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Development Assignment Brief

Element D2b Essay

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For my software instrument element of this assignment, I have created a virtual Fender Precision Elite Bass in HISE.

Initially my idea was to field record environment material such as background noises and other sound effects to build up a sample library that could be used in both the music industry and the gaming industry. I borrowed a Zoom field recorder and also purchased an interface that I could plug into my iPad and iPhone to enable me to record whilst on the move using a decent microphone. I became concerned about my ideas suitability for the assignment brief and I thought in order to demonstrate it well it would probably be a good idea to make a basic game using Unity and FMOD. Thinking this would be too much of a challenge for me to do well, I decided to make a virtual bass guitar. After all bass guitar is my first instrument and I have some lovely options to record samples from. Fender are known for making two of the most iconic bass guitars of all time, the Jazz and the Precision. I'm lucky enough to own a rare active Fender Precision Elite (www.riverband.com) which was only manufactured for two years during the early eighties and has been my go to bass for over twenty five years. It was an easy decision to make that this would be the bass for the project.

Being a bass player I had not delved too deep into the world of virtual basses until prior to starting this project. I first looked at what I had in stock in Protools. The version of Protools I am running comes with Xpand2 (pluginboutique.com2022) so I took a look at the bass instruments available in that plugin. I was unimpressed to say the least. Firstly the bass sounds are very limited and lacking in authenticity. You get the option of 'Double Bass' and 'Fretless Bass', then seven different styles of playing what seems to be the same electric bass. These consist of 'Full', 'Hard' and 'Soft' 'Pick Bass' and 'Full', 'Hard', 'Very Hard' and 'Soft', 'Finger Bass'. So basically the electric bass instruments in Expand2 consist of two timbres, 'Pick Bass' and 'Finger Bass', that can be played at different velocities. Not without swapping instruments though. If you play one of these with a keyboard, although the volume increases with the amount of pressure applied to the keys, the sound remains the same other than getting louder. It was at this point that I found I wanted to try and make a bass instrument where the tone changes along with the velocity as it would on a real bass.

As I had decided to make specifically a 'Fender Precision' (also known as a 'P Bass' or 'Fender P') sample instrument I had a look at what was already available on the market. I presumed there would be a lot of manufactures that had already created a model of such an iconic bass, however doubted my chances of finding an eighties 'Fender Precision Elite' instrument. (It's hard enough to find a real one.)

I was first drawn to Ample Sound's 'Ample Bass P'. (amplesound.net2022) The first thing I noticed is the stunning interface which has the image of a lovely looking Precision style bass above a typical controller keyboard image with various faders and knobs. When you look at the list of sounds it is clear that there are a lot more options available than in Xpand2. You have 'Sustain', 'Natural Harmonic', 'Palm Mute', 'Slide In From Below & Slide Out Downwards', 'Legato Slide (Poly Legato)', 'Hammer On & Pull Off (Poly Legato)', 'Staccato', 'Slap', 'Tap' and 'Pop'. There are also allocated keys on the keyboard to change between these sounds whilst your playing the instrument. There are controls for 'Fade In', 'Autobuzz', 'Acoustic Noise', 'Start Time', 'Release', 'Natural Acoustics', and 'Fret Sounds'. The general playing area is located in the middle section of the keyboard with the keys to the left providing the switches between the sounds and the keys to the right delivering kinds of FX/special sounds such as slides and taps or ghost notes. It's nice to see the image of the strings wobble on the screen as if they are being plucked. The features of this instrument don't end there. You have the option to alter the tuning on each string and also you can import tablature that the instrument will automatically play. (Youtube2014)

Next I looked at IK Multimedia's '*Modo Bass – 70's P Bass*'. (ikmultimedia.com2022) This instrument has a similar looking interface with a nice image of a Precision style bass then the fret board across the bottom with the keyboard just showing beneath. Although I am looking at Precision basses specifically, this plugin offers a choice of twelve different basses to choose from. The sounds on this instrument have been modelled rather than sampled or synth generated so the '*P Bass*' sounds have been recreated by algorithms using code. Like the Ample Sounds instrument you have different sound options, '*Finger*', '*Pick*', '*Slap*' and '*Muting*'. There are controls for '*Stroke*', '*Touch*', '*Fingering Position*', '*Let Ring*', and '*Open Strings*'. Another nice feature that you don't get in the Ample Sounds instrument is the ability to move the playing position up and down, either closer to the bridge or closer to the neck. You can even pick what strings to use in this plugin, with settings for four or five strings and you can also set the gauge and the age of the strings. The strings on the interface wobble when played but also the notes light up too. (Youtube2017)

Spectrasonic's Trilian bass instrument (spectra sonics.net2022) is a little different in appearance, initially looking more like a rack mountable unit than a bass guitar. This is probably due to the extensive library of acoustic, electric and synth bass sounds it makes available. I only looked at the Precision bass options as to make a fair comparison. The Trilian instrument has key selections (like the Ample Sounds instrument) that can be selected whilst playing live. '*Gliss Up*', '*Slide Down*', '*Slide Up*', '*Slide UpDown*', '*Harmonics*', '*Staccato*', and '*X-Noise*'. In Trilian each bass has its own set of settings which are adjustable on the main screen. You can mix the mic, pickup and noises, select Legato, control the velocity, Amount and Humanize on the compressor, switch octaves and adjust EQ. You can select the sound source then add and adjust modulation, filter, envelopes and up to six LFOs. There are over thirty effects that come in rack form. There are plenty of presets but are all fully adjustable. A noticeable downside in this particular instrument is that you can not tell which string you are playing on and although you can obviously play the same note on multiple strings of the same register, the tone would differ due to the thickness of the strings. This is still a great sounding instrument though. (Youtube2021)

Orange Tree Sample's Evolution Flat Wound Bass (orange tree samples.com2019) seems to be the best of both worlds. It has over four thousand five hundred samples, an extensive library of presets which combine different articulation and effects set ups to suit a variety of different genres of music. You also have the option to map your own instrument. Featuring an image of a Precision style bass strung with flat wounds with a clear display of the fret board that shows the notes lighting up as well as the strings wobbling/vibrating when played. Again it is over a keyboard that also reacts to the notes played and again has quick access to a multitude of sound settings. It has '*Sustain*', '*Palm Mute*', '*Mute*' and '*Natural Harmonics*' both in '*Finger Style*' and '*Picked*' as well as '*Slapping*', '*Popping*' and performance effects like '*String Slaps*', '*Slides*' and much more. MIDI articulations give you '*Instant Octaves*', '*Grace Notes*', '*Buzz Trills*', '*Whole-Step Slides*', '*whole-Step Hammer-Ons*' and '*Slides*'. Legato samples for '*Slides*', '*Hammer-Ons*' and '*Pull Offs*'. The articulations have three dynamics, two pick directions and two round-robins. In this instrument you also have a selection of amps and speaker cabinet set ups to choose from and even microphone types and positions. It sounds great. (Youtube2019)

Scarbee Pre Bass from Native Instruments (native-instruments.com2022) was recorded with round wound strings for what it calls a fat and dirty sound by Thomas Hanson Skarbye who has played with Nile Rodgers (Chic) and Alicia Keys. Again a nice looking interface with a P bass image which rests when played with the notes being shown and the strings vibrating. This instrument has a Legato that is controlled by the sustain pedal, it has automatic '*Hammer-Ons*' and '*Pull Offs*'. When played softly you get muted sounds and if you play as soft as possible you get harmonics. You can also select these options with key commands which also give you '*Trills*', '*Buzz Trills*' and '*Short Buzz Trills*'. It has an intelligent string selection which decides which string the note should be played on. This is

also controllable by command keys which is handy for getting a more realistic tone. For example you can choose to play an A on the E string or use the open A string which naturally sound slightly different due to the string gauge. There are different recorded samples for each note so you don't get the robotic/machine gun sound if you repeatedly play the same note. The release time is adjustable and there are lots of effects presets to choose from. There are also sound effects on the right hand side of the keyboard including fret slides when you move hand position. I nice touch and one I would like to put into my build is the vibrato controlled by the mod wheel. This instrument has player profile settings. You can choose from 'Rock and Retro', 'Soul and Funk' or 'Pop and Country'. These profiles dictate to the intelligent string selection which string the note should be played on to suit the style of music being played. There is a great attention to detail in this instrument. It even has a 'Pickup Hit' sound effect which can be controlled with a ratio knob to set the probability of how often you hit the pickup whist playing. (Youtube2010)

After looking at all these software instruments its clear that there are some very advanced products available and it seems almost anything is possible when building one.

Max, also known as Max/MSP/Jitter is a visual programming language for music and multimedia. You can build complex, interactive programs without any prior experience writing code. Max MSP is especially useful for building audio, MIDI, video and graphics applications where user interaction is needed.

"Max MSP is split into several parts. 'Max' handles discrete operations and MIDI, this is the easiest place to start getting familiar with the tool. 'MSP' deals with signal processing and audio. And 'Jitter' is for graphics rendering and video manipulation". (Instructables.com2022)

Reaktor is a graphical modular software music studio developed by Native Instruments. It allows musicians and sound specialists to design and build their own instruments, samplers, effects and sound design tools. (Wikipedia)

Reaktor is a completely modular real-time sound synthesis, sampling and effects software application/plugin. It fuses all audio applications into a single, versatile and powerful tool. Musicians, producers and sound designers are all catered to by the very broad range of instruments and sounds already included. With an open engine architecture, the potential for building your own highly individual instruments is endless.

Pure Data (or just Pd) is an open source visual programming language for multimedia.

"Pure Data lets you process audio and MIDI within a powerful modular environment and lets you combine it easily with video, custom hardware controllers, light shows and even robotics. But, best of all, its free!"

"Pure data includes functions (called objects or externals) for generating 3D graphics and video and can also control external hardware like stage lighting or robotics. In effect Pure Data can use any kind of input (audio, MIDI, video, sensors and so on) to control any kind of output, with lots of processing in the middle. So if you yearn for an electromagnetic catapult that flings jelly at the audience every time you rattle your tambourine, or a USB incense burner which radiates progressively stronger smells as the temperature in the church hall rises, Pure Data can help you achieve this". (Soundonsound.com2006)

“Native Instruments Kontakt is a playground for working creatively with samples. Whether you’re creating a specific sound for a track, or building a complex multi-sampled instrument, the tools you need to do it are right in front of you: Flexible editors, seven playback modes, built in effects and an advanced scripting language for going in deep.

Kontakt 6 also introduces Creator Tools, a standalone application that radically streamlines and improves the instrument creation process. It includes tools like a multi-instance debugger, an instrument editor and a GUI designer”. (Nativeinstruments.com2022)

“HISE is a cross platform open source audio application for building virtual instruments. It emphasises on sampling but includes some basic synthesis features for making hybrid instruments as well audio effects. You can export the instruments as VST/AU/AAX plugins or as a standalone application for windows/macOS or iOS”. (Kvraudio2022)

Having absolutely zero experience in this field and having limited time to learn, I wished to source the most user friendly option of software possible in which to create this artefact and also one where no or little coding was required. After having a look at programmes such as Max MSP, Pure Data and Native Instruments’ Reaktor and Kontakt 6 and watching a few tutorial videos, I decided I would like to use Native Instruments Kontakt 6. I looked into downloading it and decided I was happy to pay for it as I would also benefit from the libraries it comes with, ‘Analog Dreams’, ‘Ethereal Earth’ and ‘Hybrid Keys’. Unfortunately I soon became aware that my computer was incapable of running Kontakt 6. This encouraged me to look at the system requirements for the other options and HISE seemed to be the only thing I was going to be able to use.

I wasn’t expecting to make anything in the same class as Scarbee Pre Bass, Trilion Bass, Evolution Flat Wound Bass, Ample Sounds Bass P or Modo Bass however I did hope to be able to create something that would rival the virtual basses I had in Xpand2 in Protools.

Whilst planning my build I decided I would definitely record multiple samples of each note, played at different velocities as the bass instruments in Xpand2 lack authenticity due to only have one sample per note which causes a robotic or machine gun like effect when playing the same note repeatedly.

I spent some time looking at how other people sample bass guitar (youtube2021) and decided I would limit my samples to three per note, covering all three octaves of the bass. (due to complications I only managed two octaves unfortunately) The three samples would be played at three different velocities to make it more realistic and provide the user some control of not only the volume but the tone as well. In order to maintain a consistent volume whilst playing the finished product on the keyboard, it was necessary to decide on three volume levels. I meticulously watched the db meter whilst recording all the samples making sure any variations were unnoticeable to the human ear. I also let each note ring all the way out so if a keyboard key was held down it would last a realistic length of time.

The editing process was not as bad as I had imagined. I had good, clean recordings that represented the bass well. I made sure there was no space in front of the waveforms to avoid a delay once the keyboard was pressed and applied small fades to the end of each sample. Still a time consuming process but not overly tedious.

I made sure I named each sample clip (seventy two in total) clearly before exporting them from Protools into a folder on my desktop, ready to import into HISE.

Once inside HISE I opened up the sampler and was able to drag my first sample into the map editor.

As I recorded three samples of each note at different velocities, I set the velocity levels to a third of the map so this left room for the other two samples of the same note. I then set the velocities for the other two samples of the same note to lower values. Eventually I had added all seventy two samples and set the velocity levels on every one individually.

The results were pleasing as I found that when a key on the keyboard is struck hard you get the sound you would expect from slapping the bass and when struck lighter, your usual plucking sound is delivered.

The next thing I looked at was the Gain Modulation in HISE which opens up a simple envelope. I set a slightly longer release time just to leave a very short resonance once a key is released so it sounds a little more natural and doesn't cut the sound completely off. I then opened the velocity modulator and selected 'use table'. This now gives even more control to the user making the keys more touch sensitive so offering a wider range of dynamics to the instrument. This however lead to one of the first major issues I had with HISE. I could not figure out how to save the settings on the gain and velocity modulators. The samples would save after each session but the gain and velocity modulators had to be set each time I opened the saved sampler in HISE.

This did not bother me too much as it only takes a minute or two to set up once the sampler is opened in HISE. However this turned out to be the start of my issues. I started to look at building an interface. I selected the midi menu and typed in the code for making the front interface as I had seen in the tutorial video. Then from the script processor menu I was able to select elements such as new buttons, new sliders, new tables etc. These would appear on the screen but the auto scripting would not work as expected and having no knowledge of using code this stopped me in my tracks. All though there is a lot of text mentioning auto save, just like the gain and velocity controls, these features also failed to save each time I closed the session.

Within HISE I was able to use all the effects such as reverb, delay and filters on my instrument. This was just experimental and none of the settings would save anyway.

It was from this point on that I struggled to make further progress in the development of the instrument. I had grand plans to add effects and controls. I was hoping to set a tone control up via a virtual knob as is on the bass itself that I could have assigned a filter to. I also would have liked to get the pitch bend on the keyboard up and running as to emulate bending a string. I searched through all the tutorial videos I could find online as well as the limited documentation. The virtual scripting was not working as expected and I spent hours trying to resolve this with no success.

At this point in the project I decided to try and export the instrument in its current state, expecting to at least have a playable instrument that sounds good and has nice velocity controls. I had read that it was possible to export the instrument as an AAX file. Being a Protools user this was my first choice. After trawling the internet for answers, I found in a forum that this is possible but only if you acquire a licence. I tried to export as an Instrument (VSTi / AU) plugin. I tried to export as an FX plugin. I tried to export as a Stand-alone Application. I would validate all sample references but then would get the same message each time which said '*Absolute File path detected*'. Once I clicked ok on this, '*Export Error*' would pop up with the message '*The sanity check failed. Aborting export...*' The problem seemed to be that the samples were not located correctly. I tried re-importing them in different ways but the issue still persists. I repeated the process many times and failed to get any further.

I figured the problems stem either from my lack of knowledge, my IMac being too old or a combination of these. I wanted to try the process on a different computer. Determined to achieve my goal I went to my friend's development studio where he develops VR games. Whilst not a

programmer he has a core understanding of code and I thought he may be able to help. We tried the same process on the PC and managed to get a little further. We installed Steinbrenner VST3 SDK and also ASIO SDK but then had issues with Visual Studio versions not being compatible. With such vague documentation and having only scratched the surface with HISE the challenge remained. We then ran into issues with Windows SDK versions Visual Studios is trying to compile with.

With all of this on top of the virtual scripting not working as expected, just trying to add a keyboard was a struggle enough. After hours of trying it still never really worked or displayed in the build. VST builds were more of an issue but we did have success getting it to build an EXE file, but with no keyboard and without coding knowledge, getting it to display the simplest of things was a huge deviation from audio production.

In comparison to the already available products on the market, my instrument is in need of a lot of further development to become a rival product. Firstly a nice looking interface would have to be built, I would sample the final octave and increase the amount of samples for each note, set the mod wheel up to control vibrato and add some other effects. In comparison to the basses in Xpand2 , I believe my instrument sounds better. As I am unable to export the instrument, beta testing has not been possible however I have received positive feedback on site regarding the sound and velocity control. I think an upgraded computer and probably a different program would be essential for further development although I do think I could get a little further in HISE if I invested some more time in it.

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