Modified Speech For Training Language-Based Learning Disabled Children (LLDs)

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Perceptual training with coincident and synchronous sensory inputs have been shown to enhance the ability to detect and discriminate sensory stimuli. LLDs have a temporal processing deficit that results in a poor ability to recognize fast transition elements in speech.

We asked if training with modified speech could enhance reliable recognition and accelerate learning of fast elements in speech by LLDs. This modification was achieved by a two-stage processing algorithm. In the first stage, the rate of speech signal was prolonged by 50-100% while preserving its spectral content and natural quality. This time-scale modification involved linear time-scaling, phase-modification and synthesis from the short-time Fourier spectrum of the original speech signal. In the second stage, we created an enhancement (up to 20dB) of the fast transition elements of speech input, defined as the 4-30Hz components of the envelope within narrow-band channels of rate-changed speech.

This was implemented using a filter-bank summation algorithm to separate the speech signal into band-pass channels and by modifying the speech envelope within each channel. Speech tracks of speech/language training exercises, books-on-tape and educational CD-ROMs were processed by this two-stage algorithm and used in training. By the end of a 4 week training period, intelligibility of both processed and normal speech was increased to near age-appropriate levels (see poster by Tallal et al.).

We conclude that this form of processed speech can contribute powerfully to the remediation of speech reception deficits in LLDs.