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EXPERIMENTAL DEAFNESS

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THE observations to be reported here concern the "nonspecific" function of auditory stimulation in behaviour. In its specific function a sensory event arouses, guides, or inhibits a particular bit of behaviour: the S-R relationship. In addition, however, it appears that the sensory environment (with its constant variation of familiar elements in more or less familiar combinations) is essential to the maintenance of normal capacity for response, in the state referred to as "arousal" by the electrophysiologists.

Bexton, Heron, and Scott (1) found a demonstrable intellectual deterioration in college students beginning after approximately 24 hours of a rather drastic isolation from the perceptual environment. Their method, however, principally affected visual and tactual perception, and there was relatively little interference with auditory stimulation. The present experiment was designed to determine the generalized effects of a sharp loss in the auditory sphere alone, using Ramsdell's procedure as cited by Herb (2, pp. 252–3). This did not succeed, unfortunately, in completely eliminating air-borne sounds; but in the light of the findings reported by Bexton *et al.* the present results, though not extensive, appear to have some significance.

Ramsdell reported feelings of personal inadequacy and irritability, and under- or over-response in some social situations. The experiment was first repeated with one of the authors (E.S.H.) as subject, with results differing in certain respects from Ramsdell's but in general confirming his conclusions. Accordingly, the experiment was repeated with more subjects to get some idea of the extent of individual differences in the response to a sudden (partial) loss of hearing.

METHOD

Six college students (five male, one female) were paid to act as subjects over a three-day weekend. They were given no information about expected results, but were instructed to keep a diary recording

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anything out of the ordinary that they observed about themselves. The diaries, supplemented by interviews following removal of the earplugs, provide the data of the experiment. The subjects did not see one another during the experimental period.

The external auditory meatus was packed with cotton impregnated with petroleum jelly. This did not completely prevent the hearing even of speech. The subjects could with an effort converse with their friends; some had lectures to attend and were able to follow most of what the lecturer said (especially if they sat at the front of the room and paid careful attention to his lips), though they could not follow class-room discussions.

Results

Specific Effects

All subjects experienced some physical irritation from the plugs, as itching or discomfort, but this seems to have been a major factor for only one subject, F. In the others, the degree of discomfort seemed not to be related to the degree of emotional change. Subjects D and E, for example, showed more emotional effects than A, B, and C, but reported that when they were studying on the day following the experiment they wished they had the earplugs back in place. The discomfort, evidently, was minor.

All subjects reported a persistent magnification of bone-conducted sounds (C: "I can hear some neck vertebrae creaking when I turn my head slowly. . . . I was surprised to find out how loud combing my hair is"). A and B both found themselves using exaggerated caution in doing things normally accompanied by noise, such as closing a door, or even laying a book on the table in the library where others were studying. Four subjects mentioned attempts at lip-reading, two reporting that this combined with residual hearing was better than residual hearing alone (although of course they had no training in lip-reading).

All six subjects reported an inability to speak with normal volume, which persisted throughout the three days of the experiment. As C put it, he could hear himself clearly when speaking, "but in a way that does not give me a clue as to how loud my voice is." Lack of such clues, however, cannot be the sole explanation; otherwise, underestimation of loudness would be as frequent as overestimation, and the subjects were unanimous that they persistently spoke in too low a voice. D reported, after attempting rehearsal of a play, "Though my voice fairly 'screamed' in my head, enough to distract me from playing the part, apparently my voice wasn't half loud enough." E was repeatedly annoyed by his friends' requests to speak louder. Another possibly significant observation: A's

diary on the second day notes that "my coordination of speech is poorer than usual—I even missed a word once in a while in my sentence without noticing it." Nothing of this sort was reported by the others, although they were not asked specifically about it.

Nonspecific Effects

1. Motivation. In our preliminary experiment the subject (E.S.H.) had planned to give his four days to study, thus killing two birds with one stone. Ramsdell had not mentioned loss of motivation, and the subject was therefore surprised to find that he could not bring himself to study.

In our present experiment we failed to confirm this result clearly; in fact the opposite result was obtained with two of the six subjects. One subject, F, found study impossible, but we cannot rule out physical discomfort as the cause. Although the mode of insertion of the plugs was not expected to result in pain, F reported slight but persistent pain. Another subject, D, wrote of the University Library on the first day: "the complete dead hush here is terrible—enough to prevent work"; but had adapted on the two following days and studied as well as usual, or better. Two subjects did no studying, but said in the terminal interview that they had not planned to do so.

Since there was no doubt about the disturbance of motivation in our preliminary experiment, it is evident that there are marked individual differences in this respect, presumably related to different habits of study.

2. Emotion and attitude. Rather great individual differences were observed in other respects. Trivial emotional effects were reported by A and B, greater ones by C, and quite marked ones by D, E, and F. A had some feeling of inferiority ("I felt like a freak"), but no irritability or tendency to avoid others. B noticed occasional irritability only. The subjects of course explained the situation to their acquaintances, and all were able to converse by making an effort, so that there was no great barrier to maintaining social contacts.

C reported that he had strong feelings of personal inadequacy, but denied irritability or seclusiveness. His girl friend, however, did not agree with him at all; she described him as irritable and withdrawn during the whole experiment.

D, the only female subject in the experiment, seems to have had the male social situation well under control; at least she was not disturbed while in men's company. It was different with the women in her university residence. *First day*, dinner in the residence: "I don't feel like myself. I don't feel free to do and say things I ordinarily would. A

feeling of constraint. I'm sure people think I'm terribly dense judging from their expression of doubt (this makes me feel very foolish and most anoyed)." *Second day*: "I have a panic that someone will say hello behind me or at the side and I won't be able to hear. . . . It makes me want to climb back into a shell. . . . I'll probably be accused of snobbery tomorrow." *Third day*, at lunch: "I made a table-wide comment to one and all—no one showed any signs of hearing it or acknowledging the remark. Did they hear it? Or was it not so wise? This could give one a complex. I feel this lack of hearing is giving me a snivelling personality."

E, *first day*: "Two friends walked into the room without my hearing them. I was startled. . . . My first reaction was one of anger." Friends persisted in asking him to speak louder, and this as persistently made him angry. *Second day*: He joined a crowd watching television in a store window. They began to laugh; "I couldn't see (or hear) what the joke was; I became annoyed and walked away." Also: "Becoming irritable—tonight a friend spoke to me on a subject which should not have aroused any anger—I answered sarcastically and stamped out of the room." *Third day*: "Becoming annoyed with people who keep asking me to speak louder. I resolved today not to leave my room in order that I wouldn't have to speak to people."

F was the subject who reported most physical discomfort, and also the one whose behaviour was most affected. As far as we can judge, however, the disturbance, with marked irritability and seclusiveness, was much greater than would be accounted for by the slight headache he described. In the terminal interview, for example, he reported that he had come near hitting a woman. This, he asserted, was not a habit of his. He was tired and sleepy throughout the experiment, but had trouble sleeping. It has already been noted that he was unable to study (though he had an examination on the day following the experiment). He did not ascribe the "lack of ability to concentrate" or his emotional changes to the physical discomfort; but this, together with the sleep disturbance, cannot be ruled out as the cause of the change of behaviour.

C, D, and E, however, appear to present clear evidence of a slight personality disturbance not accounted for by physical discomfort. Such disturbances might be expected to be more marked if the reception of air-borne sounds were suddenly and completely lost.

It is known that chronic deafness can accentuate pre-existing personality difficulties. We do not imply, of course, that deafness necessarily produces a generalized disturbance, even a mild one. Adaptation may be rapid (as in D's recovery of the ability to study on the second day), and when the condition comes on gradually there may not even be an initial disturbance. Our conclusion here is only that a sudden lowering of

normal auditory input has shown clear evidence in this experiment, as in Ramsdell's, of a disturbance in behaviour that does not directly require auditory acuity for its guidance. The degree of this effect, and its form, may vary greatly from subject to subject.

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