

## Identifying and Preserving Audio Formats: an Introduction

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## Phonautograph (1857)





### LIBRARY HSILIN

## Phonautograph from above







### Phonautograph closeup









## Early phonautograph recording

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## Tinfoil phonograph (1877)







## Cylinder: close up of vertical grooves







## Gramophone (1887)





## Close up of lateral grooves















## Instantaneous disc (1929)







## Instantaneous disc: lacquer (1934)







### Lacquer disc: surface contraction







### Lacquer disc: plasticiser extrusion







## Lacquer disc: water damaged gelatine







## Magnetic recording







## Magnetic recording







# Wire (1945)







## Wire recorder









## Magnetic tape











## Track configuration

a) full track mono

- b) twin track stereo, or half track mono
- c) four track, or quarter track stereo (1 & 3 in one direction, 2 & 4 in the other).





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### Compact cassette (1963)





## Microgroove disc



- 1948 CBS introduce 30cm 33rpm LP (USA)
- 1949 RCA introduce 17cm 45rpm single & EP (USA)
- 1951 Decca introduce 1<sup>st</sup> LP in Europe







# Close up of mono & stereo grooves







### Fancy a short break?



## Outline

- Digital concepts, encoding & capture (ie, recording)
- Digital audio characteristics: sample rate, bit depth
- Digital audio formats: CD, CD-R, DAT, MD
- Care & handling



# Analogue v digital audio



- analogue recording: at each stage tries to faithfully reproduce detailed continuous patterns of sound variations with equivalent variations
  - e.g. magnetic variations on analogue tape, or impressions in a record groove
- digital recording: sound variations are first measured at regular intervals, encoded (in binary form) then the *code* is recorded
- an analogy of digital recording......





## Digitising steps

### -A-D (analogue to digital) converters

- sample: measure amplitude at regular intervals
- quantise: assign a discrete value to each measurement
- encode: as binary numbers
- store: this number sequence

### **– D-A converters**

reverse of the above processes





### Digitising steps 1-2







## Digitising steps 3-4

- (C) The voltage measurements are quantized.
- esperator operator Absor Agentidence Francescon aoriel Maxe allos depártor de co
- (D) The binary numbers are stored in memory or on tape.
- 1111 1110 1101 1100 1011 1010 1001 0111 0110 0101 0100 0011 0010 0001 0000 Were and flatter, fill 1000 LAST VALUE 0100 0100 0010 0001 0010 0101 1000 MEMORY LOCATIONS 1011 1110 1111 1110 1100 1100 1011 1000 FIRST VALUE





## Pros & cons of digital over analogue

### disadvantages

- complex
- multiple standards
- rapid obsolescence
- large amounts of data
- piracy a major issue for rights owners

### advantages

- low noise
- no speed errors
- reliable copying
- fast transfer & access
- scope for automation
- data compression
- continuous improvements in step with computing tech



## Digital audio characteristics

- Digital encoding method
  - PCM (CD-DA, DAT, WAV); ATRAC (MD); mp3...

- Number of channels

- mono=1; stereo=2

-Bit depth

- Sampling rate
- -Bit rate



### Compact Disc









## Structure of a Compact Disc







# Playing an Optical Disc (CD / DVD)







### CD Vs CD-R Label Acrylic Aluminum 125 nm COMPACT 1.2 mm Polycarbonate plastic **DIGITAL AUDIO** Label Aluminum CD-R Dye COMPACT **Polycarbonate plastic** Recordable

#### www.bl.uk

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## CD Vs CD-R



















## Carrier-based Vs file-based content

### **Carrier-based approach:**

- Carrier and content are one and the same
- Work to prolong life of carriers
- Continue looking for the everlasting carrier

### File-based approach:

- Consider carrier and content separately;
- Preserve the content not the carrier
- Hold content in managed Mass Storage System
- Continue looking for quicker, more reliable, cheaper ways to migrate





## Life after audio carriers

### Good news:

- no shelfmark UIDs!
- no handwritten metadata!

### Bad news:

- file name UIDs!
- no handwritten metadata!



