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ABSTRACT

This research paper summarizes several experiments in which children's speech volume was compared to the varied background noise against which they spoke. Age was found to be an important factor: 4 1/2-year-olds, as contrasted with 6 1/2-year-olds, failed to adjust their speech to make it audible over noise when talking about complex stimuli. Difficulty of material was also important: younger children adjusted their speech to the background noise level better when the materials spoken about were simple and familiar rather than complex and strange. Results are given for four studies comparing performance of preschool groups and older children from second and fifth grades. It is suggested that results be viewed in a kind of attentional model. The child properly gears communications to others only when reasonably at ease with the information being communicated. When material is more difficult, he can no longer interpret the greater complexity and also attend to the task of gearing his communication to his audience. (Author/BF)

Influence of Task Difficulty and Age on Speech to Noise Modulation in Preschoolers*

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ABSTRACT

This research summarizes several experiments in which children's speech volume was compared to the varied background noise against which they spoke. Age was found to be an important factor: 4½ year olds as contrasted with 6½ year olds failed to adjust their speech so as to make it audible over the noise when talking about complex stimuli. Difficulty of the material was also important: younger children adjusted their speech to the background noise level better when the materials spoken about were simple and familiar rather than complex and strange. An attentional model is suggested.

Influence of Task Difficulty and Age on Speech to Noise Modulation in Preschoolers.

All of the studies to be discussed in this paper today explore the modulation of preschool children's own speech volume output in response to external noise. Considered especially are age of the subjects and type of stimulus materials about which they are speaking. The first of the studies mentioned today was reported at these meetings several years ago, but it will be necessary to reacquaint you with that study before proceeding to others.

For many years we have been convinced of the importance of reaction and feedback in the development and maintainance of social behavior and communication. Some years ago, Mr. Fry became curious about the disruptive effects of delayed auditory feedback on the maintainance of speech. As you know, feeding one's own speech back through earphones to one's own ears at a two tenths of a second delay leads to stumbling, halting, and generally disrupted speech in adults. Such situations have been known to occur to speakers in the natural environment with disasterous results. As a demonstration we often introduce auditory delay to volunteers in our classes at Virginia to show the unknowing reliance which we all have on auditory feedback. At the same time, we often demonstrate our unknowing assessment of background noise level and the modulation of speech volume to suit that noise. If one raises the apparent background noise against which adults or college sophomores recite or read aloud, by feeding quiet or loud levels

of noise to them through earphones, their speech production volume changes from a whisper to a yell with little or no awareness on their part. Shifts in voice volume seem to keep suitably in pace with the increasing background noise (Kryter, 1972).

Chase, Sutton, First and Zubin (1976) reported some developmental studies concerning auditory feedback. Essentially, their finding was that preschool children (4 - 6 years old) fail to be disrupted by auditory delay, while elementary school children (7 - 9 years old) show disruption much as do adults. A plausable interpretation of these findings is that preschool children are not influenced by delay because they do not attend to the feedback, and, therefore, are not disrupted by it. If this is the case, then preschool children might not attend to feedback from the environment or to their own speech output so as to modulate it properly either. It was our thought to look at the speech noise modulation phenomenon to see whether it drops out (or is not yet found) in younger preschool children.

PROCEDURE

A basic procedure can now be described. Variations of this procedure were used in all studies to be discussed today. Each subject wore a set of calebrated earphones so that speech noise (like white noise) could be delivered to the ears, and each subject talked into a microphone, kept at a constant distance from his mouth, so that speech volume changes could be reliably recorded. A series of pictures was presented to the subject about which he was instructed to say as much as he could.

Each time a subject stopped talking about a picture, the experimenter replaced the old picture with a new one of the same general type. In the first study the subject wore an ordinary headset and looked at pictures in an old stereoptican viewer which had a microphone attached to it. In later studies he wore a football type helmet (which identified him as one of "Captain Fry's Space Cadets") in which the earphones were embedded and which had a microphone attached to the noseguard. As the child talked he experienced first one minute of quiet speech noise of 54 db, then a 30 second crescendo to a one minute noise level of 95 db, a 30 second decrescendo to a minute of quiet again. These noise levels were selected to give a psychologically loud but harmless increase to the subjects. Thus the subjects were asked to talk against variable background noise levels. Both the noise and the subject's speech were recorded independently on separate tracks of stereotape and on separate channels of a two channel polygraph.

Loudness scoring. The two channels of stereotape were transferred to the two channels of a Brush two pen polygraph. Amplitude of the pens' deviations were set so as to use a large range of the papertape on each channel. The middle 30 seconds of the quiet minute and of the noisy minute were examined and peak deviations counted in the five amplitude demarcations above the zero level. The number of peaks in each of the five demarcations were multiplied by the demarcation number (1 for smallest and 5 for largest deviation) and these products were summed for each 30 second segment. Thus relative increases in volume for each subject could be made. The

interjudge reliability of these scores was high (.94) for a sample given to an independent judge.

RESULTS

Study I: First blush. The initial study in the series explored the speech modulation in 20 preschoolers (4½ to 6½ years old) and 20 fifth graders (10 to 11 years old). The children talked about stereoptican pictures which might best be described as antiques. Not only were the pictures complex, but they included old fashion trains, buildings, clothes, etc. which must have been unfamiliar to the subjects. These results have been reported (Fry, 1971). Fifth graders increased their voice volume much as do adults. Their voice volume increases kept pace with the noise levels in the earphones. Preschoolers did not. Chi square analysis of subjective judgements of increased loudness of subject's voices, and the analysis of variance of the scoring category increases described a moment ago gave ps. < .001 differences between preschoolers and fifth graders. Further, dividing the preschool sample into quartiles by age indicated a steady increase in the voice modulation across the ages from 4½ to 6½ years old.

Study II: A failure. In this study 36 preschool children (4 to 6½ years old) were shown familiar cartoon pictures to talk about. It was felt that these familiar less complicated pictures would bring about easier, more fluent speech. Indeed, this seems to have been the case. Virtually all subjects were found to be modulating their speech to the increased background noise levels appropriately. The change in stimulus materials

led to a washout of the developmental differences noted before. This failure led us to suppose that a factor such as difficulty or familiarity interacts with age to produce the phenomenon. Clearly both factors must be considered to give a more complete picture of the phenomenon.

Study III: A different shaped relationship. The third study used pictures designed for preschool children which were drawn from the Peabody Picture Vocabulary Test as stimuli. Thirty-nine children were instructed to talk about these pictures under both quiet and noisy conditions. The results were broken down into three preschool age groups (ns. = 13): young (4:6 to 5:5), middle (5:6 to 6:0), and old (6:1 to 6:8). Analysis of variance indicated that aside from the age and noise effects (Ps. < .025 and .01) the interaction due to difficulty also proved significant (p. < .01). These results were consistent with the notion that speech volume was related to stimulus difficulty. However, the greatest increases took place for the middle age preschool group on this moderate difficulty level task. While the interaction was again significant, this finding may suggest that an appropriate difficulty or a maximum familiarity (whatever that is) brings about maximum modulation.

Study IV: An older subject's reading task. For this experiment we wondered whether modulation could be influenced by difficulty alone, while age was held constant. Thirty literate second graders served as subjects in an experiment in which each subject served in the moderate and difficult conditions in a counterbalanced order. The children were asked to select and read words in a series of sentences which were

either appropriate for second grade readers (moderate task) or fourth graders (difficult task). Analysis of variance showed significant noise effects ($p. < .01$), and indicated that significantly greater voice modulation was found for the moderate task than the difficult one ($p. < .01$). Again, more substantial change is observed where the task is appropriate or moderate, than when too difficult or hard.

DISCUSSION

Both age and difficulty have been shown to influence the loudness of children's communications in the white noise procedure. Obviously these dimensions are not independent, as a task which is easy for older children may be difficult for younger ones. The authors like to view the results interpretation in a kind of attentional model. The child can only properly gear communications for others when he is reasonably at ease with the information being communicated. Make the material more complex or difficult and he can no longer interpret the greater complexity and attend to the task of gearing his communication for his audience. Study III may further indicate that peak familiarity brings about maximum modulation.

These results can hardly be thought to bring closure to findings regarding this white noise procedure. It is an interesting procedure with interesting results. Further work seems warranted.

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