

Media Technology

Group Work 2

Digital Audio Introduction

(Frequency, sampling-rate, bit-depth, channels, sound quality)

Digital Audio Introduction

Why are frequencies, *sampling-rate*, *bit-depth* and *channels* important?

- Perceived audio quality depends heavily on a large combination of factors.
- Audio editing, video editing and interactive applications depend on digital audio techniques.
- Delivering digital audio via DVD, CD or Internet requires a thorough understanding of digital audio.
- The Media Technology course topics on audio compression are impacted by these factors.

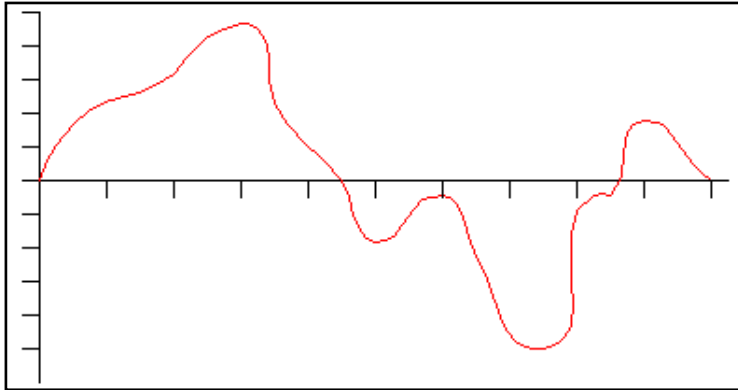
Objectives

- Short review of Sampling Rate and Bit-Depth.
- Introduction to CoolEdit Pro, an industry standard audio editor (now Adobe Encore).
- Frequency analysis – the frequencies that make up a digital audio file.
- Adjust the sampling rate for both sample audio files – hear and analyze the result.
- Adjust the audio resolution (bit-depth) for both sample audio files - hear and analyze the result.

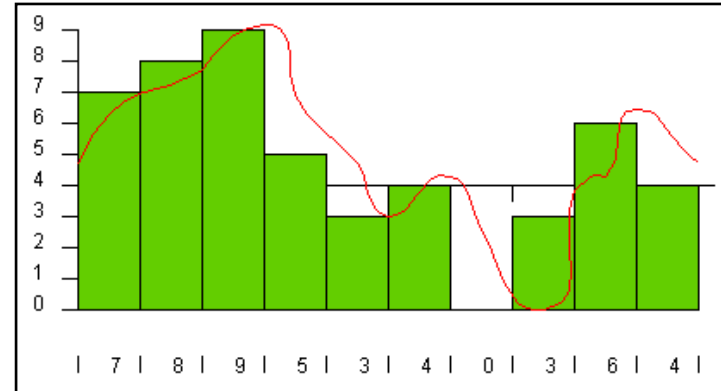
Group Work Report

- Please prepare a 1 to 2 page report of your findings from this group work. Outline the important points from each exercise and your results. (Use the section questions as a guide)
- Everyone should hand in their own report (no group reports please).
- The report is due, in printed form, by the beginning of the next Media Technology lecture.

Review: Sampling Rate & Bit-Depth (1)



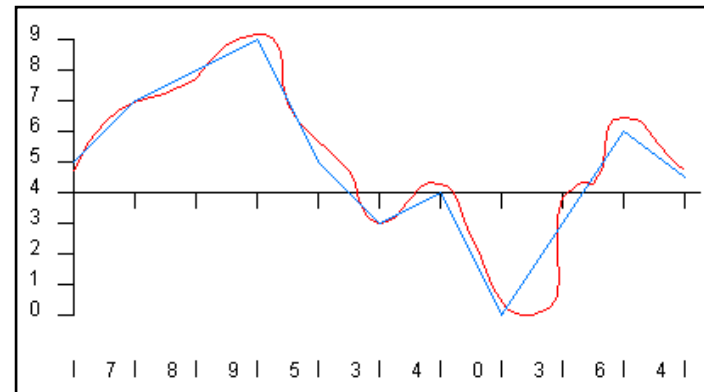
Original Waveform



Sampling & Quantizing

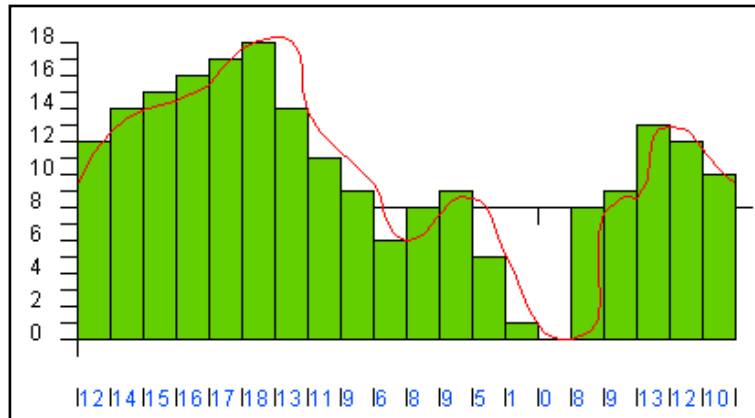
Key Terms

- **Sampling Rate:** How many samples are taken per second.
- **Sampling Precision (bit-depth):** The accuracy of each sample (quantizing levels).

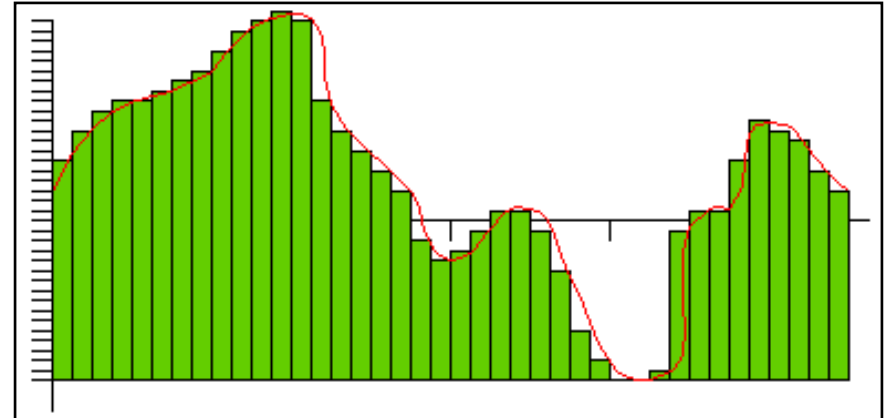


The difference between waveforms is error!

Review: Sampling Rate & Bit-Depth (2)



2X Sampling Rate & Bit-Depth



4X Sampling Rate & Bit-Depth

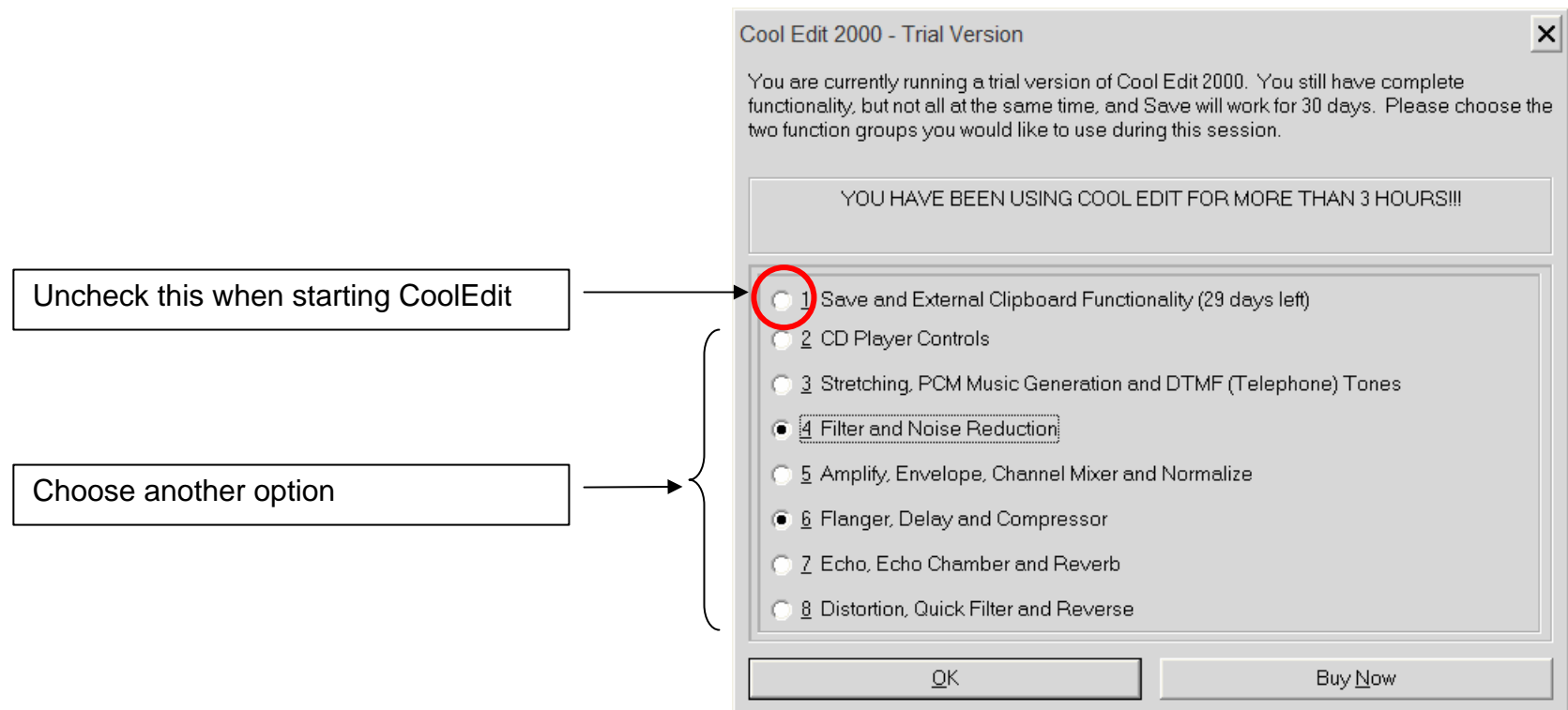
Key Points

- Increasing the sampling rate increases the range of frequencies that can be reproduced.
- Increasing the sampling rate increases the data-rate of the file proportionally.
- According to Nyquist, to regain 'perfect' sound, one must sample at **twice the highest** frequency of the original sound.
- Increasing the sampling precision increases how accurately each sample is represented

Disable Saving for CoolEdit Pro

When starting CoolEdit Pro, please **de-select** option 1 – “*Save and External Clipboard...*”

- Do this by selecting a different option from the list.
- This prevents you from accidentally saving over the original file.
- The work today does not require saving.



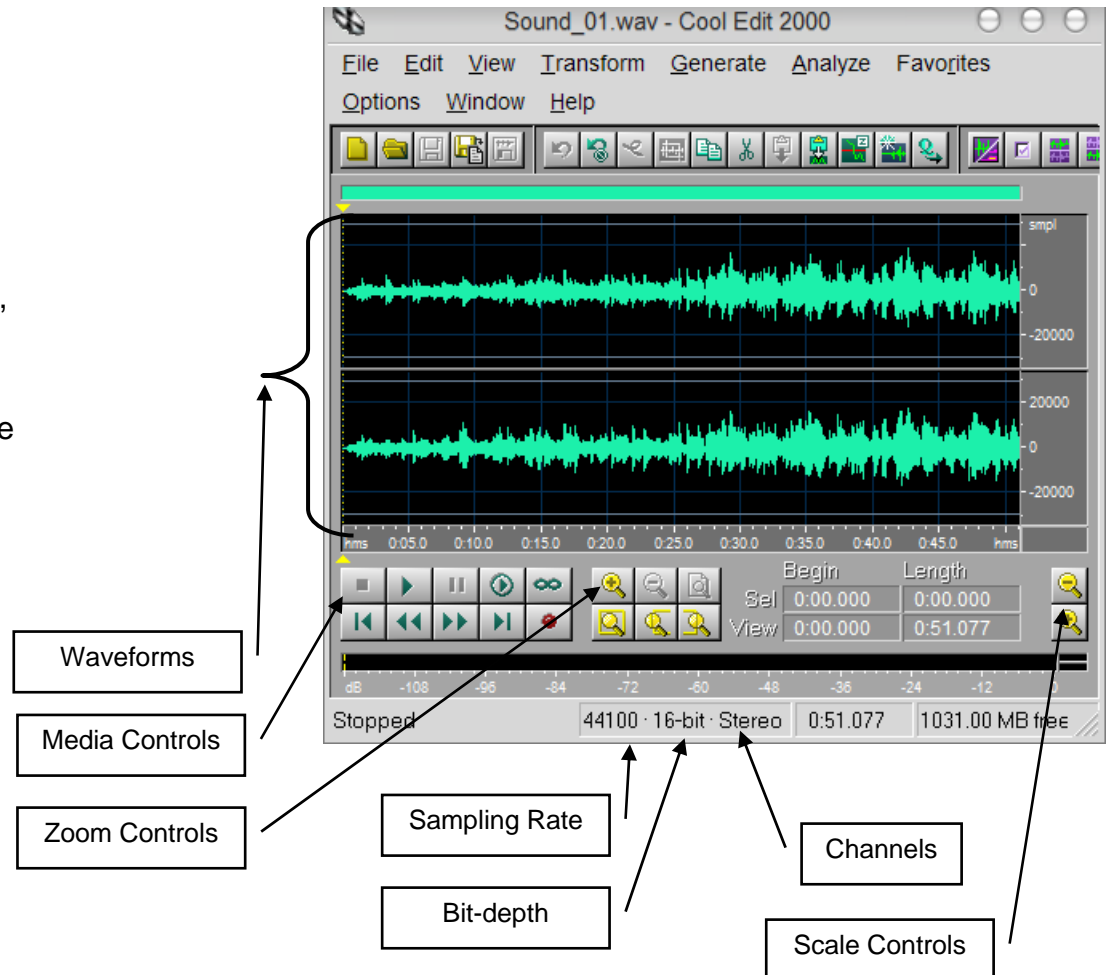
Introduction to CoolEdit Pro

Procedure

- Start CoolEdit Pro
- Locate the 2 sample audio files:
 - Sound_01.wav
 - Sound_02.wav
- Open a file in CoolEdit Pro
- Experiment with the media controller (play, stop, scrub)
- Locate file information:
 - Using the CoolEdit Pro interface (see right)
- Zoom in and look closely at the waveform
 - The scale tools can help you too see better

Questions

- What are the sampling rate, bit depth, number of channels and duration?
- When “zoomed in” close to the waveform, what are the ‘dots’ you see?



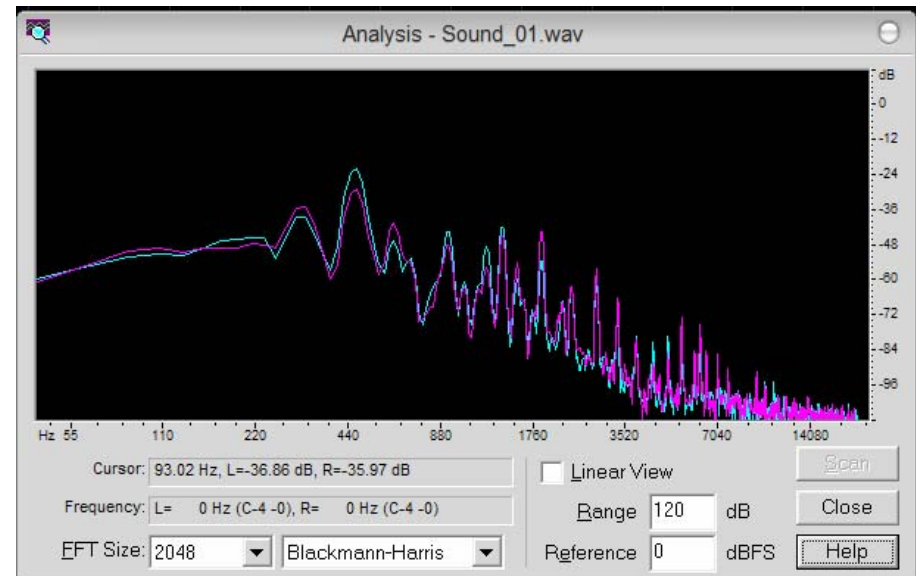
Frequency Analysis

Procedure (for each sample file)

- Open the file in CoolEdit Pro
- Make sure the frequency analysis is open
 - Select all - **Menu:** Analyze > Frequency Analysis
 - Uncheck “Linear View” (if checked)
- Play the file and watch the frequency analysis graph

Questions (for each sample file)

- What are the range of frequencies present?
- What frequencies seem to be most prominent? The least?
- Are the graphs from the two sample files different? Why or why not?



The CoolEdit Frequency Analysis Graph

Extra Info (only if you are interested!)

- Decibels are commonly used when dealing with sound because the ear perceives loudness in a logarithmic scale.

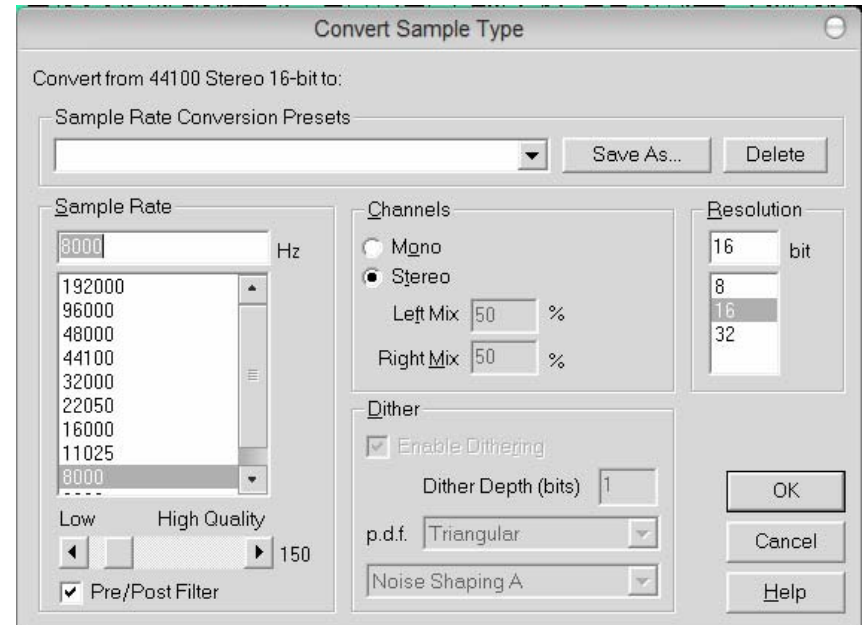
Sampling Rate Adjustments

Procedure (for each file)

- Open a file in CoolEdit Pro.
- Adjust the Sampling Rate:
 - **Menu:** Edit > Convert Sample Type
 - First choose a new sample rate of 8000Hz
 - **Click OK** – the file is resampled.
- Listen to the resampled file – play different sections
- Look at the Frequency Analysis graph and check the frequencies in the resampled file.
- **Repeat the procedure** using a new sample rate of 1000Hz. (Make sure to start with the original file!)

Questions (for each file)

- Can you hear a difference between the original and the resampled files? What is the difference?
- What was the effect of resampling on the frequencies present in the spectrum analysis?
- Was there an audible difference between the resampled file of 1000Hz compared to 8000Hz?
- Can you estimate the effect of adjusting the Sample-Rate on the data-rate of the file?
 - $\text{Data rate} = (\text{sampling-rate}) * (\text{bit-depth}) * (\text{number channels})$



The CoolEdit Convert Sampling Rate Dialog
Sample Rate Conversion

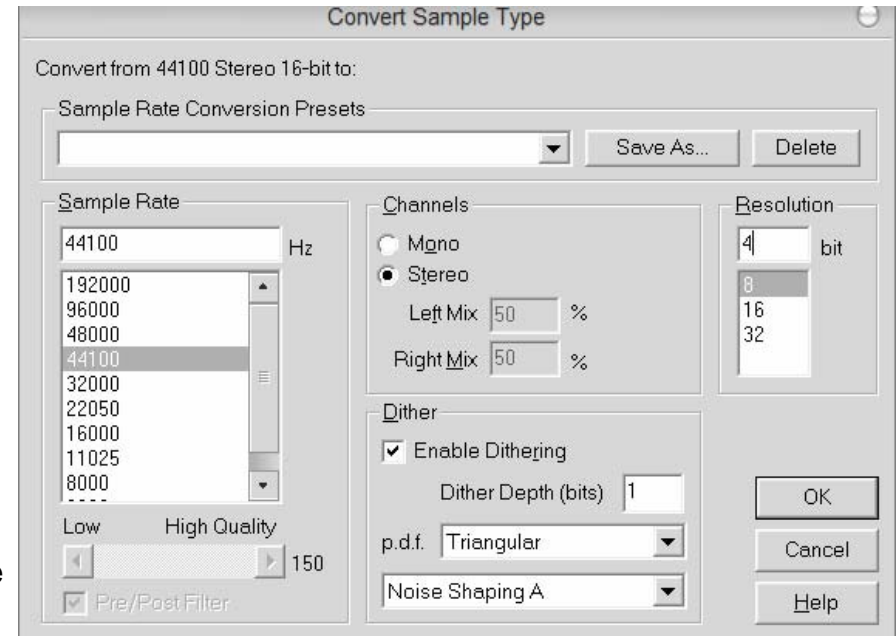
Bit-Depth Adjustments

Procedure (for each file)

- Open a file in CoolEdit Pro
- Adjust the bit depth:
 - **Menu:** Edit > Convert Sample Type
 - Keep Sample Rate at 44100
 - Choose Bit-depth: 4 bit
 - Click OK – the file is converted
- Listen to the resampled file – play different sections
- Look at the Frequency Analysis graph and check the frequencies in the resampled file.

Questions (for each file)

- Can you hear a difference between the original and the adjusted file? What is the difference?
- When looking at the Frequency Analysis, was there a difference between the original file and the adjusted file? What do these differences look like?
- Can you estimate the effect of adjusting the Bit-Depth on the data-rate of the file?
 - $\text{Data rate} = (\text{sampling-rate}) * (\text{bit-depth}) * (\text{number channels})$



**The CoolEdit Convert Sampling Rate Dialog
Bit-Depth Conversion**

Wrap up!

Links

- CoolEdit Pro (Now Adobe Encore): <http://www.adobe.com/encore>