AUDITORY ADAPTATION AND LOCALIZATION : EFFECT OF FREQUENCY AND BANDWITH

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The localization of a lateral pure-tone in a free field is modified after a sustained exposure to a frontal sound (Canévet & Meunier Acustica 1995, 82 (1), in press). The aim of the work presented here was to investigate whether this effect could also be observed for broader (and thus more realistic) signals.

In the experiment, conducted in an anechoïc chamber, subjects were exposed to an adapting sound (or masker) coming from a frontal loudspeaker. A certain time Δt after the masker onset, a 50-ms sound (or signal), coming from a loudspeaker at 30° on the right of the subject, was emitted. The task of the subject was to determine the apparent azimuth of the signal.

Six conditions were tested. In the first three, signal and masker had the same spectrum: a narrow band noise, one critical band wide, centered on 1 and 4 kHz (noted 1 kHz and 4 kHz) and a broad-band noise (2 to 6 kHz, noted 2-6 kHz). Signal and masker were uncorrelated. In the last three conditions, the signal was one critical band of noise centered on 4 kHz; the masker was either a 2-6 kHz, a 0.5-6 kHz noise or one critical band of noise centered around 6 kHz (noted 2-6 kHz/4 kHz, 0.5-6 kHz/4 kHz and 4 kHz/6 kHz). Masker and signal levels were 65 and 60 dB SPL, respectively. The R/F times were 10 ms for both signals. At the beginning of each run, the 50-ms signal was presented without the masker in order to get a reference of its position (noted "signal alone" in the figure).

Six subjects participated in the experiment, except for the 6 kHz/4 kHz condition where only five subjects were run. Each signal+masker condition was presented four times, each signal alone condition was presented three times.

The results (figure 1) show that the apparent azimuth of the signal changes as Δt increases. After some milliseconds of exposure to the frontal sound, the signal is localized more toward the side than in the reference condition. The magnitude of the change in the apparent azimuth of the signal depends on masker and signal frequencies. The effect is big at 4 kHz and rather small at 1 kHz. The phenomenon is more important when signal and masker overlap in frequency (2-6 kHz/4 kHz, 0.5-6 kHz/4 kHz and 4 kHz) than in the case of frequency separation (6 kHz/4 kHz). The bandwidth of the masker shows no influence.

In conclusion, the effect reported by Canévet and Meunier can be observed even for broad-band signals. Since it occurs for uncorrelated maskers and signal, we can expect that adaptation plays a role for daily localization tasks. We do not have a clear explanation for this phenomenon yet, but we suppose that neural adaptation at peripheral stages plays a role.

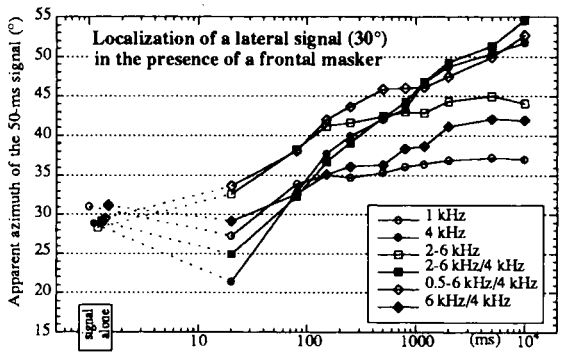

Figure 1: Apparent azimuth of the signal as a function of the onset time difference between masker and signal.