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Element D2b

Instrument Essay

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An instrument has been defined as “an object or device for producing musical sounds” (Westrup & Grame, 2022). Such musical sounds can include those with or without a fixed pitch like ones from a drum, a percussive instrument, or a guitar, a pitched instrument. Instruments have been used throughout human history with one of the earliest examples being a “60,000-year-old Neanderthal flute” (Gowlett, et al., 2012), all the way to today, where virtual studio instruments are commonly used throughout the music industry. The function of a musical instrument hasn’t changed drastically over time, where they have primarily contributed to hunting, entertainment, and religious practices (Lawergren, 1988). Instruments have moved from being physical to virtual and with technological advancements being made, this has led to a heightened accessibility to all types of instruments with a click of a button. Musicians with access to a computer with a digital audio workspace (DAW) (Cortez, 2022), no longer need to own specific instruments to create their desired sounds, allowing for combinations of sounds that are new and may be considered as unusual. Virtual studio technology, or VST, came about in the late 1990s with Steinberg Media Technologies (Steinburg, 2023) coining the acronym with their sequencer on the DAW, Cubase. This was an impactful turning point within the world of music production and the development of virtual software instruments.

Tasked with the assignment of making my own instrument, I have decided to create a virtual instrument due to the challenging nature and craftsmanship needed to produce a physical instrument. Virtual instruments come in many forms from exact replicas of existing hardware instruments to more adventurous, imaginative instruments, ones that aren’t in existence outside of a computer. To create a virtual software instrument, I must develop a new set of skills within a new software. From this process, I intend to develop new skillsets within design and sound craft using the program HISE. Such skills could include graphic design, coding, and product design. With HISE, I intended to make a software instrument with a simple set of criteria. It must be functional, useful for music production, visually appealing and ergonomic.

My initial thoughts regarding building a virtual software instrument were to create a sample instrument. An option was to create a replica sample instrument, an attempt at an exact copy of something already in existence. For example, an 808 drum machine (Roland, 2023), containing 808 drum samples and a graphic interface like the hardware drum machine. If I were to do this, I would need to include the exact features and replicate these within HISE’s interface. As a novice HISE user, I quickly decided that building such a complex instrument may be out of my current skill set, due to the time restraints of the assignment.

After research, it became apparent that the functions within my instrument would have to be basic yet must serve a purpose to both me and the wider music community.

As a producer, I have many go to samples and sounds that I use regularly and after some thought, I decided to house them within an instrument that I can access and use quickly. Furthermore, there are several effects and features that I use regularly to alter and design drum sounds. I wanted these features to be contained within my virtual instrument, to speed up drum processing and achieve drum sounds with fewer steps involved. Regarding the interface and what I wanted to include, I based many decisions from my own experiences with drum sample instruments and tried to focus on what I would describe as the most important elements.

I wanted a piano roll at the bottom of the sample instrument, like Heavyocity Damage 2 (Heavocity, 2023), so that the drum sounds can be played without a MIDI keyboard, allowing

for a wider inclusivity. Addictive Drums 2 (XLN Audio, 2023) for example, has a complex interface with too many processing points for each individual drum, so I decided that the samples would get processed together, and affected all at once. Arguably a hinderance on the drum sounds, but this was a result of both time pressures and a lack of know-how within HISE. More inspiration and influence came from virtual instruments such as DRUMLAB (Native Instruments, 2023), with their use of effects such as transient design, a compressor, a saturator, reverb, and equalisation. Other features that I intended to include were a delay, chorus, and phase effect.

The process that I followed began with locating and preparing samples. Using samples that I have acquired through sample libraries or through recording, I chose a selection of samples from what I consider form the foundation of the drums (Yamaha, 2023). I selected six of each kick, snare, and hi-hat samples, all with similar functionality but different timbre and a contrasting sound. To prepare the samples, I ensured that they were not clipping, that the samples started without a delay and that they were as similar in length as possible. This preparation was intended to negate any issues when loading the samples into HISE. Initially, I bounced each individual sample 5 times at a different velocity, intending to create round robins for the sample instrument, to increase variety. I labelled each file as follows: `drumName_type_key_dynamic_rr`. For example, a hi-hat sample would be called `hiHat_type3_82_dynamic1_rr1`. I did this to ensure an easier implementation of the sample into HISE, encouraging the program to categorise my samples correctly. Unfortunately, this method did not produce the results that I wanted, and I couldn't find a solution to combat this, apart from just using one stationary sample. A round robin (Ableton, 2023) is "a method of sample playback which allows you to play different sampled versions of the same sound, resulting in natural variations in otherwise static patterns". Using this method arguably could have enhanced my instrument, however, in my opinion, does not compromise the design and my intentions. In future projects, I intend to combat this by learning more about HISE and its sample playback methods.

Before I could add any samples into HISE, I had to prepare a sampler. Within the interface I added a Global Modulator Container then a Container which contained the Sampler. When all the samples had been prepared and correctly labelled, I dragged the samples into the Sampler and began to map them. I decided to span over three octaves with the kick samples beginning on C2, the snare drums occupied the middle of the range and the last hi-hat on C5. I thought this made logical sense as this is where the individual drum components sit regarding their frequencies. Once the samples were correctly mapped and in place, the next logical step was to start to build the visual user interface, where the effects could begin to be added. Next to the sampler, a velocity modulator was added to encourage some dynamic variation to the samples.

Regarding the effects that I wanted to add, I based my decisions on my own personal experiences, coupled with the influence of well-known drum sample instruments. These effects, as discussed earlier, were reverb, delay, saturation, compression, EQ, phase, chorus, and delay. When designing the interface, I wanted to have as many options as possible to design the widest variety of sounds.

Regarding reverb, inside the container I added an FX chain and selected the Simple reverb. The two elements that I wanted to control were the wet level and the size of the reverb. The

damping and stereo width parameters were set to a fixed position whereby the user has no control of them. Arguably, this gives less control to a user, however I was concerned about cluttering the interface with too many controls. With both a wet and size control, it allows the user to have complete control of turning the reverb on or off, combined with the size control, allowing for even more reverb if required. I added two knobs within the processorId, and I selected the Simple Reverb. I labelled the knobs `knbReverbWet` and `knbReverbSize` to align in accordance with their parameter ID and set their component specific property modes to `NormalizedPercentage`. This allowed for a percentage graphic to show when a user increases or decreases the levels of reverb wetness and size. The knobs were placed within a panel labelled `pnlReverb` to contain the feature and to allow for easier malleability later in the process. I added labels to ensure the user clearly knew the function of each knob, combined with the title label, REVERB. Every aspect of the interface was consistently labelled using their identifiable features and the same formula to ensure they were easily located.

The second FX chain I added was the Delay effect. Using delay on drums is something that can cause issues when elements are being processed together and therefore, I understand how this could result in noise bleed and a lack of user control. When adding the parameters for control within the delay, I took this into account and ensured there was enough control for the user to utilise this feature in real time. I also thought that, due to the lack of a sequencer in my instrument, which could be considered as a type of drum machine (Pontin, 2021), the delay could act essentially as a single sample sequencer. For example, hi-hat patterns could be played using the delay function, contributing to its use and relevance within a music production environment.

When building the delay interface, I added a container and three knobs. The parameters that I decided to control were the mix, the left delay and right delay functions. Within the delay FX console, I left the `TempoSync` mode on so that the 'sequencing effect' could take place. The feedback controls for the left and right were maintained at 10% so that the delay could be used in accordance with a full drumbeat, to discourage noise bleed. Within the delay container, the labels: mix, delay time, L and R were added, to correctly display the settings. Alongside default value settings, these parameters helped to enhance the speed in which the effects could be controlled. The component specific property mode for mix was `NormalizedPercentage`, with L and R being set to `TempoSync`. The left and right delay knobs were placed in accordance with their directional position with the L being placed to the left, and the R, on the right. This further simplified the product ergonomics and encourages a smoother user experience.

Following the delay, a saturator FX insert was added to the global modulator container. Saturation can add distortion and warmth to drum sounds (Martinovich, 2022) and can aid the sample instrument's sound design features to achieve more grit and nastier sounds. Within the FX insert, I maintained the wet parameter at 100% whilst allowing the user interface to control the saturation and post gain functions. This meant that the saturation could be blended with the post gain to compensate for increases in volume. This is why it is labelled as 'balance', to instruct the users of its functionality and to increase ease of use. The pre-gain parameter was left out of the interface as there was no need for increases in volume within the saturation feature. The saturation knob was labelled as `knbSatLvl` with a default of 0% and the post-gain knob, called `knbSatBalance` was set to -5db to compensate

for any added saturation. The component specific property modes were NormalizedPercentage for the saturation level and decibel for the balance knob. Aligning this information with the FX insert allows for a more accurate addition of an effect and increases overall useability. Extreme levels of saturation can cause unpleasant distortion which suggests there are elements that have been overlooked. In proper accordance with the balance knob, a level of saturation can be set that is useable and useful.

A plethora of music producers elect to utilise the technique of parallel compression when producing and mixing drum sounds. Parallel compression is a form 'upward compression' where a dry signal, or a drum sample, is mixed with a heavily or over compressed signal to achieve a balance of both signals (Robjohns, 2013). This can be used to add a form of saturation and to create the sense of a thicker sound. Not dissimilar to a saturator sonically, the parallel compression is a welcomed feature within drum sample instruments. A Dynamics insert was added to the global modulator where the gate function was bypassed, and the compressor and limiter were left on. The limiter remained on to ensure that all sampled sounds didn't exceed -5db due to the amount of FX they have been passed through. To achieve the parallel compression, the ratio was set to 32:1 with a fast attack and moderate fast release time. The button labelled Parallel Compression enabled and disabled the compressor within the Dynamic FX insert, and the threshold acted as a blend function for the dry and wet signals, creating new sounds when the threshold is reduced and emulating parallel compression. There were problems with an increase in volume which could be to do with the existing volume of the samples that were mapped at the beginning of the process. Much like saturation, when used subtly and mindfully, the parallel compression feature can add more depth to the samples and creates more interest within drum sample instruments.

Due to some samples lasting slightly longer than others when effected, the tails of the samples can be heard elongating and creating nasty, unpleasant sounds. This can be heard especially when the samples are going through the saturation and parallel compression effects. To combat this, filtering was added to tame the low-end frequencies within the heavily effected samples. A high pass filter or HPF was added to take away sub frequencies with one simple parameter. Frequently, a HPF is added to samples within music production and facilitates the removal of unwanted frequencies, encouraging instruments to work in unison. A Parametric EQ was added as an FX insert on the global modulator. Within a panel labelled pnEQ, a floating tile contained an EQ filter display. Many producers are used to working with a visual EQ, like the FabFilter Pro-Q 3 (FabFilter, 2023), so the decision was made to include a visual aspect to the HPF. A knob labelled knbEQFilter was created and controlled the HPF with its default setting being at 20hz. The filter has a range of 20-20,000hz which limits its functionality as after a certain threshold, some samples will be silent. A wider range of filtering options would allow for more user control and an enhanced interface. In future developments, an understanding of how to include optional EQ parameters would greatly enhance the instrument.

After the addition of one visual element, and implementing symmetry, an AHDSR graphic was added to control the shape of the drum samples. Due to the short length of the samples and the absence of round robins, the AHDSR graphic display plays a more visual role in the sample instrument than a transient design role. The concept was that both the AHDSR and

HPF graphics could be adjacent, to create an aesthetically pleasing design. However, the AHDSR can shape the transients of the samples within the instrument, but quite subtly. The AHDSR Envelope was added within the Sampler and controls the attack, hold, decay, sustain and release of the sample being played. The acronym is spelled out using labels with the respective controls situated above. This allows for the user to identify the functionality of the envelope easily. In theory, the AHDSR allows samples to be shortened or elongated. For example, with the attack set at 0ms, the hold at 17ms, decay at 0ms, sustain at -45db and the release at 0ms, the samples are substantially shorter, with no tail. When used in accordance with the HPF, the drum samples can sound very different, and the user can begin to design their sounds how they please. To create a visually pleasing AHDSR model, the default settings are set to create a fuller graph to occupy the empty space. The graphic was filled with colour to further enhance the graphic design.

The final two features are less common within drum sample instruments but can provide the tools for creative sound design. The phase effect can be heard primarily on guitars in psychedelic rock music (MasterClass, 2021). Chorus, however, provides a slightly different set of parameters, as when used aggressively, can create more pitched, synth like tones. This can provide the toolkit for interesting sound design but in opposition, can be difficult to use and manipulate in a productive way.

Regarding the phase effect, due to its more obscure nature, a decision was made to keep it as simple as possible. The phase FX insert was added within a container in the global modulator container. The settings resulted in a subtle phase with the only control within the user interface being the mix control. Within the insert, the Frequency 1 parameter was set to 150hz and Frequency 2, was set to 500hz. The feedback was at 97% so that when the mix function is engaged, the effect is noticed almost immediately. With a solitary knob labelled `knbPhase`, the default mix quantity is set to 0% with the component specific property mode set to `NormalizedPercentage` to display the user information clearly. Visually, the phase knob is the largest on the user interface which gives it an inviting presence, one that may encourage a user to interact with it. As the phase effect on drums is slightly more obtuse, such encouragement to interact is needed.

Lastly, the chorus effect was added. A containing panel holding a clear on/off switch in the centre, coupled with four labelled knobs, the chorus effects user interface includes all parameters that HISE offer within its FX insert. Due to its range of controls, each parameter, when altered together, can result in largely altered sounds, completely changing samples from their original source. In addition, when used alongside other interface parameters like the phaser and further the AHDSR envelope, the sounds produced could be more so described as sound effects. This gives the instrument another dimension, as it brings it closer to a multi-purpose sound design tool, due to the more abstract sounds that it can produce. With the chorus effect enabled, settings such as feedback at 0%, delay at 0, rate at 54% and the width at 61%, the chorus affects the samples in a way where they become pitched, sounding more like a synthesiser. Experimenting with the chorus settings, it's clear that the sample instrument can produce sounds intended for melody in addition to its original percussive intentions. Like the phase knob, the chorus ON/OFF button is an inviting centre piece to the chorus effect user interface. The 4 knobs follow the same naming pattern of `knbChorus(Controlled element)`. For example, the knob controlling the chorus feedback is called `knbChorusFeedback`. All knobs have defaulted values of 0 which allows for

experimentation with the effect. On reflection, the addition of a chorus effect drastically changes the capabilities of the instrument and could detract from its initial proposed use. However, with a wide range of parameters, the addition of the effect, working in unison with the others, is arguably a good addition to the instrument, adding a new layer of potential sound design to the interface.

Regarding the design of the user interface, several elements were considered, including colour, shape, its interactive nature, and layout. Applying techniques such as colour blocking, groups and sequences of colour were used in accordance with the colour wheel. Opposites of the colour wheel are said to be complimentary (Bailey & Baker, 2014), creating a sense of colour harmony (Mackiewicz, 2009) across the entire product interface. Blue and red were used as consistent colours, coupled with an achromatic approach, where black, white, and grey set the foundation for the colour scheme. Similar colour schemes can be seen with drum machines in existence like the Roland TR-727 (Roland, 2023) and the Akai MPC2000 (Boardway & Laughton, 2021). The use of blue establishes a more futuristic aesthetic due to the unnatural properties of the colour. Colour consistency within graphic design tends to yield some of the best results.

In addition to a consistent colour scheme, the font used was maintained throughout the product to create further unity within the interface design. One instance of this not being the case, is the 'RH' in the bottom right-hand side of the product. The initials are the only identifier of who made the product and, if new products were to be made, the initials within the same font would be maintained.

The layout of the instrument interface follows a symmetrical pattern. Two graphic panels reside at the top of the interface. The highest point of any display or product is the first a consumer observes and therefore it must be eye catching and spark an interest (Bailey & Baker, 2014). A symmetrical layout creates balance with the product, especially when used alongside repetition. A rule of three can be observed (Jane, 2017) where six out of the eight controllable parameters are grouped in threes. The grouping of odd numbers encourages the user to observe the product in its entirety, as opposed to their eye line focussing on the gaps and empty spaces. Groupings of even numbers can result in a less engaging experience and arguably, the two graphic components at the top of the instrument, go against this rule and could lessen its visual effect. Most components are housed within square or rectangular boxes, familiar shapes that form a simple aesthetic. Within HISE, to my knowledge, it is not possible to reshape the AHDSR and HPF graphs, and therefore these features set the standard for the rest of the design. Due to my lack of HISE knowledge, the design element of this sample instrument arguably suffered. After using KnobMan, an online knob design platform where it's possible to obtain new designs for the knobs, I decided that I preferred the stock knobs and the simplicity they brought to the interface. After importing several images into the HISE project, the interface began to look cluttered and incoherent resulting in a completely stock design, with no imported artefacts.

With reference to the interactive nature of the product and its ease of use, I asked 5 non-musician and 5 musician friends what they thought of the design. Consistently, all 5 musicians were able to work out the basic mechanics of the instrument and could use the parameters as I intended. The non-musician friends understood that the knobs and buttons were changing elements to the sounds of the samples, however, could not describe this accurately. Feedback from the beta testing period included the suggested inclusion of more colour, as the original interface didn't have red, followed by further suggestions of the

precise centralisation of the panels to enhance symmetry. I believe the useability of the instrument is moderate, with many interactive features and clear labelling. The keyboard situated on the instrument allows for those without a MIDI keyboard to interact, coupled with graphs to enhance the user experience. The instrument, in my opinion is not competitive within the current marketplace as it's heavily saturated, with countless competitors producing instruments with better and more complex interfaces. For myself, the instrument is very relevant as it houses samples that I use on a regular basis, coupled with the effects and parameters that I often add as auxiliary inserts when producing music.

In conclusion, the definition of an instrument has changed drastically over history, especially with the creation of new technologies, coupled with the accessibility of information. I have interpreted the word instrument in a very modern way and have created an instrument using HISE. I have developed a completely new skillset within digital design, using a new piece of software. The skills I have acquired include a basic understanding of coding, graphic design, and computer-based problem-solving. The instrument that I have designed is functional, aesthetically pleasing and performs similarly to other drum sample instruments already in existence. There is a coherent consistency within its design, colour schemes and layout which, in my opinion, enhances the user experience. It boasts a plethora of malleable parameters that enable creative sound design, coupled with practical uses that aid music production. The strongest features in my opinion are the range of effects on offer and the user interface. However, the samples that are mapped within HISE should follow the round robin method to increase variety and velocity choice, which would create a much more dynamic sample instrument. Due to some gaps in my knowledge within HISE, the round robin method did not supply the results that I intended and was removed. In future builds, an improved knowledge of this sample method would greatly enhance my instrument and yield my desired results. The limitations I faced included choosing the effects. There are very limited options for adding effects which means the designer may not be able to achieve the desired sound. For example, I wanted to add a gated reverb effect, which is sometimes used on snares. To my knowledge, and after research, I couldn't find a way of adding this specific feature in one, easy-to-use container. These limitations can work in the favour of the designer as sometimes too many options can cause incoherence within a product. However, the lack of options within the sound design for this instrument caused frustration and, in the future, I intend to further develop my skillset to work on a solution. Further limitations include the interface design, with very limited options for knobs, buttons, and other graphic elements. Using a different software to graphically design the interface to then import the design into HISE, may be a better solution as the design interface in HISE, in my opinion, is difficult to navigate. I believe with updated graphic design works, coupled with appropriate round robin samples, this instrument could be taken to the next level. In its current form, it lacks some visual and sonic impact and doesn't compete on a commercial level. In the future, I intend to improve on these areas to produce a better quality and competitive drum sample instrument. With features such as a pre-set library and more enhanced EQ control, I believe that this drum sample instrument, coupled with a suitable name, serves as a useful tool within commercial music production.

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