

Psychoacoustics

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Module 7 Homework (Localization)

1) (60pts -20x3) Indicate whether the statement is true or false by printing T or F .

_____ Whether an ear will be referred to as “ipsilateral” or “contralateral” depends on the sound source location relative to the head.

_____ The ability to determine sound source location when listening over loudspeakers is called lateralization.

_____ Artificial IIDs introduced through headphones can provide localization cues at all frequencies, including frequencies <500Hz.

_____ Familiarity with a sound is necessary in order to better assess source distance based solely on sonic cues.

_____ The precedence effect does not support sound source localization in reverberant environments.

_____ The duplex theory of sound source localization relies on ability to detect interaural time (phase) differences and interaural intensity differences.

_____ Assuming a relatively continuous, stationary source, ambiguous sound localization cues become more useful if the listener remains as still as possible.

_____ Assuming a continuous, stationary source, the most effective strategy in resolving localization ambiguities is head movement.

_____ ITD and IID cues are not useful AT ALL for frequencies between 500-1500Hz.

_____ IPD and IID cues may facilitate perception of signals, which would have otherwise been masked.

_____ Jeffress’s hypothesis of neural level coincidence detectors attempts to explain how we encode ITD cues.

_____ The more symmetrical our two pinnae, the better we are able to utilize interaural spectral differences.

- _____ The sensation of Dichotic beats is the result of being able to track but unable to resolve fast changes in interaural phase differences.
- _____ Beating sensations arising via free-field or dichotic binaural listening have similar physical and physiological bases.
- _____ Changes in sound source elevation (i.e. in the median sagittal plane) produce interpretable ITDs and IIDs.
- _____ The precedence effect refers to the learned strategy of focusing sound source location judgments on the binaural cues arriving first.
- _____ In general, listeners prefer longer reverberation times for low rather than high frequencies.
- _____ Perceived changes in distance based on reverberation cues tend to overestimate actual changes in distance.
- _____ Changes in sound source elevation are detected using spectral difference cues.
- _____ HRTF is defined as the ratio of the sound pressure spectrum measured at the eardrum to the sound pressure spectrum that would exist at the center of the head if the head were removed.

2) (4pts) As the free-field distance between sound source and listener increases from 1m to 1000m, the overall level decreases, while the ratio of High over Low frequencies

- a) increases (i.e. highs decrease less than lows).
- b) decreases (i.e. highs decrease more than lows).
- c) remains constant (i.e. highs and lows decrease proportionally).
- d) increases for up to ~20-40m and then starts to decrease back to the original ratio and continues to decrease to almost 0.

3) (4pts) Interaural Intensity Differences (IIDs) provide interpretable sound localization cues for frequencies

- a) with wavelengths smaller than 1/2 of the head's circumference.
- b) with wavelengths smaller than the head's circumference.
- c) between 500Hz-1500Hz.
- d) above 400Hz.

4) (4pts) The sonic cues helping humans localize sound sources include interaural differences in a signal's

- a) arrival time and intensity.
- b) arrival time, intensity, and precedence.
- c) phase, intensity, and spectrum.
- d) arrival time, duration, and spectrum.

- 5) (4pts) **A shortcoming of the Jeffress model for encoding ITDs is that it fails to explain why**
- the minimum detectable ITD is 10 microseconds and the minimum audible angle is 1° .
 - we experience the “cone of confusion.”
 - ITD cues do not work for low frequencies.
 - ITD cues do not work for high frequencies.
- 6) (4pts) “Cone of Confusion” describes one or more conical surfaces extending from the ear where
- sound sources would produce unchanging ITDs and IIDs.
 - sound sources would produce unchanging Interaural Spectral Differences.
 - the Jeffress model does not apply.
 - the duplex model does not apply.
- 7) (4pts) **Localization performance using spectral cues is most likely based on listeners’**
- experience, regardless of their anatomy.
 - experience, in the context of their anatomy.
 - anatomical factors, regardless of their experiences.
 - basilar membrane response and OHC amplification.
- 8) (4pts) **IID detection can be explained in terms of the associated difference between** [select a, b, c, or d] **in the two ears**
- low versus high spontaneous activity neurons.
 - excitatory and inhibitory activity.
 - monaural and binaural processing.
 - low versus high frequency response.
- 9) (4pts) **ATFs are highly personalized and depend on**
- pinna, head, and torso construction.
 - pinna construction and personal experience.
 - pinna construction, basilar membrane response, and personal experience.
 - ITDs, IIDs and the precedence effect.
- 10) (4pts) **The potentially lower detectability thresholds of signals in binaural versus monaural/diotic masking contexts is related to**
- cues from beating, roughness and other interference products.
 - interaural differences facilitating signal detectability in complex environments.
 - our ability to track IPDs and slow IPD changes.
 - ITDs, IIDs and the precedence effect.
- 11) (4pts) **IPDs provide useful localization cues ONLY IF a signal has**
- no spectral energy $>750\text{Hz}$.
 - some spectral energy $<750\text{Hz}$.
 - some spectral energy $<750\text{Hz}$ AND amplitude envelopes varying at rates $<750\text{Hz}$.
 - some spectral energy $<750\text{Hz}$ OR amplitude envelopes varying at rates $<750\text{Hz}$.