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Auditory considerations S.65-93

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Growth of Loudness. Loudness measurements made by BÉKÉSY [45] with short tones showed that the loudness of such tones is highly dependent on their duration, tones of the order of 0.2 second being the loudest. In later but more extensive tests MUNSON [46], measured the loudness of tones having durations of 0.005, 0.01, 0.04, 0.1 and 0.2 second. The loudness of each short tone was obtained by loudness balances against a one-second reference tone of identical frequency and was specified in terms of the pressure level of this equally loud reference tone. Later adjusted to a phon basis, the generalized results for tones shorter than one second are shown in curve form on Fig. 8.

The curves for longer durations were computed by Munson but are reasonably consistent with the only known data (Békésy's) in this range. These curves indicate that tones whose durations lie within the range between 0.5 second and 1.5 seconds are the loudest. With tones shorter than 0.5 second, loudness appears to fall slowly down to durations

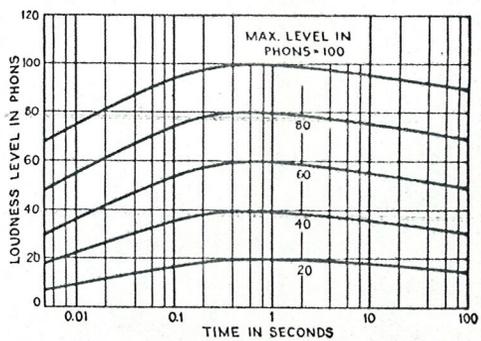


Fig. 8. Loudness level of tones as a function of duration time MUNSON [46].

of the order of 0.2 second, then rapidly and steadily with further reductions in duration. For example, it may be noted from the central curve that a tone which has a loudness level of 60 phons, when its duration is one second, has a loudness level of about 58 phons when its duration is shortened to 0.2 second, but only 35 phons with a duration of 0.01 second.

These data are of considerable interest in connection with short sounds such as speech sounds. They also have a bearing on the definitions of loudness level and the phon. As pointed out previously, the loudness level of a sound in phons is arbitrarily defined as the pressure level of an equally loud 1000-cycle reference tone. The duration of the reference tone is not specified here because definitions of loudness level and the phon found in the literature do not include it. Since the above data suggest that the loudness of tones ranging from 0.5 second to 1.5 seconds in duration is practically independent of duration and also is very close to the maximum attainable, the ideal duration for the reference tone in loudness measurements would appear to be about one second.

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