INTRODUCTION

Spectral resolution (hearing sound frequency distinctions) … is especially important for speech perception but is a major problem for cochlear implants (CIs).

PUPIL DILATION: an index of listening effort [1,2] … also an index of spectral resolution

Pupil dilation increases with increased cognitive load.

Hypothesis: poor spectral resolution results in greater effort needed to understand speech

Task: Listeners with normal hearing (NH) identify IEEE sentences degraded in one of two ways:

1. Noise vocoder with variable number of channels

2. Noise vocoder with variable carrier channel width ("current spread")

As spectral resolution becomes progressively poorer, pupil dilation increases.

As time series grows, pupil dilation increases in terms of slope of pupil dilation over time.

A CI listener regularly experiences poor spectral resolution;

If we can improve spectral resolution in a CI listener, it should result in smaller pupil dilation.

IMPROVEMENT OF SPECTRAL RESOLUTION

Goal: reduce channel interaction

1. Every other electrode is disabled, leaving the remaining electrodes further apart, and less likely to interact [11, 12].

2. "Holes" created by disabled electrode channels are activated in the implant in the opposite ear

3. The brain receives complementary sounds from the two ears that should interfere and come together like a zipper.

PARTICIPANTS

18 Listeners with bilateral cochlear implants

RESULTS

A  Word Recognition

Few listeners showed substantial change.

B  Spectral Resolution

Wide range of improvement and decline, specific to the individual.

C  Pupil Dilation

Wide range of improvement and decline, specific to the individual.

D  Relationship between Spectral Resolution and Pupil Dilation

Change in effort with interleaved channels was better predicted by the spectral resolution test than by word recognition.

CONCLUSIONS

Degraded spectral resolution causes increased listening effort in NH listeners.

Interleaved channels can be beneficial for individual bilateral CI users, in terms of improved spectral resolution and reduced listening effort.

Some individuals showed benefit, others showed decline.

Improvements in spectral resolution correlated with reduced listening effort in listeners with bilateral CIs.

Word recognition alone did not reveal much improvement or decline.

Spectral resolution and listening effort are not accessible through pupil dilation.

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