Chapter 11

**THE AUDITORY BRAIN AND SOUND LOCALIZATION**

1. We have previously discussed the importance of movement in the visual perception of depth. Movement creates optic flow and motion parallax. Given your understanding of sound localization, and thinking of phenomena like the cone of confusion, what might be the importance of movement in the auditory perception of space?

*Hints and discussion: Head movements (rotation) can eliminate the confusion by moving the head relative to the sound source so that the source is no longer within the cone. In cases where the sound is directly ahead or behind, and the inter-aural time difference is the same, the head rotation will change the inter-aural time difference.*

1. Imagine attending a concert in a small intimate club. Imagine attending a concert by the same band in a large concert hall (such as an indoor basketball arena). Can you describe the difference in sound? What is the difference in sound between an empty concert hall and one full of people?

*Hints and discussion: Discuss the phenomenon of reverberation and how sound bounces off of walls, and the difference between direct sound (sound directly from the source to the ear) and reverberant sound (sound from the source, reflecting from a surface, and then to the ear). Discuss how the time it takes for reverberant sound to reach the ear is a function of the size of the room (the distance of the reflecting surfaces from the sound source and to the listener). Thus the concert hall will have a great deal more reverberant sound than the small club. The loudness of the reverberant sound is affected by how much sound is reflected by the walls and how much is absorbed. Flat smooth surfaces especially concrete and plywood reflect a large percentage of the sound, but carpeted surfaces (and specially designed acoustic tiles) and people will absorb a large proportion of the sound, reducing the loudness of the reverb. One can extend the discussion to different environments like outdoor concert venues and introduce the idea of an anechoic chamber, where the acoustic tiles absorb almost all sound. There is a fun video online demonstrating what it is like to sit in an anechoic chamber:* [*https://www.youtube.com/watch?v=mXVGIb3bzHI*](https://www.youtube.com/watch?v=mXVGIb3bzHI)

1. Have you ever misperceived the location of a sound? What factors cause this to happen?

*Hints and discussion: This discussion helps students draw a connection between auditory localization and reverberant sound. Reverberant sound can help specify the size of a room, as in the previous discussion, but can interfere with perceiving the direction of the sound source. Sometimes a loud sound in an urban environment will bounce off buildings and appear to be coming from a direction from which it is not because the reverberant sound might be louder than the direct sound. When this occurs, we may (incorrectly) judge that the reverberant sound is actually the direct sound.*

1. Consider the phenomenon of auditory scene analysis. You can listen to a song and analyze it into the various musical instruments; one can perceptually isolate the bass track, or the drums, and so on. But most of the time, we don’t do this, we just listen to the music as a whole sound event. Thus, we can switch from listening to music in this holistic manner to adopting the more analytical approach and isolating individual instruments. Can you draw any parallels between auditory scene analysis and visual search? What is the role of selective attention in this process?

*Hints and discussion: This discussion helps students apply their understanding of selective attention to other phenomena, and helps them introspect about auditory scene analysis and segregation.*