

## U6 Music Technology > Sampling & Samplers



P A Siepmann  
Uppingham School Music Department  
<http://www.petersiepmann.net>



## Sampling & Samplers

- electronic musical instrument
- similar in some respects to a synthesizer but...
- instead of generating sounds, it uses recordings (or “samples”) of sounds that are loaded or recorded into it by the user and then played back by means of a keyboard or sequencer.
- A single sample may often be pitch-shifted to produce musical scales and chords.
  
- Often samplers offer filters, modulation (LFO, etc.), that allow the original sound to be modified
- Most samplers are polyphonic and multitimbral.



## History of Sampling

Prior to computer memory-based samplers, musicians used tape replay keyboards, which store recordings on analog tape. When a key is pressed the tape head contacts the tape and plays a sound.

The Mellotron was the most notable model

- used by a number of groups in the late 1960s and the 1970s
- expensive, heavy, inflexible
- range limited (three octaves at most)



<http://www.youtube.com/watch?v=yrXtmKGkSa4>

The emergence of the digital sampler made sampling far more practical...



- 1962: First digital sampler - EMS Musys system  
(12KB of ROM, hard drive of 32KB, plus tape storage)
- 1976: First commercially available sampling synthesizer -  
Computer Music Melodian
- 1979: First polyphonic digital sampling synthesiser - Fairlight CMI
- 1987: E-mu SP-1200 percussion sampler (influence on Hip-Hop, and  
sample-based sound of the late 1980s and early 1990s)



<http://www.youtube.com/watch?v=8y8BzEILdDw>



During this time, Akai and others pioneered many processing techniques, such as:

Crossfade Looping

Time Stretch

Pitch Shift

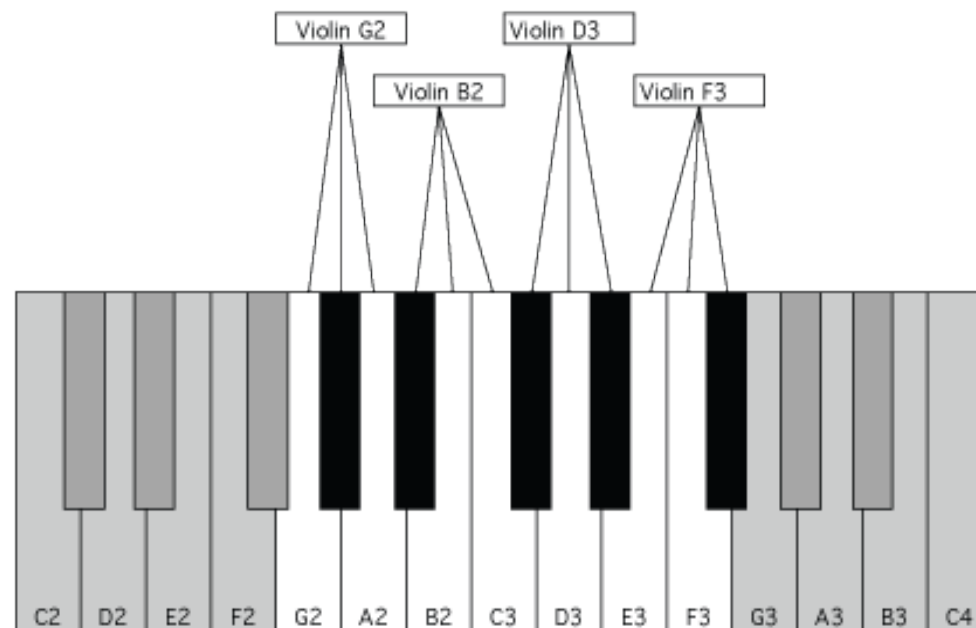
Hybrid synthesizers: short samples (such as the attack phase of an instrument) along with digital synthesis to create more realistic imitations of instruments than had previously been possible (Korg).



## Components of Sampling

### Interface

- Usually controlled from a keyboard or other MIDI source
- Each note-message accesses a particular sample
- Often multiple samples are arranged across the keyboard, each assigned to a note or group of notes.
- Keyboard tracking (keyzones, keymap):





## Hierarchy

1. Samples
  - Recordings of individual sounds
  - Sample rate
  - Resolution
  - Reference Centre Pitch
  - Looping (crossfade, etc.)
  
2. Instruments
  - Group of Keymaps
  - Filters (LFO, envelope generators, etc. to shape the amplitude, pitch, filter or other parameters)
  - Multi-layer keymaps (i.e. more than one sample at the same time)
  
3. Bank
  - Groups of instruments assigned to different MIDI channels.



## Types of Sampler

1. Keymapping Samplers  
*Advantages and Disadvantages?*



## Types of Sampler

### 1. Keymapping Samplers

#### *Advantages and Disadvantages?*

- fewer samples than notes, therefore efficient use of memory
- higher and lower parts of such a keymap may sound unnatural
- transition from one to another may be too noticeable for realistic imitation of the instrument

### 2. Phrase Samplers

- used for “one-shot” sounds
- each keymap spans only a single key
- simplified interface, e.g. drum pads
- no re-pitching required





## Sampler Specification

- Polyphony
- Sample Space
- Channels
- Bit depth
- Outputs



## Sample Storage

Most older samplers use SCSI (Small Computer System Interface) to communicate with devices such as

- Hard drives (fastest)
- CDROM drives
- Zip drives

Modern (post-2000) samplers use solid-state memory cards (such as compact Flash or SmartMedia).



## Software samplers (example of VST)

In the last 10 years the increases in computer power and memory capacity have made it possible to develop software applications that provide the same capabilities as hardware-based units.

Some such samplers provide relatively simple sample playback facilities, requiring the user to turn to other software for such tasks as sample editing, sample recording, and DSP effects.

Others provide features beyond those offered by rack-mounted units.

Garageband for iPad includes a simple sampler!

<http://www.youtube.com/watch?v=BqJ58Oy-1j4>