Temporal aspects of binaural interference

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BACKGROUND

Binaural interference: reduced spatial sensitivity to a binaural "target" cue in the presence of a competing "interferer" stimulus at a distant frequency

This decreased sound localization ability affects how listeners navigate complex auditory scenes.

Localization of rapidly modulated sounds is dominated by onset cues. Sound onsets might also be more resistant to binaural interference.

Salient spatial cues must be preserved when developing optimal signal processing for hearing assistive technology.

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QUESTIONS

1. Does binaural interference occur with these stimuli?

2. Is binaural interference reduced for target cues presented at sound onset versus offset?

METHODS AND MATERIALS

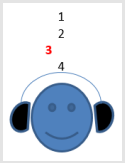
Stimuli:

- Target: binaural 4kHz Gabor click train; inter-click interval of 2 ms
  Interferer: diotic 500Hz tone
- Both 80 dB SPL; 32 ms duration; 10ms rise/fall time

Target cues:

- Interaural level difference (ILD): 0 to 10 dB range
  Interaural time difference (ITD): 0 to 500 µs range
- ILD/ITD threshold measured using adaptive threshold trackers

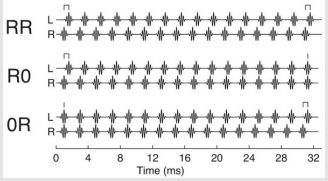
Task:



- Headphones; response buttons
- 4-interval, 2-alternative forced choice procedure (4I2AFC)
- Subjects with normal hearing judged which sound occurred off to the right side (this sound carried the ILD/ITD)

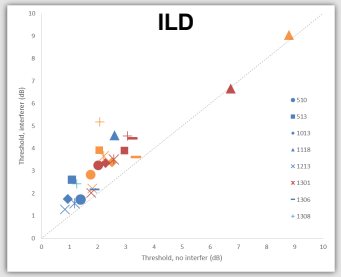
Temporal conditions:

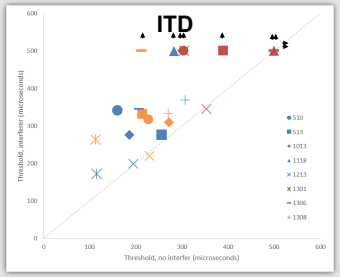
RR: constant ILD/ITD
R0: ILD/ITD present at onset, decreasing to 0 at offset
0R: ILD/ITD 0 at onset, increases until maximum value reached at offset (see below)



ILD RESULTS

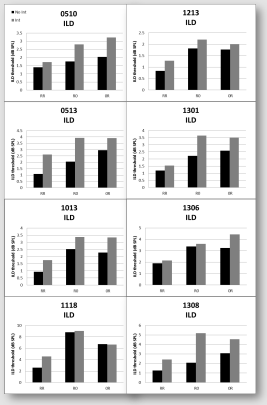
ITD RESULTS

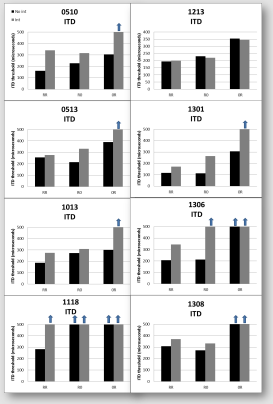




Figures 1, 2: *Group data. Trends of binaural interference across temporal conditions. Symbols above the line represent conditions demonstrating interference. Symbols below the line represent absent interference. Magnitude of interference can be noted by distance above the line. Arrows indicate thresholds 500 µs or greater (ceiling effects).*
RR=blue; R0=orange; 0R=red

Both ILD and ITD group averages show significant interference in each temporal condition ($p < .05$).





Figures 3, 4: *Individual data. Arrows indicate thresholds 500 µs or greater (ceiling effects)*

DISCUSSION

Nearly all subjects experienced binaural interference across temporal conditions.

In ILD conditions, subjects were affected by absence of the interaural cue at both onset and offset. Some subjects showed similar interference in the R0 and 0R conditions, while others showed a clear temporal preference with greater interference for ILD at sound onset or offset.

In ITD conditions, subjects were most affected by absence of the interaural cue at sound offset. Interference was strong in this 0R condition and was often unmeasurably large due to experimental ceiling effects.

CONCLUSIONS

1. Binaural interference occurs consistently with high frequency Gabor click trains and spectrally-distant tonal interferers.

2. Temporal features appear to impact the amount of binaural interference experienced.

3. Individual differences in temporal trends are present, however, group patterns are consistent with previous demonstrations of interaural onset strength for ITD detection and both onset and offset contributions for ILD detection.

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