

in both reading and spontaneous speech samples at follow-up than at original baseline conditions.

We are encouraged to explore further the use of calcium channel blocking agents in stuttering. The present study used a fixed dosage schedule (80 mg 3 times daily). As this was well tolerated with virtually no side effects, larger doses are worth exploring. We also plan to investigate other drugs of this class. The use of calcium channel blockers may prove to be a useful component of a broad program of speech retraining for severe adult stutterers (Burns and Brady 1980).

References

- Beck A, Rush J, Shaw B, Emery G (1970): *Cognitive Therapy of Depression*. New York: Guilford Press.
- Burns D, Brady JP (1980): The treatment of stuttering. In Goldstein A, Foa EB (eds), *Handbook of Behavioral Interventions*. New York: John Wiley & Sons, pp 673-722.
- Derogatis LR, Lipman RS, Covi L (1973): SCL-90: An outpatient psychiatric rating scale. *Psychopharmacol Bull* 9:13-28.
- Ingham RJ (1984): *Stuttering and Behavior Therapy*. San Diego, CA: College-Hill Press.
- Johnson W, Darley FL, Spriestersbach DC (1963): Scale for rating severity of stuttering. In *Diagnostic Methods in Speech Pathology*. New York: Harper and Row.
- Murray TJ, Kelly P, Campbell L, Stefanik K (1977): Haloperidol in the treatment of stuttering. *Br J Psychiatry* 130:370-373.
- Zachariah G (1980): Verapamil in the management of stammering. *Antiseptic* 77:87-88.

Auditory Hallucinations in Schizophrenia: Does Humming Help?

Michael Foster Green and Marcel Kinsbourne

Introduction

A simple and effective behavioral method to control auditory hallucinations has so far eluded researchers. Such a method would be useful because neuroleptics are sometimes ineffective for controlling auditory hallucinations and often result in troublesome side effects. Falloon and

Talbot (1981) reported coping strategies (including working, lying down, walking) employed by 40 schizophrenic patients to control persistent hallucinations. However, no particular method seemed to be especially effective.

Bick and Kinsbourne (1987) tested the view that auditory hallucinations result from disinhibited subvocal activity. They used an experimental procedure (holding the mouth wide open which presumably interferes with subvocalization) and control conditions. Following each condition, the subjects reported whether the manipulation increased, decreased, or did not change their hallucinations. There were fewer halluci-

From the Department of Psychiatry and Biobehavioral Sciences, University of California, Los Angeles, CA (M.F.G.), and the Division of Behavioral Neurology, Eunice Kennedy Shriver Center, Waltham, MA (M.K.).

Address reprint requests to Dr. M.F. Green, UCLA Research Center, Box A, Camarillo, CA 93011.

Received May 2, 1988; revised June 20, 1988.

nations when schizophrenics held their mouths open, but not when they closed their eyes tightly or made a fist. Consistent with this finding, Erikson and Gustafson (1968) suggested (based on two case studies) that humming or gargling can help patients control voices.

The goal of the present study was to systematically and quantitatively investigate the effects of several behavioral conditions on hallucinations. This preliminary report is part of a larger project on the role of subvocal processes in auditory hallucinations.

Methods

Subjects for this study ($n = 17$) were state hospital inpatients who experienced frequent auditory hallucinations. All subjects met DSM-III criteria for schizophrenia based on an expanded version of the Present State Exam. Average neuroleptic medication (in chlorpromazine equivalents) was 1208 (SD 831), and length of present episode (in months) was 17.4 (15.3). Interviewers were trained to reliability by the Clinical Research Center for the Study of Schizophrenia at UCLA. No patient had mental retardation, a neurological disorder, or was over 55 years of age.

Five experimental conditions were selected based on predictions about their effects on subvocalizations: opening the mouth, biting the tip of the tongue, softly humming a single note, raising the eyebrows, and making a fist. The first three conditions were predicted to reduce hallucinations by interfering with subvocalization. The last two were control conditions.

Testing was conducted in a sound-proof room. Electromyogram (EMG) electrodes were attached to the oral and laryngeal regions (to index subvocal activity), and subjects were instructed to depress a response button for as long as they heard voices. The duration of the button press was recorded by a polygraph in an adjacent room.

Conditions lasted for 90 sec and were counterbalanced across subjects. Baseline levels were recorded after instructing the subject to relax. The only dependent variable for the current re-

port was the length of time the subject pressed the button.

Results

A repeated measures Analysis of Variance on the scores for baseline and the five experimental conditions revealed a strong effect for the type of condition ($F = 5.59, p < 0.0002$). Each experimental condition was then contrasted with baseline. Humming was the only condition to significantly reduce the self-report of hallucinations ($p = 0.002$). A nonparametric procedure (Wilcoxon sign-rank) yielded similar results ($p < 0.003$). This effect was not simply due to outliers: 15 of the 17 subjects showed a reduction with humming. Table 1 shows the mean score (in seconds) for each condition.

Discussion

The data show that humming reduced the amount of time that subjects reported hallucinations. Although the mechanism is unknown, there are several possible explanations.

Humming might provide an auditory distraction that interferes with hallucinations. However, the subjects were instructed to hum a single note as quietly as possible, so auditory interference was relatively small. Also, several of our patients reported that auditory stimuli seem to increase their hallucinations (e.g., listening to the radio). In fact, Alpert (1985) found that patients reported more hallucinations at moderate levels of white noise.

Perhaps humming required more effort than the other conditions. However, subjects mentioned that it was difficult for them to raise their eyebrows and hold their mouth open for the required time intervals. They did not complain about the humming condition.

In terms of the subvocalization theory, humming might have successfully overridden the subvocal speech (by engaging its output mechanism) and hence reduced hallucinations. However, we did not confirm Bick and Kinsbourne's (1987) finding that opening the mouth reduced hallucinations. Unlike the Bick and Kinsbourne

Table 1. Mean Time Spent Hallucinating

	Baseline (sec)	Mouth open (sec)	Bite tongue (sec)	Hum a single note (sec)	Clench fist (sec)	Raise eyebrows (sec)
Mean	33.35	32.10	28.21	17.97	36.81	31.38
SD	29.28	28.10	27.14	26.46	29.96	30.97

study, subjects in the present study had EMG electrodes attached to their mouth that might have precluded the subjects from opening their mouths wide enough to suppress subvocalization.

With respect to the view that auditory hallucinations result from verbal activity in the non-dominant hemisphere (P. Green et al. 1979; Birchwood, 1987), could humming have interfered with the generation of hallucinations? Humming a melody is considered a right hemisphere task, but our subjects simply hummed a single note, which was probably mediated by the left hemisphere (Gordon and Bogen 1974).

Though Falloon and Talbot (1981) did not list humming as a spontaneously used coping strategy, we found that it reduced reported hallucinations in our subjects. The present study demonstrates the value of using behavioral techniques (with a hypothesis-driven approach) to control auditory hallucinations.

The authors express their gratitude to Sun Hwang, Ruth Roelke, Dan Sohlden, and especially Donna Gaier for their assistance with the data collection and analysis. The data were collected in the UCLA Clinical Research Center for the Study of Schizophrenia (Robert P. Liberman, P.I.) at Camarillo State Hospital.

References

- Alpert M (1985): The signs and symptoms of schizophrenia. In Alpert M (ed), *Controversies in Schizophrenia*. New York: Guilford Press.
- Bick PA, Kinsbourne M (1987): Auditory hallucinations and subvocal speech in schizophrenic patients. *Am J Psychiatry* 144:222-225.
- Birchwood M (1986): Control of auditory hallucinations through occlusion of monaural auditory input. *Br J Psychiatry* 149:104-107.
- Erickson GD, Gustafson GJ (1968): Controlling auditory hallucinations. *Hosp Commun Psychiatry* October:45-47.
- Falloon I, Talbot RE (1981): Persistent auditory hallucinations: Coping mechanisms and implications for management. *Psychol Med* 2:329-339.
- Gordon HW, Bogen JE (1974): Hemispheric lateralization of singing after intracarotid sodium amobarbitone. *J Neurol Neurosurg Psychiatry* 37:727-738.
- Green P, Glass A, O'Callaghan MAJ (1979): Some implications of abnormal hemisphere interaction in schizophrenia. In Gruzellier JH, Flor-Henry P (eds), *Hemispheric Asymmetries of Function and Psychopathology*. Amsterdam: Elsevier.
- McGuigan FJ (1978): *Cognitive Psychophysiology: Principles of Covert Behavior*. Englewood Cliffs, NJ: Prentice-Hall.