Underestimation of dichotic click rates: Results using methods of absolute estimation and constant stimuli¹

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In Experiment 1, Ss made absolute estimates of monotic and dichotically-alternating click rates. In Experiment 2, Ss compared monotic and dichotic rates in a constant-stimuli procedure. Results of both experiments were similar to those obtained with a different method, and reported earlier: relative underestimation of dichotic rates was small at 1/sec, increased rapidly as dichotic rate was increased to 5-10/sec, and then levelled off.

In a previously-reported study (Axelrod, Guzy, & Diamond, 1968) it was found that the repetition rates of dichotically-alternating clicks were underestimated relative to those of monotic clicks. If the monotic click rate matched with a given dichotic rate (DR) is called the monotic point of subjective equality (PSE) for that DR, then the plot of PSE as a function of DR was well represented by a straight line with a Y-intercept near the origin (0.05) and a slope constant of 0.62. (Completely veridical judgments would have yielded an intercept of 0, and a slope constant of 1.) Plotting the proportion PSE/DR as a function of DR yielded a curve starting near unity at a DR of 1/sec (indicating near-veridical matching at this rate), declining rapidly to about .60-.65 at a DR of ca. 7.5/sec, and remaining at that level through a DR of 40/sec. The theoretical asymptote of such a curve is the slope constant of the line relating PSE to DR, in this case, 0.62; the asymptotic relative underestimation of dichotic clicks is the complement of the slope, 38%.

The study reported earlier utilized a method of limits. In the present paper, we report two experiments using different psychophysical procedures.

EXPERIMENT 1

Method

The apparatus has been described in detail by Axelrod, Guzy, & Diamond, (1968). Trains of moderately-intense clicks (55 dB) were presented via earphones, either to one ear (monotically) or in alternation to both (dichotically). Subjects (Ss) were asked to make absolute estimates of the repetition rates in clicks/sec. S was instructed not to try to time himself, nor to attempt to count. Six practice trials were given to familiarize S with the task, and to make sure he understood the requirements. Ten click trains (8-13 sec duration) were presented under each condition (monotic, dichotic) at each of the following rates: 1, 5, 10, 15, and 20/sec. The sequence of stimuli was randomized with respect to condition, ear receiving the stimulus in the monotic condition, and repetition rate.

The Ss were 39 undergraduate men and women without hearing deficit known to them.

Results

The mean estimates of the monotic clicks presented at 1, 5, 10, 15, and 20/sec were 1.32, 4.58, 7.40, 10.30, and 12.72, respectively. The mean estimates of the dichotic stimuli were 1.23, 3.96, 5.62, 7.36, and 9.49, respectively. The numbers of Ss giving lower mean estimates of the dichotic than of the monotic rates were 16, 28, 34, 38, and 36, respectively.

The monotic PSE of each DR was derived by linear interpolation into the interval between the two successive monotic estimates bracketing the dichotic estimate. (The first interval was arbitrarily taken to begin at 0 clicks/sec.) The PSEs so derived are plotted as a function of DR in Fig. 1 (filled circles). PSE increased approximately linearly with DR, the equation of the line of best fit (least squares criterion) in this case being $PSE = 0.54 + 0.64$. The dashed line labelled "POE" in Fig. 1 represents the hypothetical situation where PSE = point of objective equality, i.e., where the estimates under the two conditions are identical. In Fig. 2, the filled circles represent the obtained proportions PSE/DR, shown as

a function of DR. The obtained proportion declines rapidly between DRs of 1 and 10/sec, and then varies between 0.66 and 0.68 between DRs of 10 and 20/sec, with a theoretical asymptote of 0.64 (relative underestimation, 36%). The dashed line is the theoretical function based on the straight-line equation.

EXPERIMENT 2

Method

A method of constant stimuli was used, with 22 undergraduate men and women serving as Ss. None had served in the previous experiments. Eleven Ss constituted a dichotic-standard (monotic-variable) group, and 11 a monotic-standard (dichotic-variable) group. For six Ss in the dichotic-standard group, the standard was set at 10/sec; for the remaining five Ss in this group, the standard was set at 40/sec. For six Ss in the monotic-standard group, the standard was set at 5/sec, and for the remaining five Ss at 20/sec. The standard train (always presented first) and the variable train (presented second) lasted 6 sec; the silent interval between the trains lasted 0.2 sec. S had to judge whether the variable was faster or slower than the standard; equality judgments were not permitted.

Twenty trials were given at each of 15 variable settings, ranging randomly from trial to trial between rates almost always judged slower than the standard train and rates almost always judged faster than the standard. Each S was also run with the standard set at 1/sec, 10 trials being given at each of nine variable settings at the beginning of the session, and 10 trials at the end.

The ranges in clicks/sec of the variable rates were as follows: *Dichotic-standard (DS) 1/sec condition*, 0.56-1.67; *monotic-standard (MS) 1/sec*, 0.83-1.67; *DS 10/sec and MS 5/sec*, 3.85-16.67; *DS 40/sec and MS 20/sec*, 15.38-66.67.

Results

For each S in the dichotic-standard group, at each standard rate, the monotic PSE was defined directly as the repetition rate corresponding to the intersection of the functions relating percentage "slower" and percentage "faster" judgments to the rate of the variable train. The mean PSEs are shown as open triangles in Fig. 1. For each S in the monotic-standard group, the standard rate was considered to be the monotic PSE, and the DR to which it was subjectively equal was derived from the percentage "slower" - percentage "faster" intersection. The means of the values so obtained are represented by open circles in Fig. 1. The equation of the line of best fit for these six points is $PSE = 0.58 + 0.56$. In Fig. 2, the open symbols represent the obtained proportions PSE/DR. Again, the proportion is near unity at 1/sec, drops

Fig. 1. Monotic PSE as a function of dichotic rate (DR). Filled circles, Experiment 1. Open circles, Experiment 2, monotic-standard group. Triangles, Experiment 2, dichotic-standard group.

Fig. 2. PSE/DR as a function of DR. Symbols as in Fig. 1.

rapidly, and then levels off, approaching a theoretical asymptote of .56 (relative underestimation, 44%). The solid line is the function derived from the straight-line equation. In this experi-

ment, all DS Ss underestimated the two standards to which they were exposed, and all MS Ss overestimated both of their standards.

Discussion

Thus, so far as their general form is concerned, these results are in agreement with those reported earlier. In all three experiments, the apparent rates of dichotic and monotic clicks presented at 1/sec were closely similar, the amount of relative underestimation of dichotic clicks increasing rapidly as dichotic rate was increased to 5-10/sec, and remaining fairly constant thereafter. Further, the asymptotic levels of underestimation extrapolated from the curves fitted to the data are not strikingly different across experiments: 38% in the previously reported study, 36% in Experiment 1, and 44% in Experiment 2.

REFERENCES

AXELROD, S., GUZY, L. T., & DIAMOND, I. T. Perceived rate of monotic and dichotically alternating clicks. *J. Acoust. Soc. Amer.*, 1968, 43, 51-55.

NOTES

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