MACHINE AUDIO

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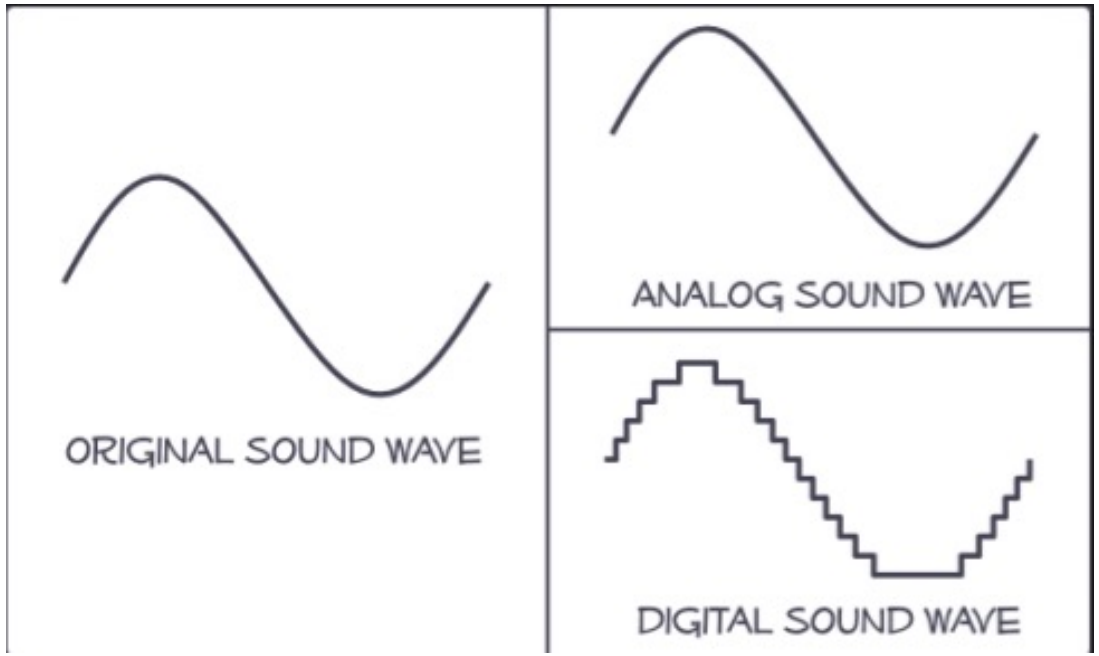
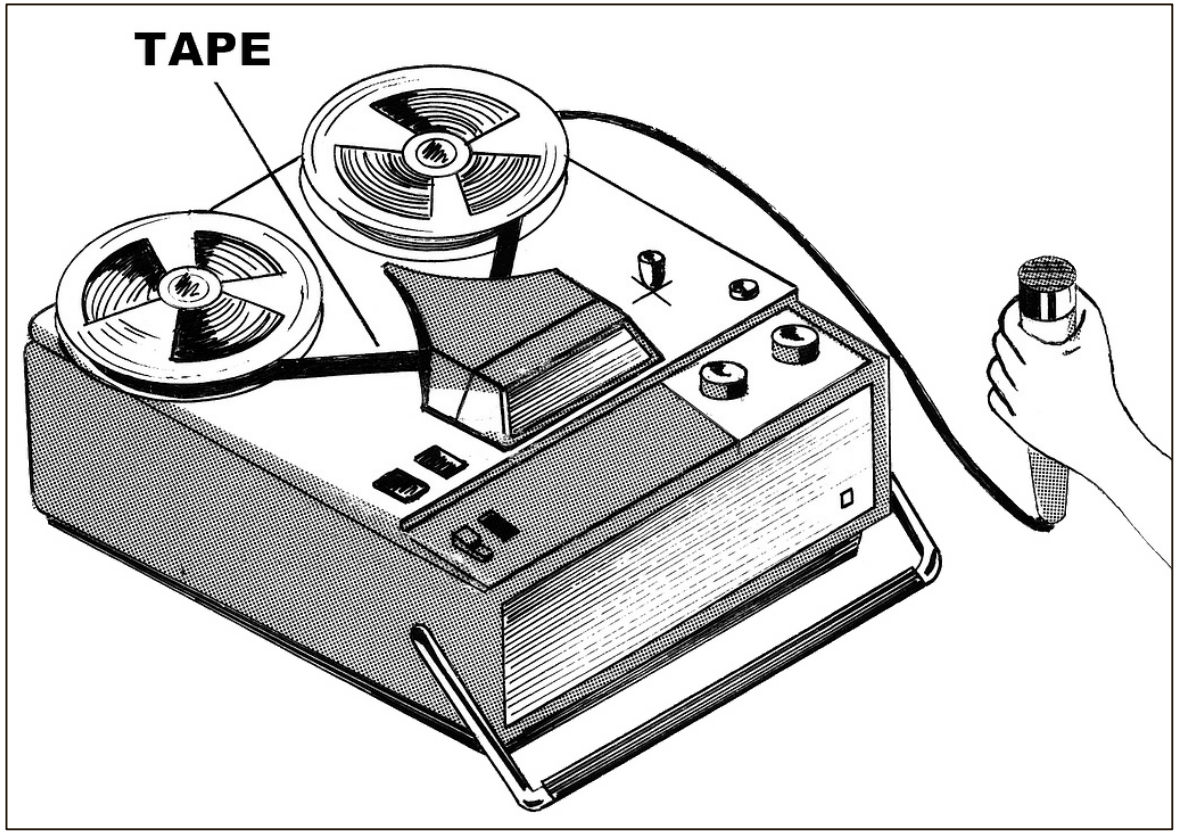
WHAT GOES INTO MAKING AUDIO?

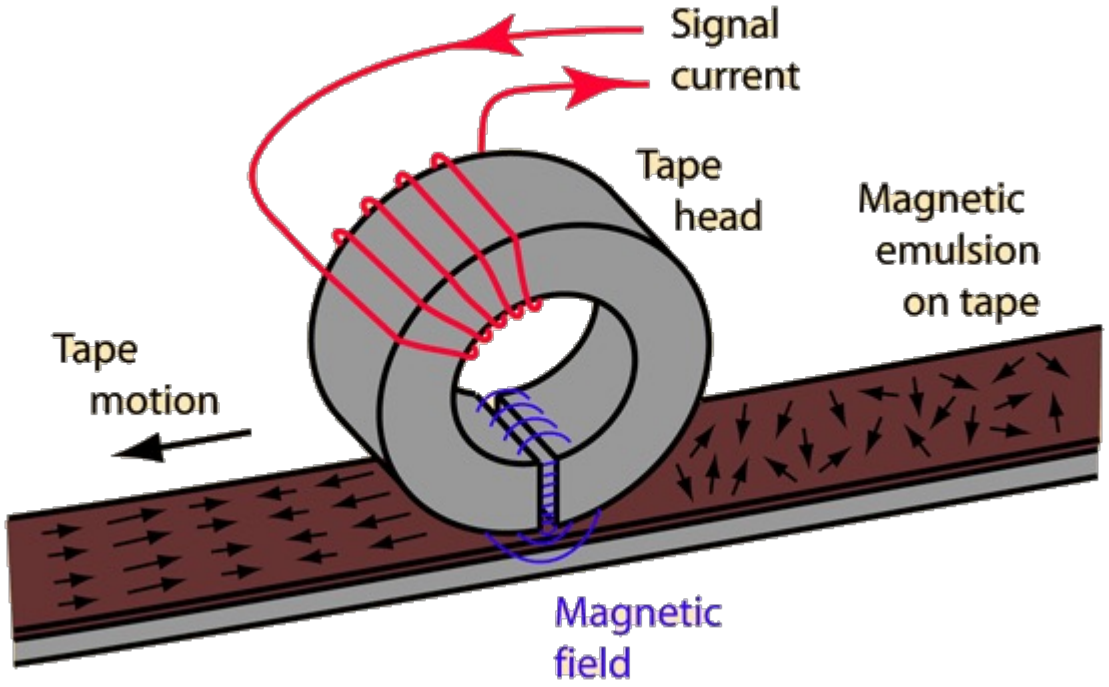
Analog Vs. Digital



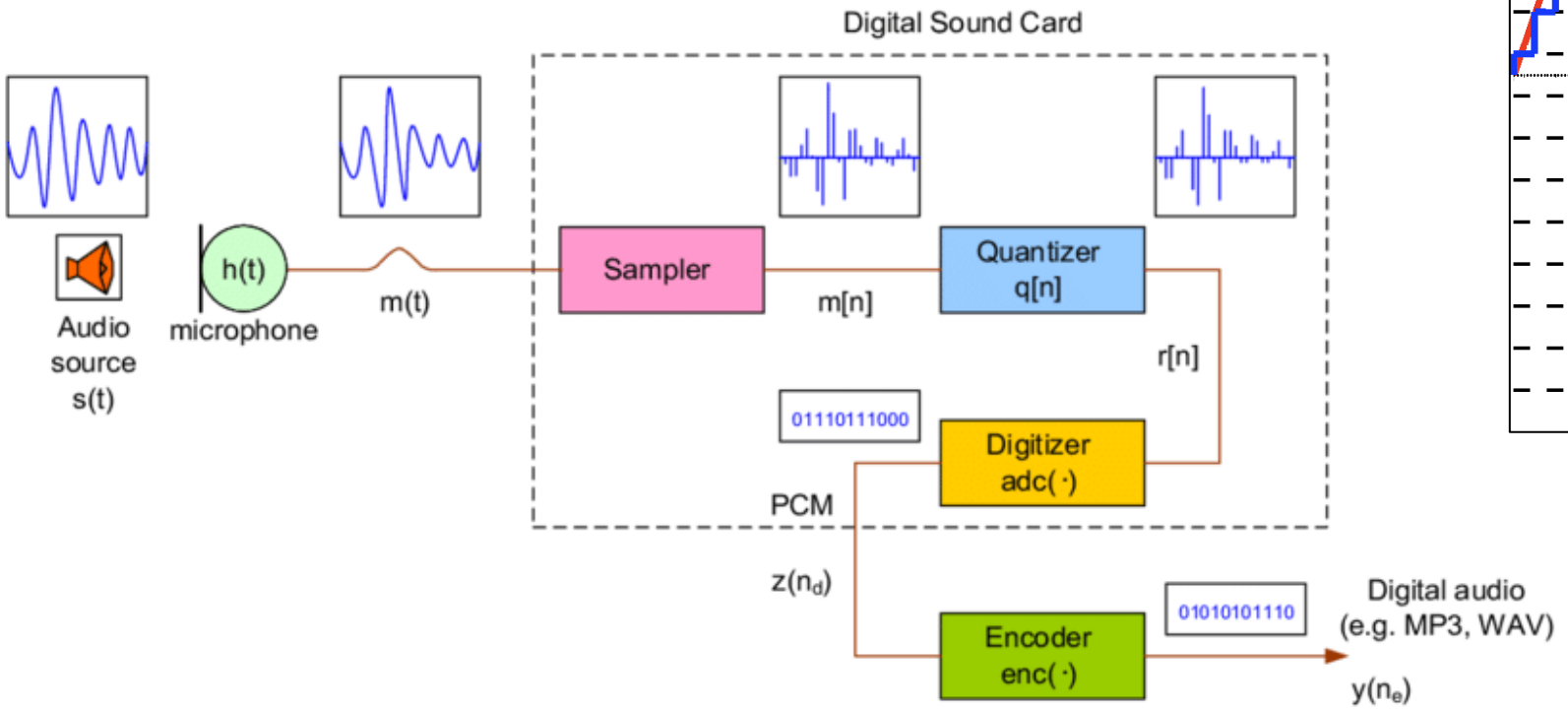
- Analog waveforms have an infinite number of values between two points
- Digital waveforms have a finite number of values, often grouping similar values to whichever best matches those values

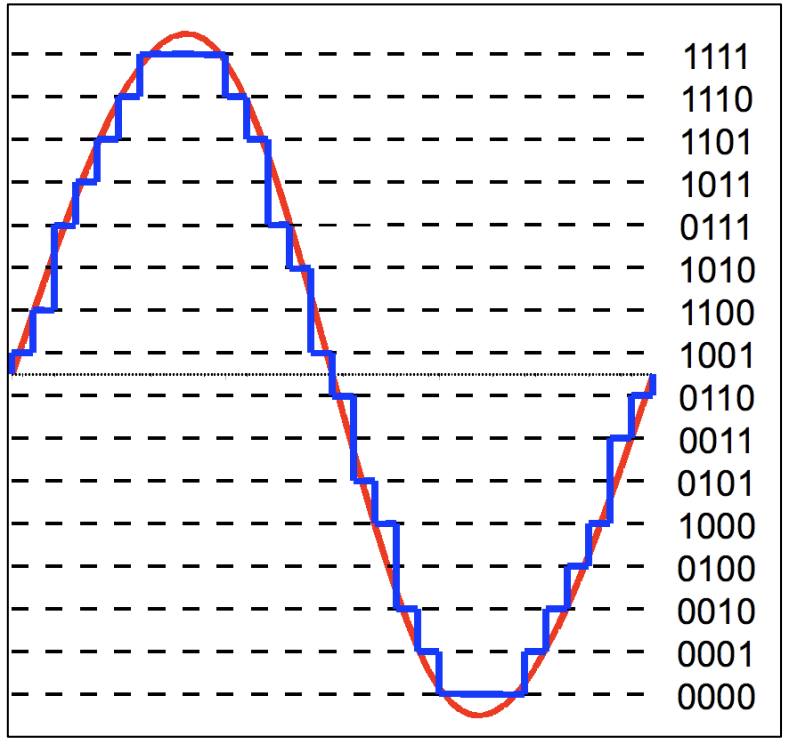
How Audio is Recorded to Analog





Recording to Digital





Top:
An example of what a PCM sound graph looks like using a 4-bit depth resolution

Source: “Digital Recording System Identification Based on Blind Deconvolution” – Kulhandjian et al.

Audio Compression

Lossy Compression
(MP3, AAC, Ogg Vorbis)

- Pros:
  - Light on storage space
  - Various levels of compression
  - Removes insignificant parts of the audio
- Cons:
  - Data is permanently lost when compressed

Lossless Compression
(FLAC, ALAC)

- Pros:
  - Can be uncompressed back into its original form
  - No enhancements are needed to restore the sound
- Cons:
  - Can only compress the file to a certain extent; therefore, the file is still somewhat large

HISTORY OF AUDIO

First Computer Music

- Manchester Mark 1
- Created at Manchester University
- Integrated “Hoot” command
- Melodies from simple tones

Release of the MIDI

- Musical Instrument Digital Interface
- Enabled computers, synths and musical hardware to communicate
- Easily adjust tone, pitch, and noise levels

Music Editing Software

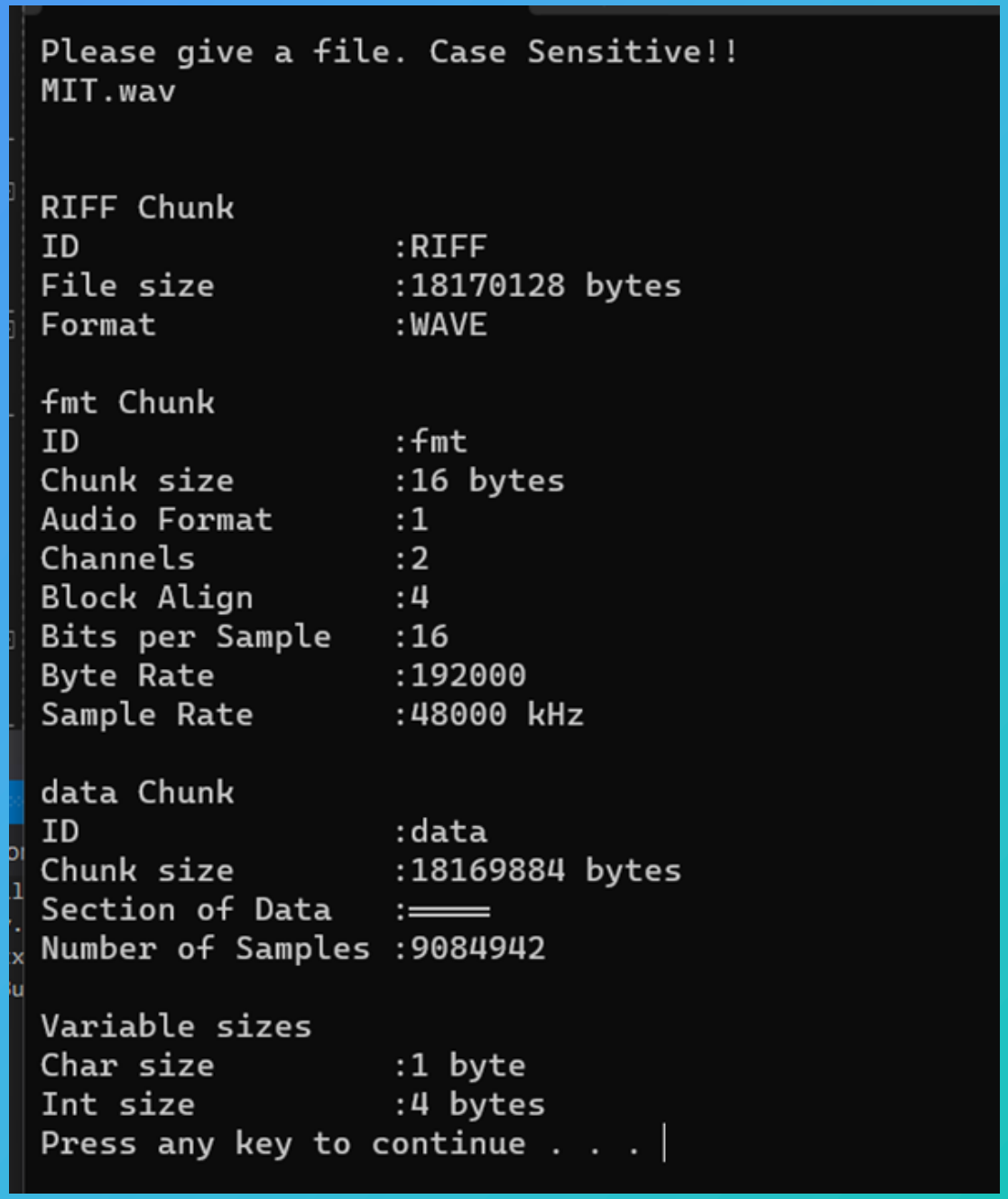
- Cubase software initially released April 1989
- Released as a MIDI for the Atari ST
- First digital music editing software
- Still receiving present day updates on Windows and Mac

CONDENSING AUDIO

Audio Example

16-bit audio

8-bit audio



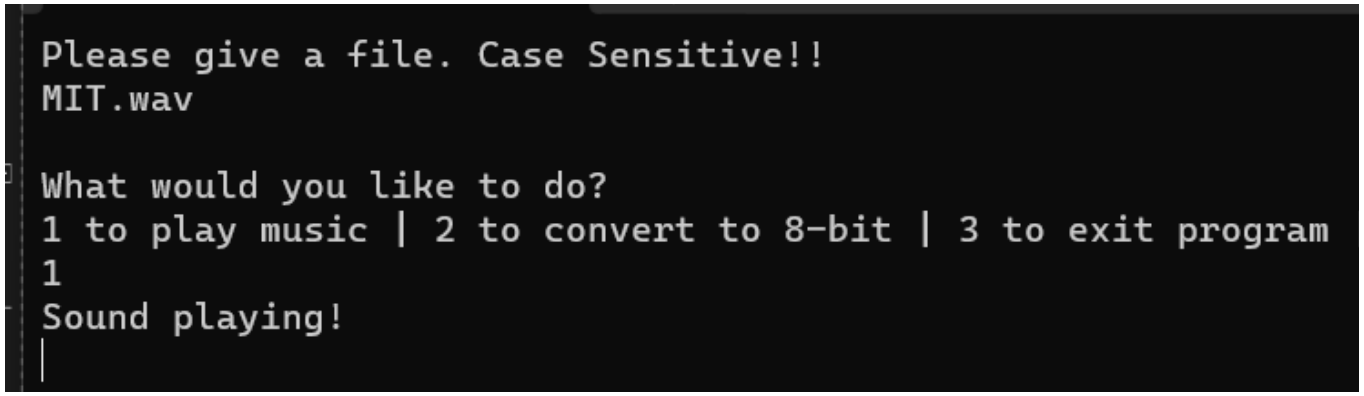
Code Overview

- The code would take a given wave file, assuming it was at least 16-bit or higher quality, and modify the bits in the file making it so that the resulting wave file would be 8-bits.

- A separate c++ project, displayed here, takes in a wave file and displays its contents.

What We Learned

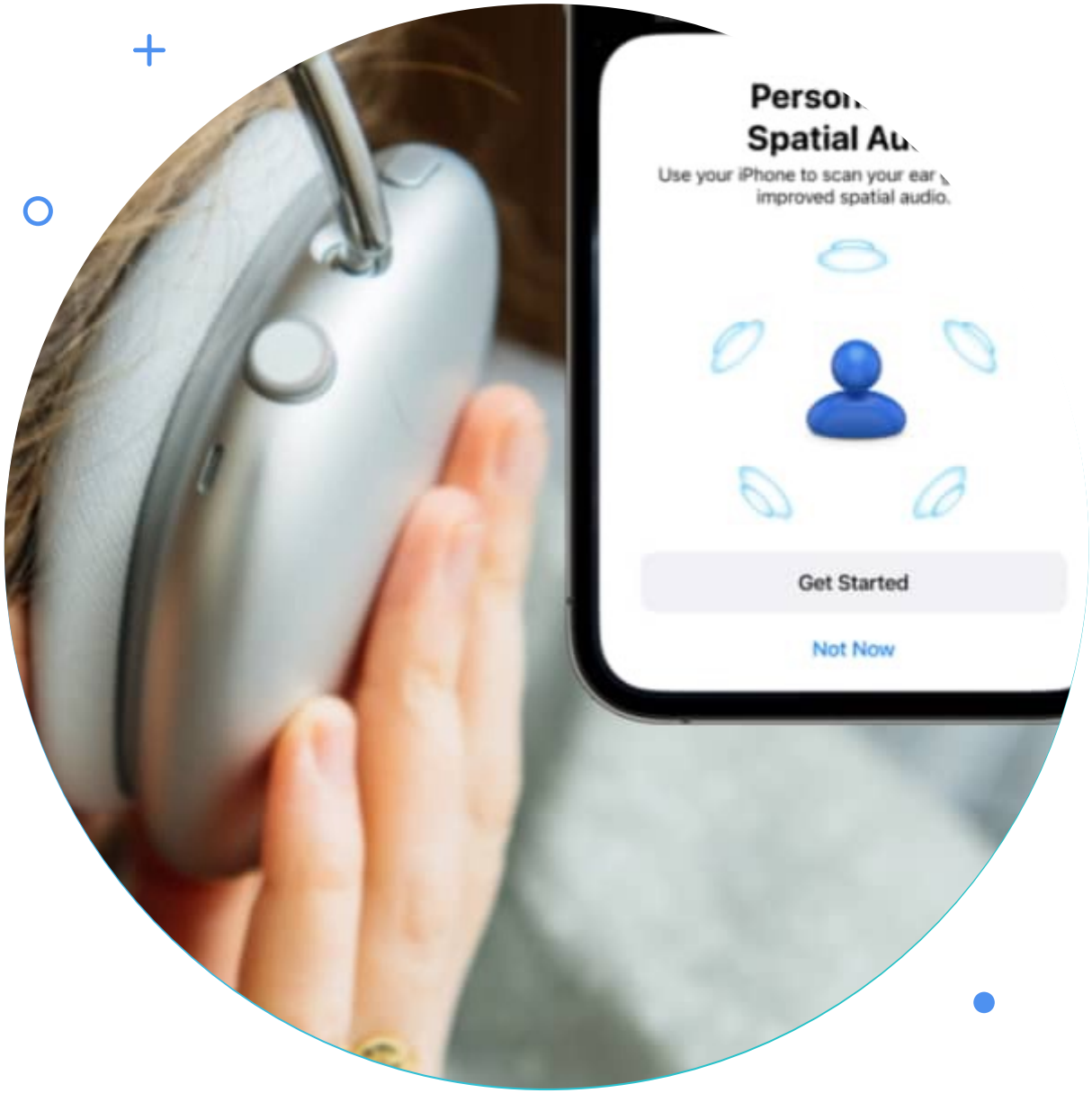
- The Format of a Wave File.
- The discovery of bit operators and additional variable type conversions in c++.
- Music Functions



Complications

- Reading in specific sub chunks of a wave file.
- Saving the data array that contained the music.
- Modifying the bits in the data array.
- Writing the new data to a new wave file.

FUTURE OF AUDIO

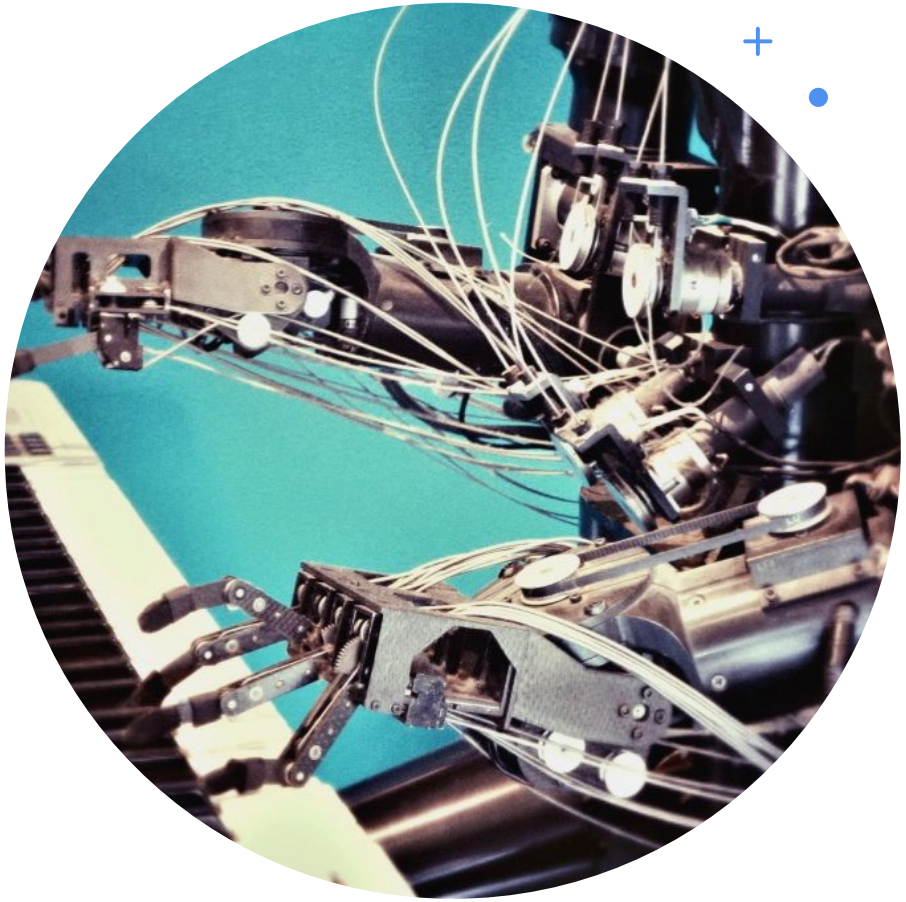


Spatial Audio

- Creation of 3-Dimensional Audio
- Most namely available through Apple Headphones
- Improve immersive feel of VR, gaming, and sound passthrough

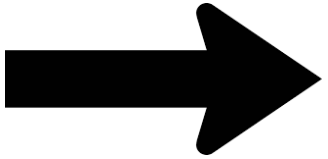
AI in Music Production

- Quickly generate original pieces
- Users specify specify mood, style and duration
- Algorithms that optimize and balance
- Predict musical trends
- Used in film, games, and advertising



Digital Outdoes Analog

- Professional quality without expensive physical equipment
- Emulate any type of instrument
- Create, mix, and master music in one place



QUESTIONS?

Sources

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Future:

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Making Audio:

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Condensing Audio

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