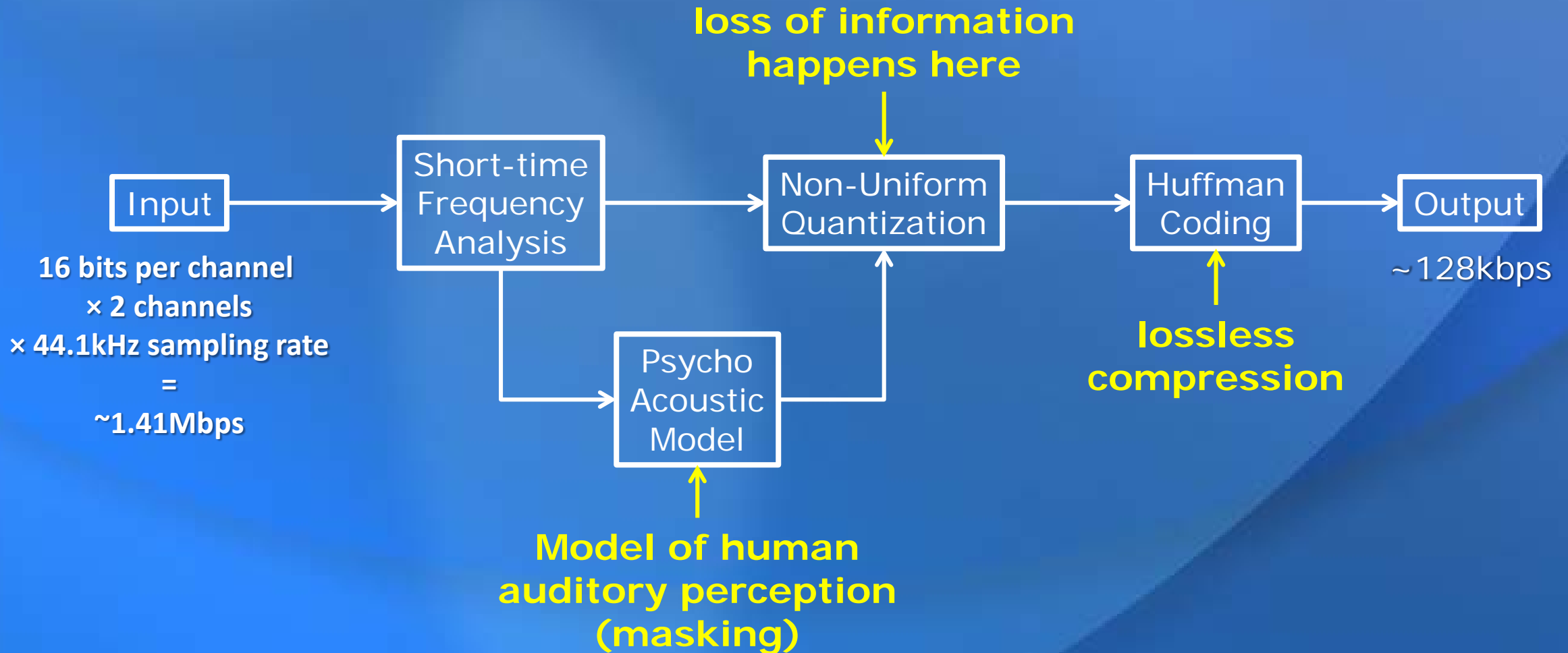


Time Frequency Analysis

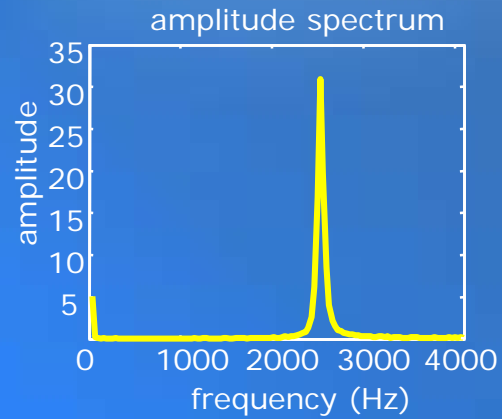
Key Steps in MP3 coding



Time-Frequency Analysis

- For complex sounds (e.g. speech or music),
 - Short time segments are well described by a few important frequency components
 - Long time segments are not
- Time-frequency analysis uncovers how the short-term frequency content changes over long time periods.
 - The spectrogram is one example of time-frequency analysis.

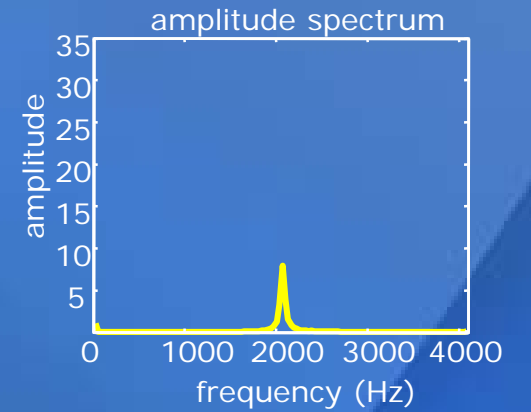
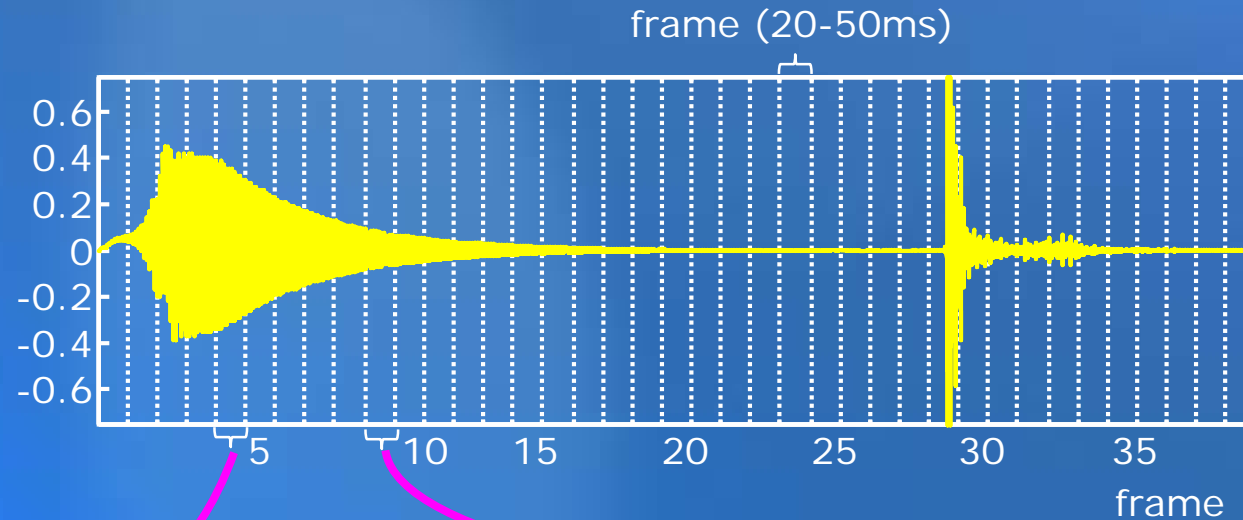
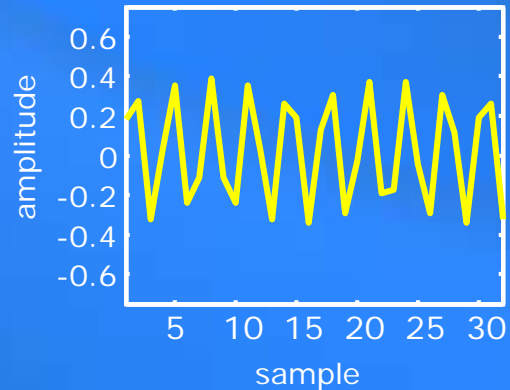
Short Term Spectrum



Fourier
Series



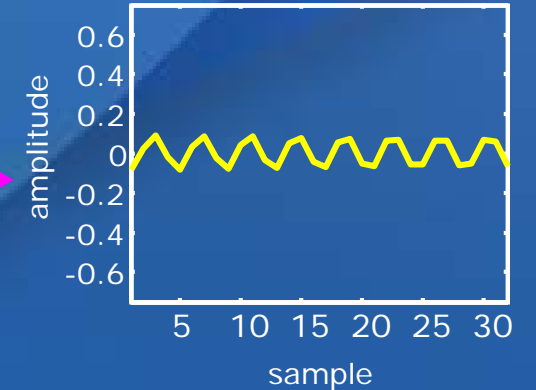
Frame 5



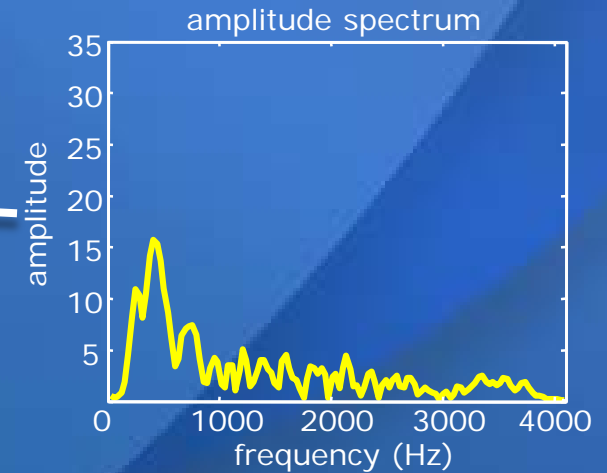
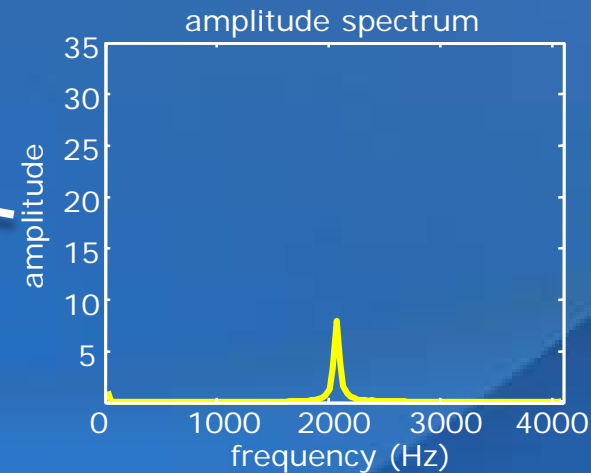
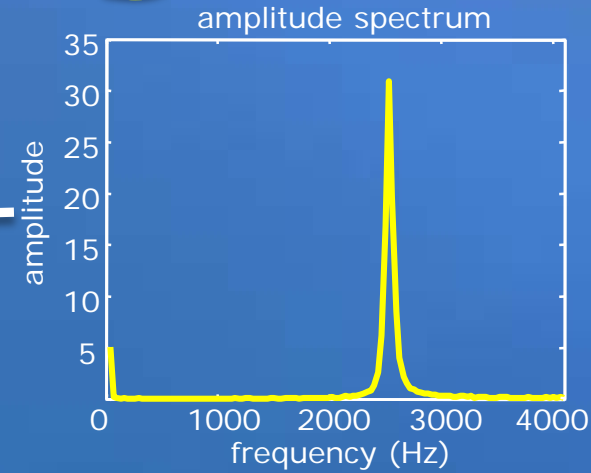
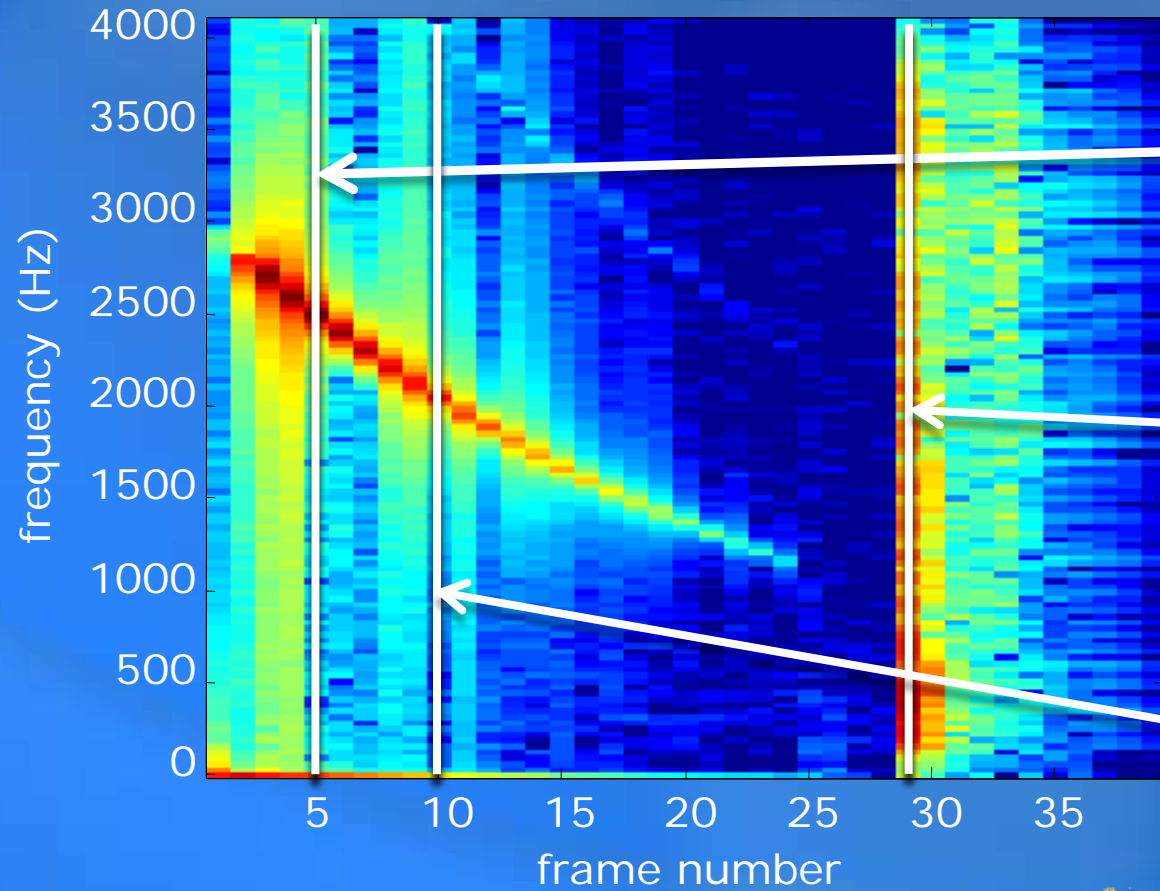
Fourier
Series



Frame 10

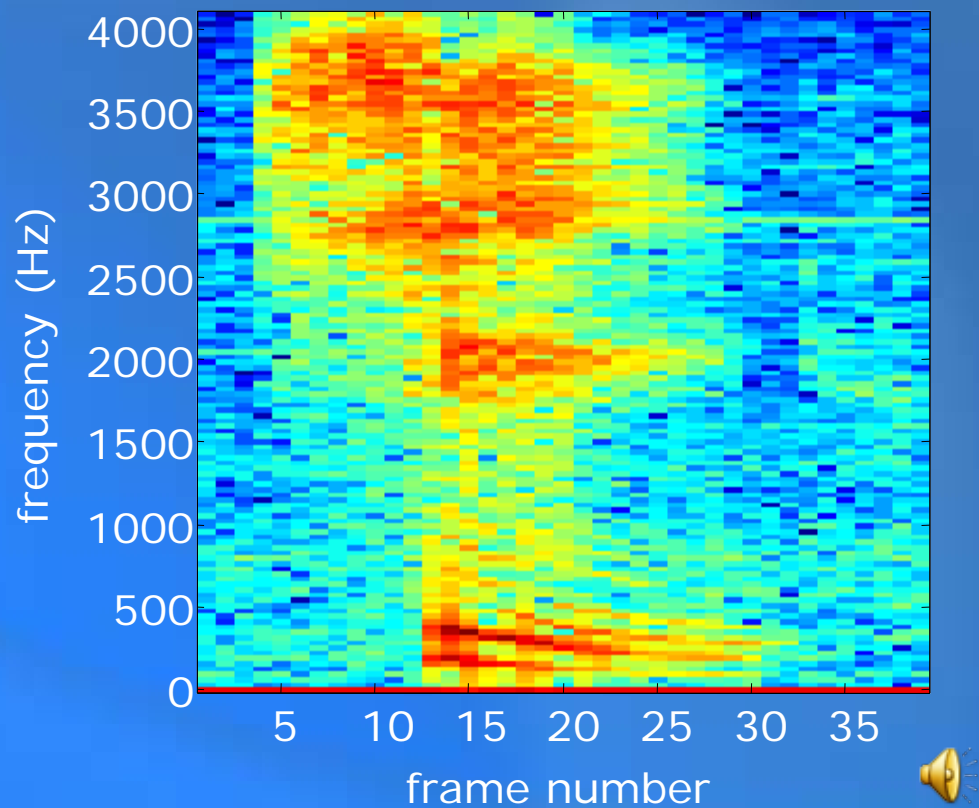


Spectrogram

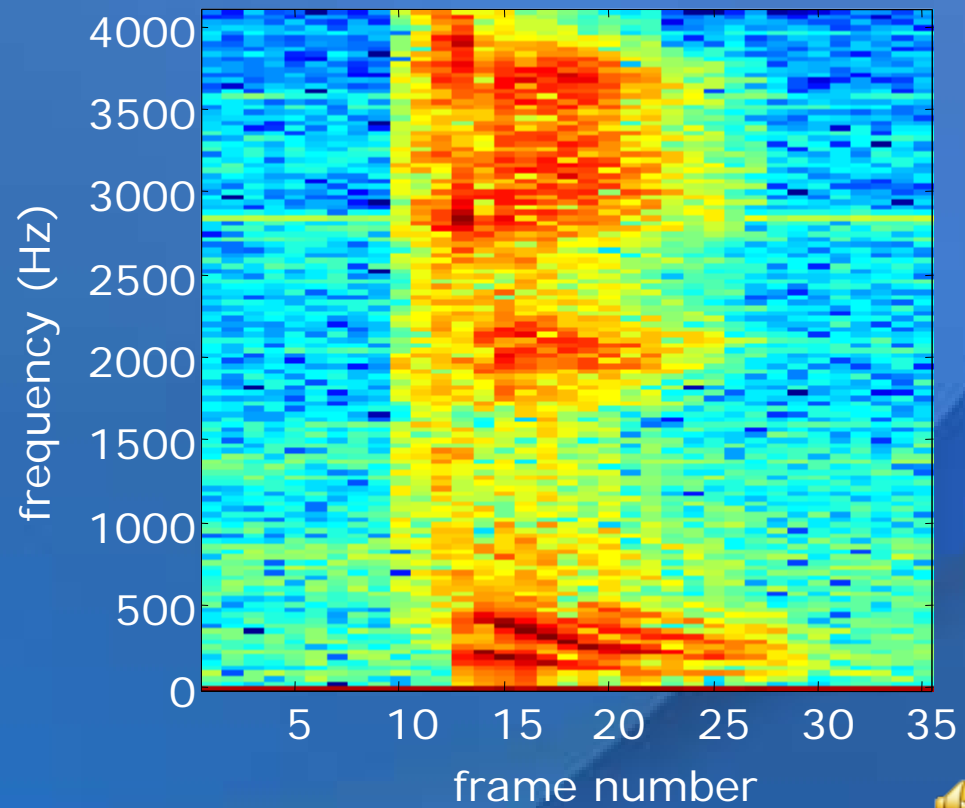


Speech Spectrogram

spectrogram of "she"

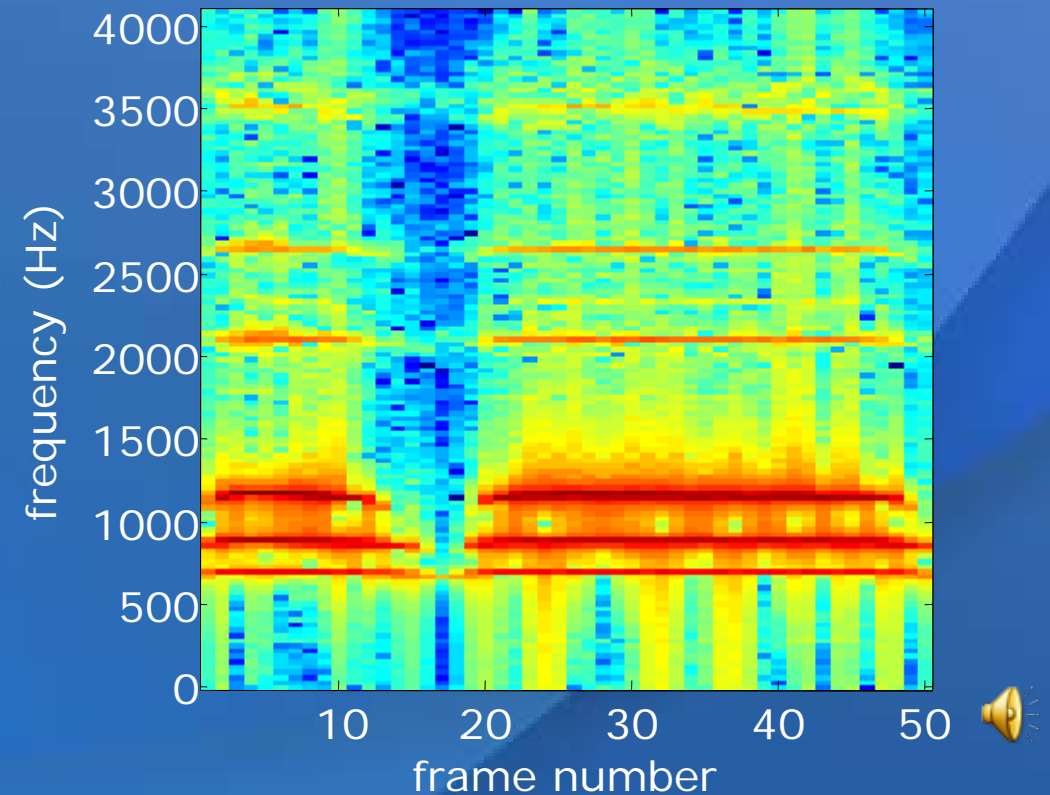
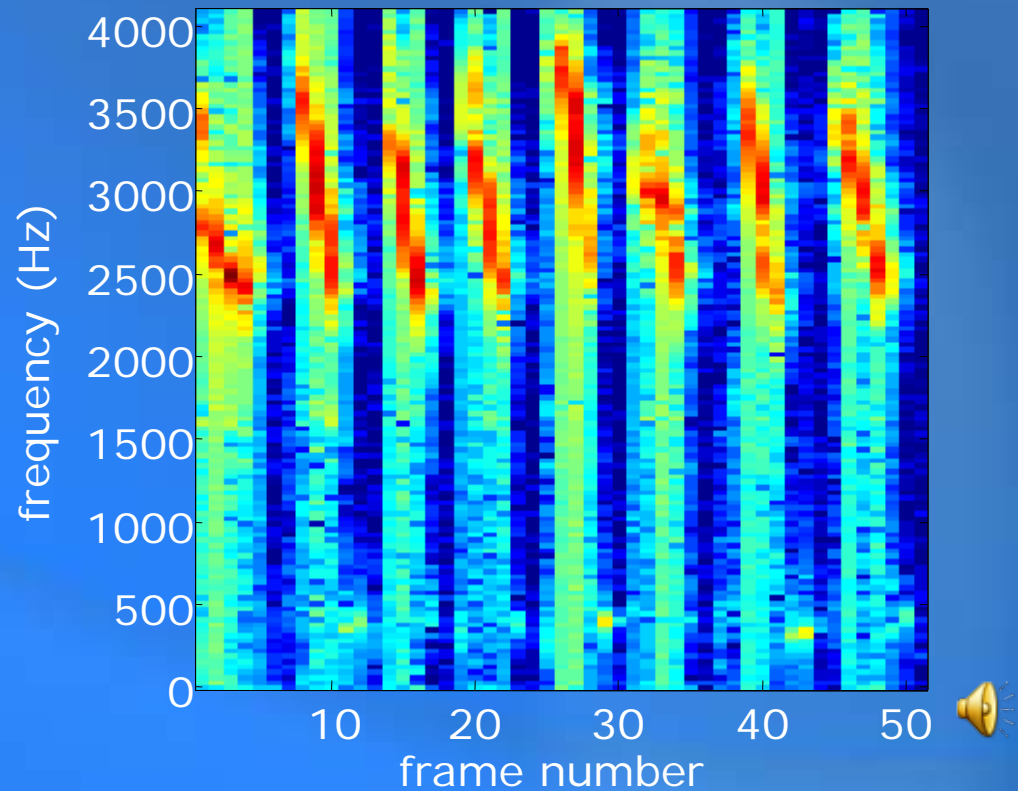


???



Train Whistle vs. Bird Chirps

Which is which?



Speech Data

- Words are made up of units called phonemes
- Phonemes have different spectral content
- As the phonemes change, the spectral content changes.
- The spectrogram can be used to visualize this.

