento Medical Center, Mental Health Unit, 4430 V Street, Sacramento, California 95817.


Psychophysiological Analysis of Fear Modification Using an Automated Desensitization Procedure: Peter J. Lang,* Barbara G. Melamed, and James Hart: Department of Psychology, University of Wisconsin, Madison, Wisconsin 53706.

Relation of Formal Thought Disorder to the Communication Deficit in Schizophrenics: Leonard C. Suchotliff,* Fairfield Hills Hospital, Newtown, Connecticut 06470.


*Asterisk indicates author for whom address is supplied.