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INTRODUCTION

• When a target tone is omitted from a complex tone and is then reintroduced at a later time, the audibility of the target tone is increased. This phenomenon is called the auditory enhancement effect.

• Viemeister (1980) demonstrated enhancement for a variety of conditions in two normal-hearing (NH) listeners, and the parameter space has subsequently been better explored with a larger number of listeners (e.g., Carloy, 1989).

• Enhancement has been shown in cochlear-implant (CI) listeners (Goupell and Mostardi, 2012; Wang et al., 2012) but, perhaps unexpectedly, not in hearing-impaired (HI) listeners (Thibodeau, 1991).

Questions

1. Do normal-hearing (NH), hearing-impaired (HI), and cochlear-implant (CI) listeners experience the enhancement effect?

2. If so, how do spectral characteristics (fundamental frequency, spectrum level, and target frequency) influence performance across these types of listeners?

3. Is it possible to determine the mechanism producing enhancement?

GENERAL METHOD

• Stimuli:
  - Complex tone (NH, HI listeners) or multi-electrode constant-amplitude pulse train (CI listeners) (see Fig. 1).
  - Precursor Duration = 0 or 1000 ms
  - Test/Target Duration = 100 ms
  - Background Components/Electrodes were always present
  - Target Component/Electrode was in one interval
  - Interstimulus interval (ISI) = 200 ms

• Procedure:
  - 3-interval, 2-alternative forced choice task
  - Last 8 used to calculate threshold
  - 12 turnarounds

• Thresholds were higher for f0=100 Hz compared to f0=200 Hz [F(1,79)=56.9, p<0.0001], and there was 4 dB less enhancement for f0=100 Hz [F(1,39)=5.1p=0.031].

• Thresholds were higher for 2000 Hz target frequency [F(1,79)=30.8, p<0.0001], but there was no change in enhancement [F(1,39)=0.2, n.s.] with target frequency.

DISCUSSION

The stimulus spectrum and level affect enhancement differently for different types of listeners.

• NH listeners showed an effect of f0 but not level (Figs. 1, 2). Arguments against AN adaptation, but could be a peripheral (MOC) or more central (widespread inhibition or group locking) phenomenon.

• CI listeners showed enhancement (Figs. 4, 5), a trend of more enhancement at higher levels, but little effect of spacing or number of electrodes. Perhaps AN adaptation is contributing to enhancement for CI users and the other 2 CI users are using spectral grouping cues.

• HI listeners showed higher enhancement for higher levels in regions without hearing loss (Fig. 7), implying that audible high-frequency masking energy could be very important for enhancement (Figs. 7, 8).

Comparison across listener type suggests multiple physiological sources of the enhancement effect:

1. A peripheral mechanism sensitive to spectral characteristics (MOC?) [NH & HI data]

2. A central mechanism like widespread neural inhibition [NH & CI data].

3. Spectral grouping cues [NH, HI, and 2 CI listeners data].

REFERENCES


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