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NOISE AND LOUDNESS EVALUATION

LOUDNESS PERCEPTION UNDER THE INFLUENCE OF DRUGS

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INTRODUCTION

During the last ten years, considerable effort has been devoted to individual loudness functions. Once the existence of individual differences had been demonstrated (1-7), workers attempted to clarify the possible sources of interindividual variation (4,8,9). The effects of stimulant and depressant drugs on perceptual phenomena have been intensely studied. Recent investigations in the areas of the influence of alcohol (10,11,12), amphetamine (13,14,15) and caffeine (16,17) on visual and auditory perception, visual memory, auditory fatigue, reaction time, sensory thresholds, and temporary threshold shifts, etc. have produced important results.

The purpose of the present paper is to study the effect of stimulant and depressant drugs on the individual loudness function, as well as to restate the possible relationship between individual loudness function and personality variables, such as general anxiety, extraversion-introversion and neuroticism.

METHOD

Subjects: 30 volunteers, were used (18 women and 12 men); mean age 18.4 years. Median age 18 years. None of the subjects had any experience of loudness estimation or was accustomed to taking stimulant or depressant drugs. The following questionnaires were applied to the whole sample; the Alpert-Haber Scale, the Taylor Manifest Anxiety Scale and the Eysenck Personality Inventory. Hearing thresholds were measured at 1000Hz and found in all cases to be within 10 dB of normal.

Procedure: The 30 subjects were randomly divided into three groups of 10 subjects.

The first group of 2 men and 8 women attended three experimental sessions, each with a different experimental criterion: in the first, all took a placebo; in the second, all had the stimulant and in the third, all had the depressant.

(Stimulant: 2-Phenyl-3-Methyl-Tetrahydro-1.4 Oxazine, dose 25 mg) (Depressant: Flurazepam, dose 30 mg for the first group and 15 mg for the second group).

The second group of 5 men and 5 women, attended only one experimental session, with the stimulant.

The third group of 5 men and 5 women, attended only one experimental session, with the depressant.

The first group were tested under all three experimental conditions

(placebo, stimulant and depressant) in order to obtain an idea of the range of results to be expected.

Subjects came to the experimental sessions individually, and were asked to consume no food, tea or coffee, and not to smoke, for a period of two hours before coming. Half an hour after taking the appropriate pill each subject made a series of estimations of the relative loudness of pairs of tones (i.e. the loudness of the second tone as a multiple of the loudness of the first).

Tones were presented in a quiet room by means of headphones, at 1000Hz and at the following decibel levels:

40-50; 50-60; 60-70; 70-80; 80-90; 40-60; 50-70; 60-80; 70-90; 40-70; 50-80; 60-90; 40-80; 50-90; 40-90 db.

The tone-pairs were presented binaurally and in a random sequence.

RESULTS AND DISCUSSION

First group: There were no significant differences between the slopes of the loudness functions in the three experimental conditions (see Fig. 1). The subjects were highly consistent in their estimations and the drugs did not have, apparently, any important effect on the subjective estimation of the sound intensity.

Analysis of the results obtained with all the three groups (The first group ingesting placebo). (See Fig. 2).

a) The slope of the loudness function obtained from the group 2 (stimulant) is not different from the one obtained with the group 1 (placebo).
b) The third group (depressant) yielded the lowest mean slope and the highest intercept.
c) The effect of the stimulant drug was very slight, producing at most, an increase in the ability to discriminate pairs of tones a few db apart. Spilker and others (13,14,17) working on different sense modalities, and on reaction time, have found that stimulant drugs do not produce appreciable changes. But they observed that under the effect of alcohol and barbiturates, the function decays significantly.

Eysenck argues that as almost every person works at the optimum level of cortical arousal, it could be expected that the administration of small doses of depressant drugs decreases efficiency; on the contrary, small quantities of stimulant drugs should be relatively ineffective.

d) In the third group, a phenomenon of general levelling of the estimations has occurred, which means a decrease of the discriminating ability with regard to the entire range of intensities. However, the first group in the third experimental session, (with depressant) behaved very differently; consequently the intercept decreased and the slope increased. This fact might be attributed to one of two reasons: a) the small dose of the depressant drug, instead of producing a decrease in efficiency, produced a cortical activation, by way of compensation (18); b) the reference frame of the numerical scale previously used, permitted the subjects to make estimations consistent with those made during the previous sessions, in spite of the effect of the drug.

Personality factors Table 1 and 2 show the Spearman correlation coefficients between slope of loudness functions and personality variables.

For the first group, in the three experimental sessions, Table 1 shows that the facilitatory aspect of the Alpert-Haber Scale

correlates positvely and significantly with the slope of the loudness function, except in the third session (depressant drug), where the coefficient does not reach the 0.05 level of significance.

The inhibitory aspect of the Alpert-Haber Scale and the Manifest Anxiety Scale correlate negatively, but not significantly with the slope of the loudness function. This fact indicates a tendency for the anxious subjects to produce lower slopes and viceversa. With regard to the Neuroticism Scale, this correlates negatively and significantly with the slope, which agrees with all that has been said previously. At this point it could be concluded that the ingestion of depressor and stimulant drugs does not produce any effect on the slope of the loudness function. Nevertheless, in Table 2 there are indications of a different conclusion: when different groups of subjects are being studied, the direction and the strength of the association between those variables, do change in the different experimental conditions.

The facilitatory effects of the anxiety are neutralized when any of the drugs used here are ingested.

Neuroticism correlates negatively in the group with placebo, and positively in the group with depressant drug. In the group with stimulant there is a slight tendency to positive correlation. Perhaps the smaller dose of depressant drug neutralizes the 'neuroticism'.

CONCLUSIONS

The same group, in three different experimental conditions, placebo stimulant and depressant, produces highly similar results regarding the loudness function and the relation between this and the various personality variables. There is only a tendency to increase the slope of the loudness function in the condition that includes depressant drug.

In three different groups, each exposed to one of the three experimental conditions, the results show a variation in the magnitude of the slope of the loudness function - lower in the group with depressant drug - and in the sign of the correlation coefficient.

TABLE 1

	Alpert-Haber+	Alpert-Haber-	Taylor	Eysenck E	Eysenck N
Condition 1	0.60*	-0.29	-0.25	-0.12	-0.57*
Condition 2	0.55*	-0.24	-0.15	-0.16	-0.53
Condition 3	0.47	-0.08	-0.15	-0.12	-0.53

Correlations between loudness slopes and personality scales for the first group. Condition 1 - Placebo, Condition 2 - Excitant, Condition 3 - Depressant.

*Significant at P = 0.05 level.

TABLE 2

	Alpert-Haber+	Alpert-Haber-	Taylor	Eysenck E	Eysenck N
Group 1	0.60*	-0.29	-0.25	-0.12	-0.57*
Group 2	0.05	0.24	-0.13	0.39	0.15
Group 3	0.01	0.29	0.10	0.01	0.55*

Correlations between loudness slopes and personality scales for the three groups. Group 1 (placebo), Group 2 (excitant), Group 3 (depressant)

*Significant at P = 0.05 level.

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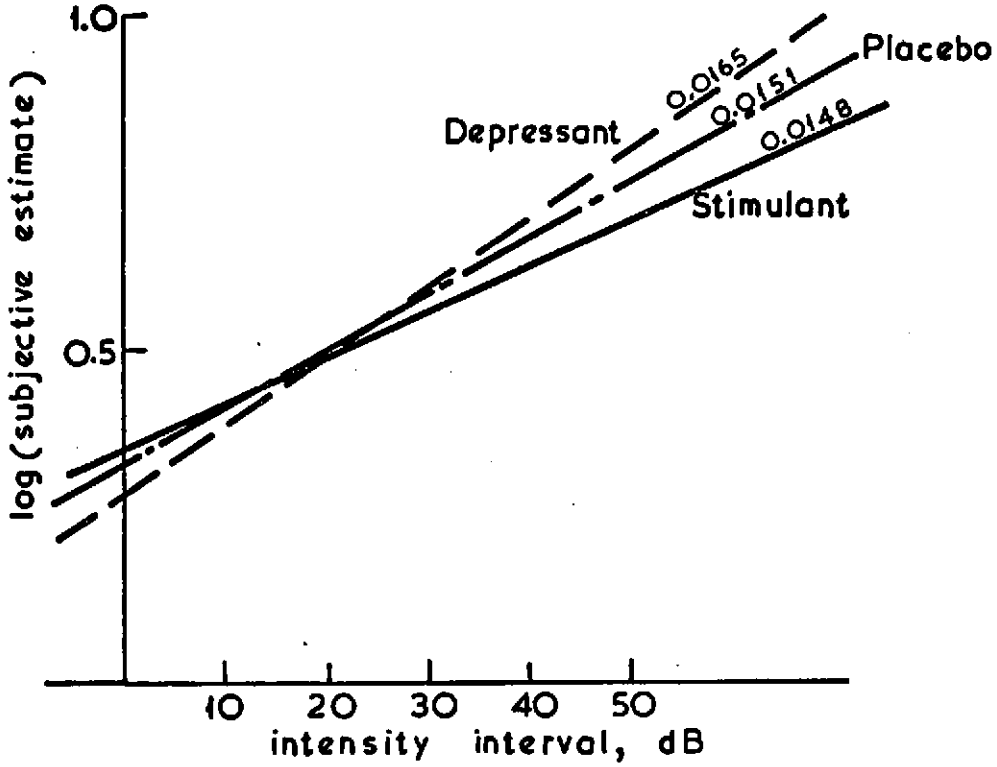

Fig.1 Mean loudness function for the first group in all three experimental conditions.

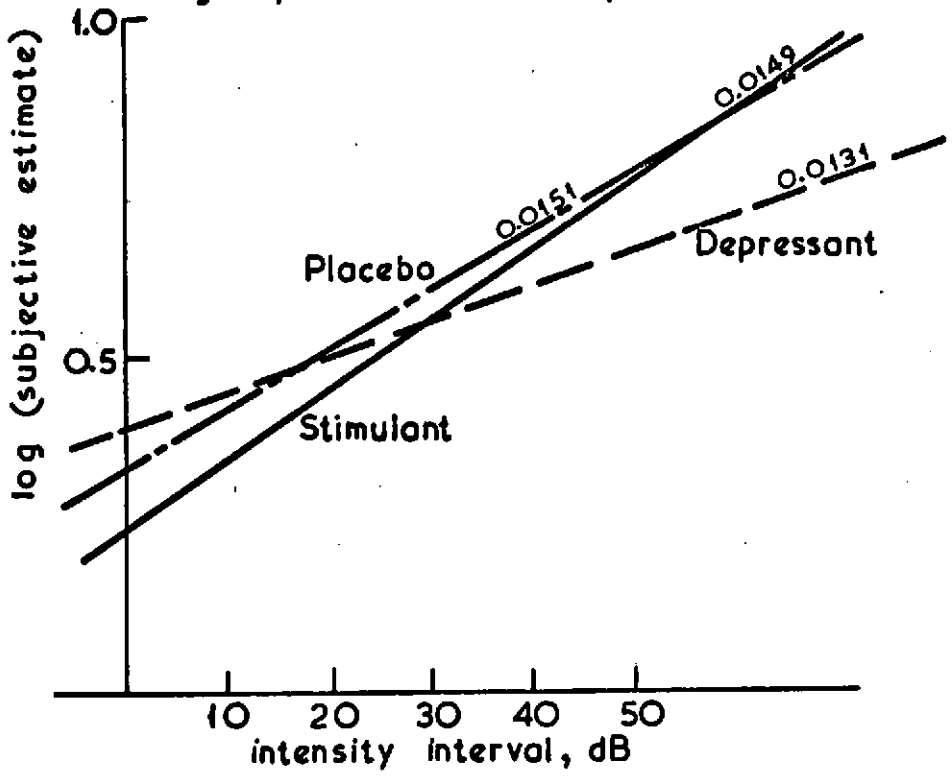

Fig. 2 Mean loudness functions for three groups.