Auditory Hallucinations and Subvocal Speech in Schizophrenic Patients

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Fourteen of 18 hallucinating schizophrenic patients reported that the voices they heard went away when they undertook a maneuver that precluded subvocalization. The same applied to 18 of 21 normal subjects who hallucinated under the influence of hypnotic suggestion. Control maneuvers had no such effect. The authors suggest that auditory hallucinations may be projections of schizophrenic patients' verbal thoughts, subvocalized due to deficient cerebral cortical inhibition.

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Hallucinations have variously been regarded as 1) an expression of excess (e.g., disinhibited) brain activity or 2) products of adaptive behavior, either searching for organization in a chaotic array or motivated by dynamic imperatives. Each approach derives support from a different domain of hallucinatory experience: drug, seizure, and electrical stimulation effects; perceptual isolation; and the content of hallucinations of psychotic patients. They are not mutually exclusive. In particular, thought-disordered content could be superimposed on either primary or compensatory brain-based phenomena.

We have examined auditory hallucinations with respect to the recurrent claim that they are accompanied by subvocalization. Subvocalization could either accompany ("shadow") hallucinated voices or mediate (generate) them.

Following Hansen and Lehmann's suggestion (1) that covert oral behavior occurs during thinking, Perky (2) demonstrated subtle laryngeal movements in 84% of 155 subjects asked to form memory images but in only 9% of 214 subjects asked to form abstract images. The activity of vocal musculature increases even when normal control subjects merely concentrate (3–5). Subvocalizing during reading decreases reading speed but improves comprehension (6). Objective evidence of subvocalization during silent reading tasks was first provided by Faaborg-Anderson and Edfeldt (7). Using an electromyogram (EMG), they found increased laryngeal muscle activity in five subjects reading unfamiliar foreign prose (as compared to their native language). Thus, when words are difficult to phonemically encode, subvocalization increases.

McGuigan et al. (8, 9) demonstrated that when reading in distracting conditions, children and poor readers exhibit large-amplitude laryngeal EMG activity; the amplitude is inversely related to reading speed (8–10). McGuigan hypothesized that laryngeal movements code the words being read (11).

In 1897 Parish (cited by Gould [12]) conjectured that patients who report hallucinations concurrently generate automatic speech. In 1914 Seglas (13) termed this phenomenon "verbal pseudohallucination." La Gache in 1935 (14) made the causal inference that verbal hallucinations are a distortion of self-produced speech. Several reports endorsed this idea (15–17), and Gould (12, 17, 18) was the first to support it with objective data. He found a close correspondence between the content of subvocal speech, recorded with a microphone close to the mouth, and the reported content of hallucinations. There also was a surge of EMG activity recorded from the lower lip each time the patient signaled a hallucination. Eighty percent of 56 schizophrenic patients had increased chin EMG activity while hallucinating, whereas 10% of 33 nonhallucinating control subjects had such EMG activity in similar test conditions (18). However, although Roberts et al. (19) confirmed increased subvocal activity in hallucinating compared to nonhallucinating schizophrenic patients, they found no specific relationship between increased subvocalization and the actual period during which the hallucinations occurred.

Lindsley (20) recorded vocalizations by a voice key and a hidden microphone set to filter out nonspeech wavelengths. He thought that a high frequency of vocalization was an index of hallucinations. He was able to provoke vocal activity by auditory stimulation, to the extent that it resembled the human voice. He took the vocalization to represent the patients' response to their voices (or extraneous sounds). McGuigan (21) reported increased chin EMG and breathing amplitude two seconds before the report by button press of hallucination. In two instances, whispers picked up with a microphone near the patient's

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lips resembled the later reported content of the hallucinations. This finding was replicated with nine schizophrenic subjects (22). Amplified subvocalizations from a hallucinating patient were relayed to three independent raters (23), who rated 108 of 142 segments as resembling the content of the hallucinations reported by the patient. These included orders in the third person, which are considered to be typical of schizophrenic hallucinations.

Inouye and Shimizu (22) recorded, by needle electrodes, activity from four speech muscles in nine schizophrenic patients. The patients depressed a switch whenever they experienced a hallucination. Significantly more vocal activity was observed at that time than when subjects were asked to depress the switch randomly. In addition, vocal EMG was transduced into sound in two cases. Patients confirmed that the onset of the sound coincided with the onset of their hallucinations.

These findings were all correlative (but see reference 23), and the correlations were not always exact (20). Indeed, Lindsley (20) took the vocalizations to be the patient's *response* to the hallucination. The data thus far do not prove that the voices are actually the patients' own speech sounds.

We carried out a pilot study of eight schizophrenic patients who complained of voices. Each patient was asked to perform two tasks, one of which (holding the mouth wide open) has been shown to prevent subvocalization in normal subjects (Nazarova, cited by Luria [24]; Bond and Tinker [25]). The other, a control task, was to clench the fists and squeeze tightly. Six of the eight patients reported that the voices disappeared when they held their mouths open but not when they clenched their fists. In view of these results, a controlled experiment was devised. In it, the interviewer was unaware of the hypothesis. In case a patient might assume that a facial movement would affect voices more than the manual control task, a facial exercise that does not interfere with subvocalization was used as an additional control.

EXPERIMENT 1

Method

The subjects were 18 psychiatric inpatients who met *DSM-III* criteria for schizophrenia; they consisted of 11 men and seven women 21–63 years old. Most (N=11) had been inpatients for over 3 months, and the remainder were seen in an acute admission ward. All were taking psychoactive drugs. They all described hearing voices that spoke to them, gave them commands, or commented on their behavior. All patients who admitted to hearing voices at the time of the initial interview were included in the study. The 11 chronic patients said that they had been hearing voices almost every day for 2–33 years.

The experimenter made the following statement to the patients: "I am going to ask you to do some exercises and I want you to tell me after each exercise if your voices got worse, stayed the same, or went away." In a random order, counterbalanced across subjects, the experimenter asked the patients to 1) close their eyes tight, 2) open their mouths wide, and 3) make fists and squeeze tight for 1 full minute and then to comment on the status of the voices they heard. The experimenter rated each reply as indicating an increase, a decrease, or no change in the voices.

Results

The mouth-opening maneuver abolished hallucinations in most subjects, but the fist and eye maneuvers did not. No one reported an intensification of voices (table 1).

The patients complied readily but seemed indifferent to the fact that they could abolish the voices by a simple movement. Patients who had characterized the voices they heard as burdensome or terrifying expressed no relief that they could control them. One patient who reported hearing continuously harassing voices was reinterviewed 1 week later. Asked if she had used the mouth-opening maneuver when the voices became intolerable, she said that she had not and expressed no interest in doing so.

Discussion

The finding that obstructing subvocalization suppresses auditory hallucinations clarifies the mechanism by which these experiences are generated. The previously reported correlation between voices and subvocal activity did not identify cause and effect. The patient could have been repeating (shadowing) what he or she heard (20). But were that so, the patient could not have inhibited the perceptual experience by otherwise engaging his or her vocal apparatus. We therefore infer the following sequence of events: The patient subvocalizes, listens to his or her covert speech, and attributes it to another.

Such dissociated behavior is not unprecedented. The victim of possession regards his or her vocal apparatus as under the control of another—for instance, a demon. When people speak in tongues, they sometimes attribute the speech to some hypothetical individual (26). Hypnosis is another dissociated state (27). The second experiment investigated whether hypnotically suggested voices are also generated subvocally.

EXPERIMENT 2

Method

Twenty-one volunteer college students, 11 men and 10 women 21–30 years old, were told that while hypnotized, they would be given some harmless suggestions to follow. During hypnosis it was suggested

TABLE 1. Ability of Motor Maneuvers to Abolish Hallucinations in Schizophrenic Patients and Hypnotized Normal Subjects

Group	Sex	Maneuver-Abolished Hallucination		
		Fist	Eye	Mouth
Patients[a]				
1	M			Yes
2	M			Yes
3	F			Yes
4	F			
5	M	Yes	Yes	Yes
6	M			Yes
7	M			
8	F			Yes
9	M			Yes
10	M			Yes
11	F			
12	F			
13	M			
14	F			Yes
15	M			Yes
16	M			Yes
17	M			Yes
18	F		Yes	Yes
Normal subjects[b]				
1	F			Yes
2	M			Yes
3	M			Yes
4	M			
5	F			Yes
6	F	Yes	Yes	Yes
7	M			Yes
8	M			Yes
9	F			Yes
10	M	Yes	Yes	Yes
11	F			Yes
12	M			Yes
13	M			
14	F			Yes
15	F			Yes
16	M			
17	M			Yes
18	F			Yes
19	F			Yes
20	F			Yes
21	M			Yes

[a]For schizophrenic patients, there was a significant difference among the maneuvers ($\chi^2=26.95$, df=2, $p<.01$). There was also a significant difference between mouth maneuvers and fist and eye maneuvers ($\chi^2=26.38$, df=1, $p<.001$).

[b]For normal subjects, there was a significant difference among the maneuvers ($\chi^2=35.77$, df=2, $p<.01$). There was also a significant difference between mouth maneuvers and fist and eye maneuvers ($\chi^2=34.52$, df=1, $p<.001$).

that they hear voices. Fourteen other subjects were rejected after they failed either to be hypnotized or to hear voices. Everyone who initially acknowledged hearing voices was included.

Subjects were instructed as in experiment 1.

Results

The mouth-opening maneuver abolished hallucinations in a majority of subjects significantly more often than did fist and eye maneuvers (table 1).

These normal subjects typically heard a mixture of men's and women's voices in a low-volume murmuring that was difficult to understand. They reacted by expressing amusement or bewilderment. They shared the schizophrenic patients' indifference to the effect of mouth opening in abolishing the voices and were untroubled when the voices returned after the mouth-opening maneuver ended.

Discussion

When normal subjects hear voices under hypnotic suggestion, they self-generate the sounds. This finding demonstrates the sweeping generality of the subvocal genesis of hallucinated voices. It aligns the schizophrenic patient's experience with behavior to which normal subjects may "unconsciously" resort.

GENERAL DISCUSSION

We found that mouth opening selectively dispels hallucinated voices. Thus, self-produced subvocalizations are experienced as voices. The results confirm that subvocalization accompanies auditory hallucinations in schizophrenic patients. However, the previous literature included no specific or controlled manipulation of this phenomenon. Nonspecific distraction can account for reportedly successful manipulations, as when two patients with chronic hallucinations treated themselves, one by wearing stereo headphones and the other by watching television (28, 29). Distraction could also explain the alleged success of other coping devices used by patients (30), including jogging, singing, dancing, reading, listening to the radio or television, thinking of other things, and naming (31) and speaking (32–35) to another person. Thus, until now, the alternative hypothesis could not be excluded that schizophrenic patients shadow, in whispers, voices that they hear (21). From the present data we can draw a stronger inference. Schizophrenic patients actually generate the voices; they do not merely shadow them. The voices' messages reflect the patients' disordered thought processes, projected on other, imagined, speakers. The projection process would be held responsible for grammatical differences between patients' thoughts and the corresponding hallucinations and for the report of tonality of voice that is different from the patient's own.

Another novel finding is that during hypnotic suggestion, normal subjects similarly set up the suggested voices. Given that this mechanism is so general, one wonders whether subvocalization also mediates the experience of voices when it is generated by temporal lobe lesions (36, 37) or direct electrical stimulation of specific areas of the exposed temporal (38, 39) or frontal (40, case 3) cerebral cortex.

Although hallucinating patients may be taught how to control their voices by simple maneuvers, caution should be exercised before this finding is used for purposes of treatment, lest one thereby deprive the patient of a helpful compensatory device. For instance,

if hallucinations help the patient cope with disorganized sensory input, removing the hallucinations in this way, or by aversive conditioning (30, 32, 35, 41–43), might expose the patient to a more dissonant state. An adaptive function of hallucinated voices may explain the patients' disinterest in the revelation that they themselves could control the production of the voices. If the subvocalizations represent the patients' verbal thoughts, disinhibited into vocal activity, treating the voices would be therapy at an inappropriate level. Instead, the thought processes themselves require attention. If, say by some chemical means, it became possible to strengthen patients' inhibitory processes, then it would become apparent whether patients benefit (because the aversive voices would be gone) or actually deteriorate (because they would have been deprived of a way to project troubling thoughts, used as a coping device).

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