

#### MUS421–571.1 Electroacoustic Music Composition

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# Psychology of Electronic Music

- How does hearing work?
  - Outer ear receives signal, is transmitted through ear canal (amplification), hammer, anvil, and stirrup bones, cochlea (basilar membrane)
  - Basilar membrane vibrates at different location based on frequency content

#### Differentiating sound



Figure 12.1 (a) Schematic presentation of the cochlea; (b) Excitation pattern of basilar membrane for high, medium, and low frequencies; (c) Auditory pathway; 1. Auditory nerve; 2. Cochlear nucleus; 3. Superior olive; 4. Lateral lemniscus; 5. Inferior colliculus; 6. Thalamus; 7. Auditory cortex

### Hearing as we know it

- Cochlea transfers signal to auditory pathway (connection to brain)
- Auditory cortex (frontal lobe) makes sense of the signal = hearing

#### Localization

- Azimuth (point in space around you on a horizontal plane)
- Elevation (less accurate, depends more on timbre)
- Distance
  - Motion Parallax the closer you are the object, the more its position changes when you move
  - Timbre low frequencies carry farther through space/time, high frequencies attenuate more quickly

### How to create space/movement?

- Doppler Effect
- Quieter sounds seem farther away
- Panning (separation vs. blend)
- Darker EQ (low frequencies) seem farther away
- Reverberation (less=closer, more=farther)

### Simultaneous Masking

- Low frequency > High frequency
- Noise > Sine wave
- Keep your sound elements in their own frequency range so they are clear in your mix

## Temporal Masking

- Quieter sound can be lost if hear right before/ after louder sound
- Give your quiet sounds more space (silence) around them

# Auditory Streaming

- Multiple layers of listening at once / Gestalt
  - Objects close to one another grouped together (panning)
  - Objects sharing similar characteristics grouped together (timbre/volume/etc.)
  - There is a preference for continuous forms (not disjunct phrases)
  - Objects that seem to form closed entities grouped together (?)
  - Objects that move together grouped together (panning)

## Making sense of multiple streams

- Sequential Integration
  - Musical events follow closely enough together in time/pitch/timbre/loudness to create a phrase
    - Andean pitch pipe music, bass drum line, handbell choir
  - The closer in time the two sounds are, the closer they need to be in pitch to hear as one stream

## Making sense of multiple streams

- Spectral integration
  - Harmonicity overtones resonate well together
  - Harmonic sounds will be grouped together, inharmonic ones heard as separate
  - Sounds that arrive at the same time also grouped together
  - Sounds with similar envelope grouped together (vibrato)
  - Brain will try to connect similar sounds, particularly when interrupted