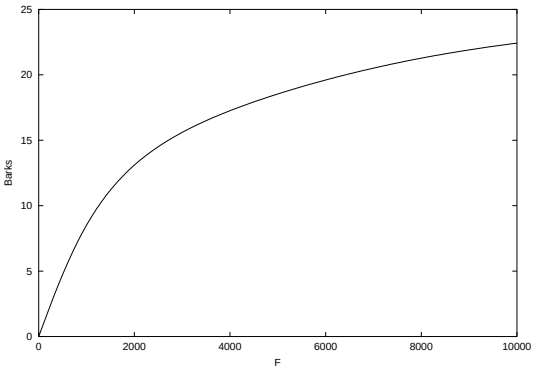
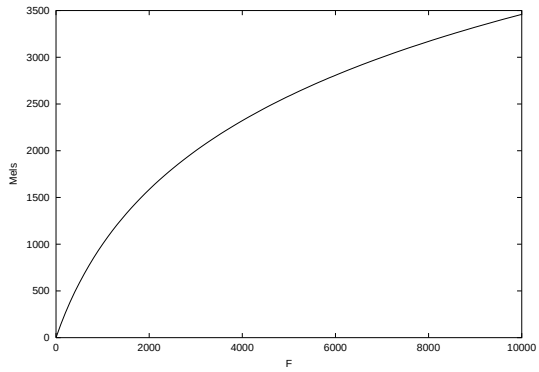
Frequency Transforms

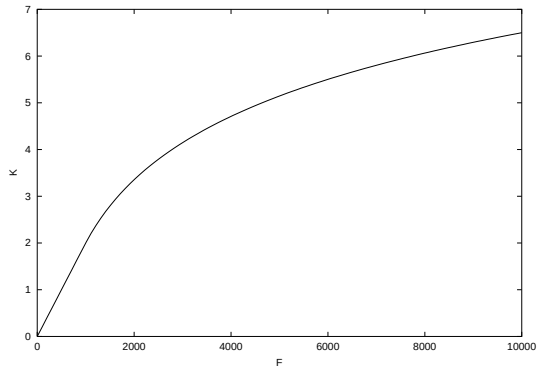
Several transformations of the frequency scale are to be found in the phonetic literature. They represent attempts to use a scale more in accordance with psychophysics. Here are the defining equations and graphs showing their numerical relationship to raw frequency. The shapes of the transforms are very similar although the numerical scales are quite different. The Bark transform is defined by Zwicker and Terhardt (1980). Technical Mels were defined by Fant (1973). The Koenig scale was defined by Koenig (1949).



$$Bark(f) = 13\ tan^{-1}(\frac{f}{1315}) + 3.5\ tan^{-1}((\frac{f}{7500})^2)$$



$$TMels(f) = \frac{1000}{log_{10}2}\ log_{10}(1 + (\frac{f}{1000}))$$



$$Koenig(f) = \begin{cases} 0.002f & f < 1000 \\ 4.5\ log_{10}f - 11.5 & f \geq 1000 \end{cases}$$

References

Fant, Gunnar (1973) *Speech Sounds and Features.* Cambridge: MIT Press.

Koenig, W. (1949) "A new frequency scale for acoustic measurements," *Bell Laboratories Record* **27**.299-301.

Zwicker, E. and E. Terhardt (1980) "Analytical expressions for critical-band rate and critical bandwidth as a function of frequency," *Journal of the Acoustical Society of America* **68**.1523-1525.