Relationship between Apparent/Perceived Loudness Level L_{app} (Phons units) and Apparent/Perceived Loudness N_{app} (Sones units) for *Pure* Tones

For ***apparent*** loudness levels of L_{app} = 40 phons or greater, for pure tones (and/or narrow bandwidth sounds) ***only***, there exists a straight line relation on semi-log plot (like $y = mx + b$) of:

$$\log_{10}\left(N_{app}(sones)\right) = m\, L_{app}\left(phons\right) + b$$

slope intercept

where numerically:

slope $m = \log_{10}(2) = 0.30103$
intercept $b = -40.0 \log_{10}(2)$

Hence:

$$N_{app}(sones) = \left[10^{\frac{L_{app}(phons)-40}{10}}\right]^{0.30103} \quad \text{or:} \quad L_{app}\left(phons\right) = 40 + \frac{10 \log_{10} N_{app}(sones)}{\log_{10}(2)}$$

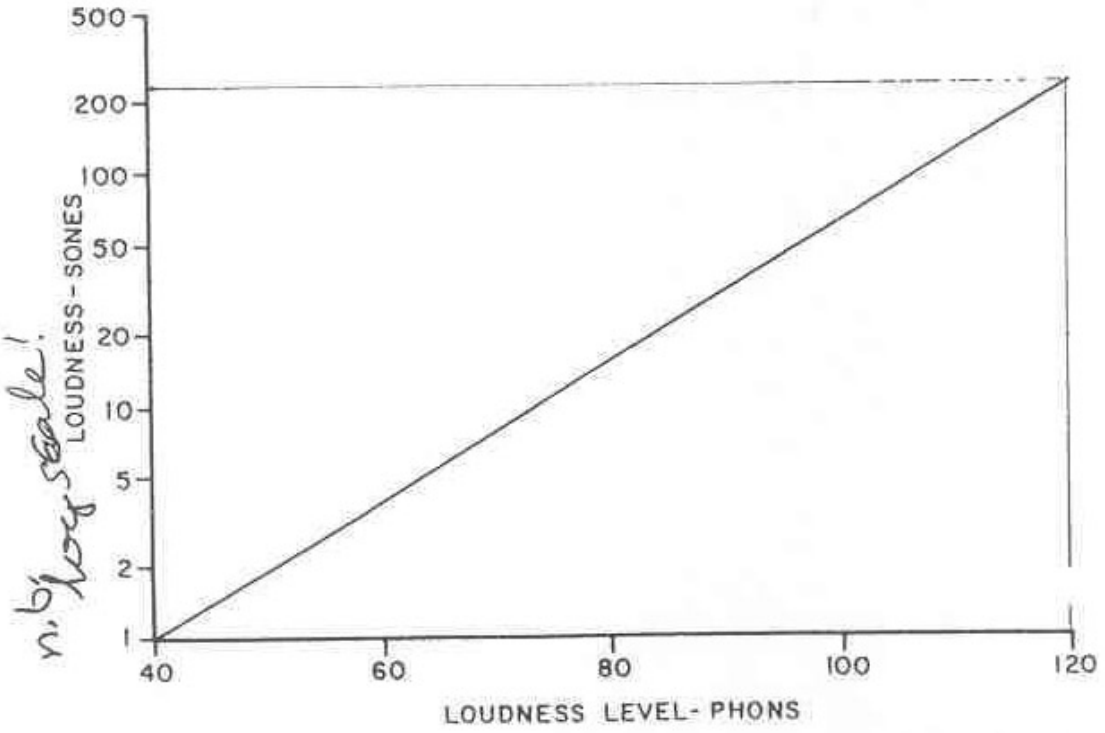

FIG. 4. Relation between loudness in sones and loudness level in phons.

$N_{app}(sones)$ is used primarily by psychologists in carrying out human psychoacoustics research.