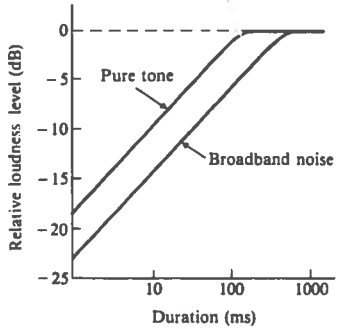
Demonstration 8. Temporal Integration (2:02)

How does the loudness of an impulsive sound compare with the loudness of a steady sound at the same sound level? Numerous experiments have pretty well established that the ear averages sound energy over about 0.2 s (200 ms), so loudness grows with duration up to this value. Stated another way, loudness level increases by 10 dB when the duration is increased by a factor of 10. The loudness level of broadband noise seems to depend somewhat more strongly on stimulus duration than the loudness level of pure tones, however. The graph below shows the approximate way in which loudness level changes with duration.



Variation of loudness level with duration. (After Zwislocki, 1969).

In this demonstration, bursts of broadband noise having durations of 1000, 300, 100, 30, 10, 3, and 1 ms are presented at 8 decreasing levels (0, −16, −20, −24, −28, −32, −36, and −40 dB) in the presence of a broadband masking noise. Each 8-step sequence is presented twice.

Commentary

"In this experiment the level of a broadband noise signal decreases in 8 steps for several signal durations. Staircases are presented twice for each signal duration.

Count the number of steps you hear in each case."

References

- D.M.Green, T.G.Birdsall, and W.P.Tanner (1957), "Signal detection as a function of intensity and duration," J. Acoust. Soc. Am. *29*, 523-31.
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- W.Reichardt and H.Niese (1970), "Choice of sound duration and silent intervals for test and comparison signals in the subjective measurement of loudness level," J. Acoust. Soc. Am. *47*, 1083-90.
- J.J.Zwislocki (1969), "Temporal summation of loudness," J. Acoust. Soc. Am. *46*, 431-41.