Concept identification of auditory dimensions as a function of age and sex¹

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Auditory concept identification task was presented to 200 male and female Ss between the ages of 6 and 18. Auditory dimensions of number, intensity, laterality, frequency and duration were tested for their saliency. Intensity was the most difficult dimension. Performance improved with age, although Ss in the 12-13-14 yr. old group in intensity condition made greater number of errors than both the younger and older groups. Males performed at significantly higher rate, with no difference in errors between the sex groups. Explanation of decrement in performance by the adolescent Ss was attempted.

Recent research in concept identification (CI) utilizing auditory dimensions with adult Ss indicates that there are sex differences in CI performance and that females reach solution at a significantly higher rate than males when laterality is the relevant dimension (Pishkin & Blanchard, 1964; Pishkin & Shurley, 1965). In the same experiments it was shown that the intensity dimension was more difficult to categorize than dimensions of number, laterality, frequency or duration. Since previous results are based on adult populations, it was speculated that sex differences may stem from developmental factors and are due to adult females' narcissism and their sensitivity to body stimuli (Pishkin & Shurley, 1965). Thus, it is plausible that as children grow older, males should show poorer performance on laterality as compared with females.

The present experiment focused on saliency of five different auditory dimensions in an attempt to examine the function of S's sex and age in auditory CI.

Method

The Ss were 200 male and female volunteer students between the ages of 6 and 18 years who performed on an auditory CI task to a criterion of 16 correct consecutive trials for a maximum of 192 trials. The stimuli were presented through earphones worn by S who sat in front of a panel with two response buttons with feedback light directly above each button. The Ss were told to categorize each stimulus into one of two categories by depressing a response button and that the feedback lights would indicate the correct response. The task was self spaced and the sequence of events was as follows: (1) presentation of auditory stimulus, (2) S's response, (3) feedback light on for 1 sec., (4) 3 sec. silent interval and (5) presentation of next stimulus. S's responses, feedback, response latency and type of stimulus were recorded on the Esterline Angus 20 pen operations recorder.

This was a 5 by 4 by 2 factorial design with five auditory dimensions (number, intensity, laterality, fre-

quency, and duration); four age groups (6-7-8, 9-10-11, 12-13-14 and 15-16-17 year old Ss) and sex with equal number of male and female Ss randomly assigned to age and dimension conditions. In this paper the age groups (AG) will be referred to by the median age, i.e., AG-7, AG-10, AG-13 and AG-16.

The bileveled dimensions varied in the following manner: number (one or two tones with 2 sec. interval between them); intensity (65 or 80 db Sound Pressure Level, 250 cps); laterality (sound was presented on either left or right earphone); frequency (250 cps or 1800 cps); duration (1 sec. or 3 sec.). Only one dimension varied on any specific problem, e.g., when number was relevant, stimuli consisted of one or two sounds and the first level listed for other dimensions was consistently presented, i.e., 65 db, 250 cps, 1 sec., with the exception that sound was presented through both earphones when laterality was irrelevant. The sequence of stimuli and feedback were programmed with a Western Union punch tape-transmitter controlling the sound generator (Pishkin & Shurley, 1965).

Results and Discussion

An analysis of variance was performed on errors as the dependent variable. The main effects of Age, $F=10.95$; $df=3/160$; $p<.001$, and Dimensions, $F=5.92$; $df=4/160$; $p<.01$ were significant as indicated in Fig. 1. None of the interactions reached significance. With all the dimensions combined, there was a reduction in errors from AG-7 to AG-10, and from AG-13 to AG-16 (see Fig. 2). It is noteworthy that there was very little difference between the performances of AG-10 and AG-13. As shown in Fig. 1 this result stems

Fig. 1. Mean errors as a function of number (N), intensity (I), laterality (L), frequency (F) and duration (D) dimensions for AG-7, AG-10, AG-13 and AG-16 Ss.

Fig. 2. Mean errors as a function of age and sex.

from greater number of errors by AG-13 than by AG-10 on number and intensity dimensions. Since it is clear that AG-13 actually produced more errors than AG-10 with sex and dimension groups combined, it is speculated that this increase in errors may be attributed to biological aspects of puberty stage, conflicts of identification, hormonal changes and generalized depression of attention span (see Fig. 2). Although it is not clear what factors play the most important role in this error increase, it is plausible that developmental stresses associated with adolescence, such as preoccupation with search for identity, restlessness and awkwardness may interfere with the trend for improvement in CI—requiring sustained attention in information processing, which was pronounced from AG-7 to AG-10. In contrast to previous findings where adult females were superior to males on laterality dimension (Pishkin & Shurley, 1965), present results indicate no difference between the sex groups. It is plausible that ability for identification of laterality deteriorates with older males.

The mean errors for dimension of intensity, duration, number, frequency and laterality were 31.85, 15.72, 15.5, 8.95, and 5.80, respectively. It is clear that intensity was the most difficult dimension, producing

significantly greater number of errors than any other dimension, as shown by Duncan's tests (lowest $df=35$; $p<.01$). There were no significant differences between errors of other dimensions (the most significant level for all pairs of Duncan's tests was $df=35$; $p<.10$). Laterality was the most salient dimension, while duration and number conditions produced essentially the same levels of performance. That the intensity dimension was most difficult confirms previous findings with adult Ss (Pishkin & Blanchard, 1964).

An additional analysis of variance was performed on the dependent variable of time to solution, consisting of total number of minutes required to complete the 192 trials or attain solution. Again, main effects of Age, $F=4.32$; $df=3/160$; $p<.025$ and Dimensions, $F=3.87$; $df=4/160$; $p<.025$ were significant. Moreover, it is noteworthy that the main effect of Sex reached significance, $F=11.94$; $df=1/160$; $p<.001$, indicating superior performance of males on this measure. The significant Age by Dimension interaction, $F=9.98$; $df=12/160$; $p<.001$, indicates there was an overall increase in time required for solution by the AG-13 Ss. A Duncan test of this interaction demonstrated that AG-13 Ss performing on intensity dimension took greater amount of time than did any other AG, including AG-7 ($df=36$; $p<.05$). Thus, the finding relative to inhibited performance of the adolescent group is supported further, demonstrating inferior response rate by the adolescent groups when compared to even the younger, AG-7 Ss.

References

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