

# **Sampler plugin for digital audio workstations**

**Trabajo de Fin de Grado en Ingeniería Informática**

**Juan Chozas Sumbera**

Dirigido por

**Jaime Sánchez Hernández  
Miguel Gómez-Zamalloa Gil**



**UNIVERSIDAD COMPLUTENSE DE MADRID  
FACULTAD DE INFORMÁTICA**

# Abstract

Music production is at anyone's reach. Nowadays, computers, smartphones and tablets are able to run software that provides the necessary tools to compose music. Digital Audio Workstations (DAWs) are found at the more sophisticated end of the spectrum. These feature-packed programs are the type that you would find in locations ranging from the aspiring musician's personal computer to the most professional recording studio in your city. One of the most powerful characteristics of these environments is being extensible via plugins.

The sampling techniques that emerged during the end of the 20th century gifted the world with new methods of music composition. The technique that this project develops upon consists in the creation of an instrument using audio recordings as its only source of sound. The nature of the process is far from complex and it can be streamlined to provide a fast way to design a bespoke instrument. By implementing this tool as a plugin, the instrument takes the form of a loadable module that is readily accessible to anybody working on a DAW.

## Key words

music, sound, sampler, sampling, instrument, MIDI, DAW, plugin, VST, synthesizer

# Resumen

Cualquier persona tiene a su alcance la producción musical. El mundo en el que vivimos está plagado de dispositivos capaces de ejecutar programas que ofrecen todas las herramientas necesarias para componer música. Las estaciones de audio digital son los programas que ofrecen la mayor gama de herramientas para la creación de música. Es el tipo de software que no puede faltar en los ordenadores de los músicos principiantes ni de los estudios de grabación más sofisticados. Estos entornos pueden ser enriquecidos mediante módulos externos (plugins), extendiendo la gama de utilidades que pone a disposición del usuario.

A finales del siglo 20 emergieron nuevas técnicas de muestreo, nuevas maneras de producir música utilizando grabaciones de sonido. Este proyecto utiliza estas técnicas de base para ofrecer una manera rápida de crear un instrumento a medida que utiliza regiones de una muestra para producir sonido. El proceso es sencillo por naturaleza y se puede implementar de forma eficiente para hacer un proceso sin demoras innecesarias del diseño de un instrumento basado en muestras. La implementación en forma de plugin hace que el instrumento sea accesible para todo el que trabaje con una estación de audio digital.

## Palabras clave

música, sonido, muestra, muestreo, instrumento, MIDI, DAW, plugin, VST, sintetizador

Contents

1 Introduction . . . . . 5

1.1 Background . . . . . 5

1.2 Objectives . . . . . 7

2 Results . . . . . 9

2.1 Conclusion . . . . . 9

3 Bibliography . . . . . 10

# 1 Introduction

## 1.1 Background

The technique of sampling dates back to the 1960s when recordings were captured on tape. Thanks to a hardware design that made contact between the playback head and different sections of a moving tape, musicians could play the distinct recordings on keyboards of instruments such as the Mellotron. During the 1980s, the popularity of drum machines increased significantly. Many drum machines were sample-based, i.e. they created sounds using digitally stored samples. The alternative was to synthesize sound in an analog fashion. In 1988, the first Music Production Center (MPC) by Akai was made available to the public: a sample-based music workstation that was capable of arranging samples of all lengths in its sequencer to produce full fledged music tracks without the need for additional instruments or hardware. In a recipe for music, an MPC could be the only ingredient, reaching a vast number of musicians because of its affordability in comparison to previous means of music production. It is a tool that gave artists a new way to create music, a technique that has been a foundation to several genres and highly influential to music as a whole.

When it comes to modern music composition, Musical Instrument Digital Interface (MIDI from now on) protocols provide grounds for an alternative to *analog* instruments. This standard erects a bridge for communication between digital instruments and computers, providing the world of digital music production with the tangible interfaces of normal instruments. The MIDI standard provides, among many other features, a communications protocol that encodes music events. This manifests in the form of messages which describe data such as the pressing, releasing, and velocity of musical notes. A digital audio workstation (DAW from here on out) is a software environment for music production. These workstations revolve around MIDI, and can be extended with plugins in the form of effects or instruments. The former normally have a sound-based input-output relation with the DAW, meanwhile instruments will take MIDI messages and produce a sound as an output. For example, a simple plugin could be a sine wave based instrument. The frequency of the wave will depend on the note being held down, and the force applied to the key will dictate the amplitude of the wave. This plugin, although simple, could be considered a synthesizer. In a world of highly complex information systems, digital music production has been developed thoroughly. One can have an extensive range of digital synthesizers, samplers, and effect chains all working simultaneously in computer software. A DAW provides a playground that routes audio between racks of components

and effects, making music production a possibility to anyone that owns a computer.

A sampler is a synthesizer that uses samples rather than oscillators to produce sound. The sources of the sounds it produces are samples, which can be described as clips of audio that are stored in a digital format within the sampler's memory. You're likely to find that hardware and software samplers offer sets of "stock" samples that are loaded by default. The option to load samples from an external source such as an SD card is also common, just like recording external input from a recording device such as a microphone. As is the case with non sample based synthesizers, there are several ways that the samples can be manipulated. Once samples are loaded, the sampler can make the notes on a keyboard trigger the samples so users can play them to compose music. This sampler, in particular, takes the form of a plugin for digital audio workstations. The DAW routes MIDI messages describing the notes being played into the plugin, which in turn processes the input to produce a stream of audio that is returned to the host as sound.

## 1.2 Objectives

Most DAWs have built in samplers or similar tools that allow a user to sample sound and directly manipulate it so as to employ sampling techniques. In most cases, these tools are more than capable of providing the means to translate these techniques into action, however, depending on the DAW, you may be hindered due to the program's presentation. Whether it be the user interface, the imposed workflow, or the minimum amount of steps required to reach your sampling goals, it is likely that the process involves inconveniences.

Personally, I find that there are a minimum of three steps to achieve a usable sampler configuration. First, a main sample must be loaded. Second, the process of *chopping* the sample, where a set of subsections are created within the sample, creating sub-samples otherwise known as *chops*. Third comes the assignment of chops to MIDI notes, in other words, the mapping of sample subsection playback to a controller's keys. These steps are a prerequisite to playing chops on the controller. At this stage, the user can experience the instrument and judge whether it is necessary to take a step back and make adjustments, for example, shifting the start time of a chop, creating/deleting a chop, or moving the trigger note to another of higher convenience. All of this implies that the design of a sampler instrument is an iterative process, and that the user may keep reforming it in several ways to fit the necessities of the creative process in musical composition.

The aim here is to reduce the amount of user interaction required to translate an idea into sound. For the simple implications of sampling techniques, the means by which you achieve a minimum setup with which you can play around and manifest ideas should be straightforward. With this project the intention is to strip the process of whatever element that is not essential to it. By downsizing in the features that a DAW would offer, I aspire to build a plugin strictly optimized for sampling.

The capabilities of the sampler can be summarized to four key functionalities:

- Capacity to load an audio clip as the main sample
- Manual chopping and automatic chopping with peak detection algorithm
- Visual representation and audio preview of the main sample and its chops
- Editable envelope parameters for each chop

## **2 Results**

### **2.1 Conclusion**



### 3 Bibliography