

**A Discussion and Reflection on Applying Blended
Skillsets to Create a Musical Instrument**

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It seems today, more than ever, that the modern music producer is required to have an understanding of a diverse variety of skillsets that allow adaptability at any obstacle. The decision to create a functional, stylised, and commercially viable sampler instrument in the Native Instrument “Kontakt” format was not an easy task to undertake, but a rewarding and challenging task nonetheless. Skillsets that were required for this project included audio production, audio engineering, coding, and graphic design. With Kontakt’s already powerful engine I was able to create an instrument that despite having room for improvement, was effective in what I set out to create both stylistically, and functionally.

A “sample” is described by the Berklee College of Music as “an audio with a length of somewhere between a single cycle of a waveform, and a few measures of music.” (Berklee College of Music, 2017). These can then be used by a sampler instrument such as Kontakt to create a realistic performance of a given instrument.

My choice of instrument to take samples from was a drum kit. Despite this being my first instrument, and an instrument I feel is well within my expertise, creating a sampler instrument that was stylised yet marketable, proved more complex than I initially prepared for. Drum samplers that are currently available on the market include samplers such as Steven Slate Drums by Slate Audio, Modern and Massive Kontakt Library by Getgood Drums, and EZDrummer by Toontrack. These companies and their respective products aim their sample libraries at a specific styles of modern rock and metal offering a wide variety of tones, kits, and textures within these specific genres. With my previous work and studies of lofi hip-hop, I set out to create a Kontakt sampler featuring an acoustic drum kit with a stylistic approach to sound design within the lofi hip-hop genre. I also feel that the development of a sampler instrument was stylistically appropriate due to hip-hop and its various sub-genres using sampling as a core musical idiom, notably with J Dilla’s use of the

MPC-3000 (Vox, 2017). Lofi hip-hop is typically constructed with a instrumental featuring jazz samples and harmony and drums with tonal qualities derivative of producers “J Dilla,” “Nujabes,” and “Madlib,” (Parham, 2021). This also combined with techniques that make the recording sound low fidelity (i.e Lofi). The producer J Dilla was known for his work with the Akai “MPC3000” (Vox, 2017).

“‘Lo-fi’ itself can apply across genres, as the term speaks to how music is recorded. This includes environmental sounds that make it onto the track, like kids playing outside or the rustling of papers.” (Nemo, 2020)

The initial instrument concept was aimed at a gap in the market of drum kit samplers, whilst targeting an already significantly popular genre of music. I decided to name the drum kit sampler “Get Dis Kit” in homage to the Slum Village song “Get Dis Money,” produced by J Dilla, and written by J Dilla, T3 (T. Glover), and RL Altman III.

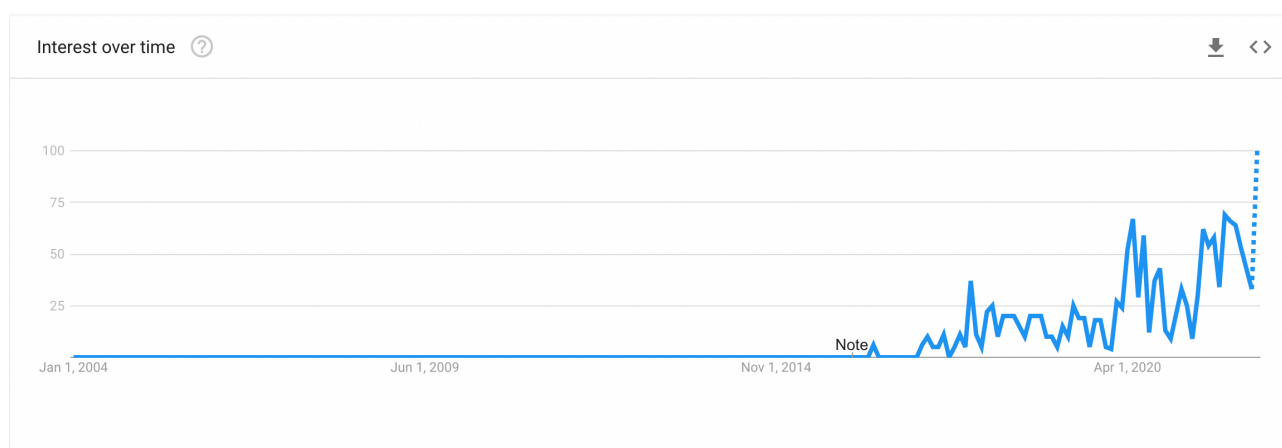


Figure 1. Interest over time in lofi hip-hop, Google Trends (01/01/2016 to 02/04/2022).

Alongside targeting the genre of lofi hip-hop, I aimed the design and functionality of the product at music producers whilst still maintaining a simple user interface (UI) that a less technically proficient user could still achieve a performance and engage with the features of the instrument. As

a music producer, I find that the sound sources I get the most use out of are samplers and sample libraries that include processed, and un-processed sounds. I then planned to implement this concept in the “Get Dis Kit” sampler instrument once the sampling process was completed. Alongside this initial market research and understanding of what features I practically and stylistically wanted to implement, I began researching existing Kontakt libraries from a variety of sources featuring a wide variety of samplers and instruments. The majority of instruments that were researched were sourced from forums such as pianobook.co.uk (2020). By analysing the resources which included samples, visual assets, and source code, I was able to build a general idea of what was achievable given the level of work in the timeframe given. The instruments included in this research was the “Winter Voices” sampler, a choir based instrument, “Windy Welsh Voices”, comprised of a tenor recorder, recorded outdoors, and “LO-FI Milan,” a sampler comprised of violin and cello samples recorded in a busy street in Milan.



Figure 2. User Interface for Winter Voices by pianobook.co.uk

The sampling sessions for the “Get Dis Kit” instrument were fairly straight forward. As discussed earlier, I wanted to aim for a sample library that was both usable in a variety of settings, with the option of further stylisation. The drum kit samples were going to be organised on a standard midi

keyboard as follows: Octave C2-B2 would host the main drum kit samples which would have a limited mix to provide a cleaner tone and as a result more useable sound. Octave C3-B3 would include the same samples but with a more stylised mix with a distinct “lofi” characteristic. This was later implemented into the final instrument. Both sample sets could be further affected by Kontakt’s built in FX parameters by simple “knobs.” The approach to including a “one-knob” effect to the sampler was to ensure a simple way to achieve a more affected sound and was inspired by the designs of “Sausage Fattner” and “Endless Smile” by Dada Life.



Figure 3. User Interfaces for Endless Smile and Sausage Fattner, respectively, by Dada Life, featuring simple “one-knob” parameters.

The drum kit that was sampled for this project was a Tama Silverstar in “bop” sizes, featuring an 18” bass drum tuned low, 12” rack tom tuned high, and a 14” floor tom tuned to a medium range. This was alongside a Ludwig 400 snare drum, and a mix of Zildjian and Istanbul Agop cymbals. The Tama Silverstar was chosen for its tonal qualities as a result of its birch shell and smaller sizes. Generally speaking, birch provides a degree of warmth and clarity of tone, with a degree of dryness and is generally better suited for louder styles of music as a result of its projection. I found that despite the volume, the tone coming from the birch shells suited the wide tuning range needed for the recording session. This tonal character can be observed in the choice of snare drum too. The 14” by 5” chrome-over-brass shell of the Ludwig 400 creates a distinct “snap” that suits the style of

snare drum used in hip-hop. In order to further the “lofi” characteristic of the samples, thin towels were placed over the snare and toms, along with a scarf being placed underneath both the batter, and resonant head of the bass drum. For the final sampling session the cymbals that were used were Zildjian 14” K Session Hi Hats, a 19” Istanbul Agop Traditional Thin Crash, an Istanbul Agop Clap Stack (11”/13”/15” effects cymbals stacked), and a Zildjian 22” Constantinople Medium Ride. These cymbals were chosen due to their complex qualities, without being overly dark and dry.

For the capture of the drums I took a standard approach. The drums were close mic’d, and an ORTF stereo overhead placement for the kit was used. An ORTF placement was chosen due to its ease in setting up and achieving phase alignment, and its enhanced stereo spread over an XY placement. To add character and distinguish this recording from other drum kit recordings, the bass drum and snare drum were sent through a DAV Electronics BG1 preamp, and an SE Electronics Gemini II tube condenser was used as a room mic. These additional sound sources added a genuine analog profile to the samples to further the organic quality of the “lofi” sound I aimed to achieve. The room mic was placed behind the drum kit, elevated to approximately 6 feet and was aimed at an estimated line between the snare and bass drum to ensure phase alignment. Once mixed, the noise floor from the DAV Electronics BG1 and Tube Condenser became a key feature I planned to exploit in the mixing process. The mixing and editing process was completed in Logic Pro X due to my experience in the Logic Pro X platform and its ease of use, especially with the marquee tool in order to cut the audio files directly at the first transient, similar to the work flow of “Tab to Transient” in Pro Tools. The recording process was entirely based on the accurate capture of “Round Robins” at six dynamic layers. A “Round Robin” is a method of creating samples that don’t sound repetitive to the human ear.

“Round-robin is simply a way to let sample developers play back a different sampled version of the same sound each time you hit the same key, so that just like most acoustic instruments each note

sounds slightly different for more realism. This feature becomes particularly important with drum libraries to avoid the 'machine gun' effect of rapidly repeating the same (for instance) snare drum sound.” kvraudio.com (2010)

In testing, before I had established the Round Robins in Kontakt, the samples started to sound inhuman, simple, and quite frankly archaic. It reminded me of some of the earlier sampling that was achieved on basic digital keyboards and programmes heard through the 80s until more recent developments in sampling in the last decade.

“The problem (with one-shot samples) is that we’re playing back the same sample over, and over, and over again” (Hilowitz, 2018)

To create the Round Robins for my instrument, each part of the drum set was planned to be mapped out on the following keys and was recorded in this order:

C2 - Kick, C#2 - Cross stick, D2 - Snare, D#2 - Clap Stack, E2 - T2, F2 - T1, F#2 - HH, G2 - Ride.
G#2 - Stepped HH, A2 - Ride Bell, A#2 - Open HH, B2 - Crash.

Each voice was recorded five times at six dynamic layers from pianissimo, to fortissimo. However, not all instruments were recorded at every dynamic layer. For example, the Clap Stack had little difference in tone from mezzo-forte to fortissimo, so only mezzo-piano and mezzo-forte were implemented into the final sampler instrument. Once recorded, the stems were mixed into to groups. The first being the “raw” kit, and the second being the “lofi” kit which was mapped to the next octave above the “raw” kit. To achieve a “lofi” sound, along with the incorporation of the chosen sound sources, the “lofi” samples were processed though a Strymon Deco Tape Saturation Guitar Pedal to provide analog warmth and high frequency saturation, and the Goodhertz Vulf Compressor to heavily compress and add a low bit rate digital quality. Once both the “raw” and “lofi” samples

had been mixed and edited, over 850 samples were produced and ready to be built into a Kontakt instrument.

Once the samples were mapped and grouped, the round robins began to create an audible repeated pattern of five as it cycled through the groups. This was due to some inconsistencies in the recording process. To counteract this problem, a custom script was sourced in order to create a randomised Round Robin, that didn't repeat the last note that it played. For example, a randomised group could play samples in the following order: 1, 2, 4, 3, 3, 3, 1, 5, 3, 2, 2 etc. Although by definition this is random, it does not solve the problems that Round Robins serve to solve. The script discussed by Hilowitz (2018) creates a randomised Round Robin that does not repeat the last group in its sequence.

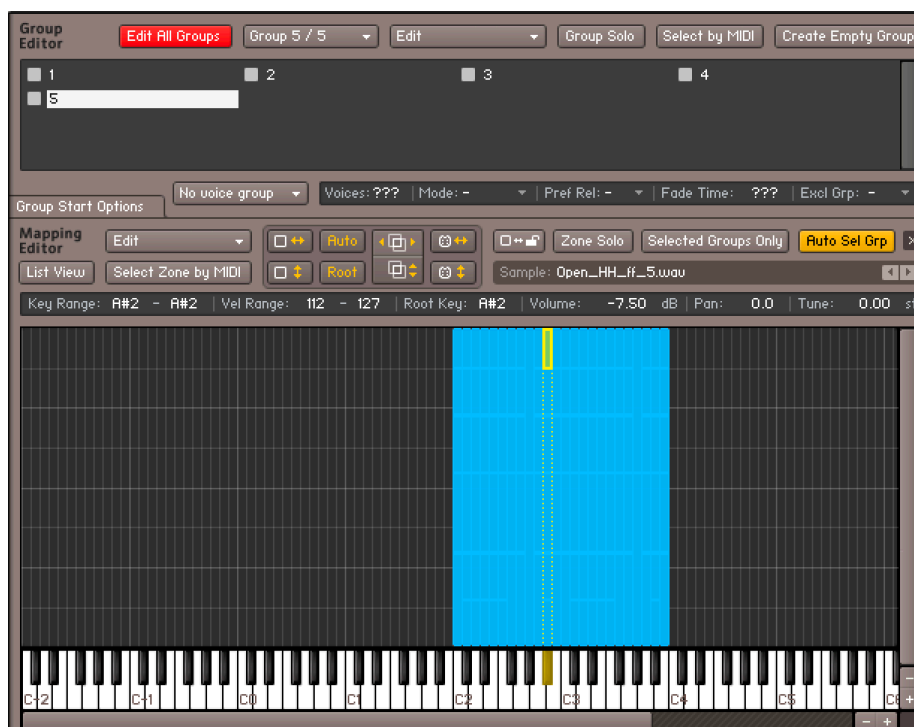


Figure 4. Kontakt's Group Editor and Mapping editor.

“Round robin order usually works fine, but not always. It is sometimes possible to hear that the same sequence of samples are repeated over and over. For example, playing drum samples usually

means playing the same note repeatedly in a way that makes it easier to hear. Kontakt has a group start option called "Cycle random"...This is kind of nice, but it can still result in only two samples playing over and over." (normalsounds.com, 2018)

The line of code featured in the YouTube essay by Hilowitz (2018), sourced from normalsounds.com (2018) solved this issue to great effect:

"This script can be used with any number of round robin samples with minimal changes:

```
on init
  declare %list[7]
  declare $at := num_elements(%list)
  { %list is the order the groups will play, $at is the current position in the list. }
  { for any number of round robin groups other than 7, change the %list size. }

  declare $x
  declare $last

  declare @debug { remove this and the debug section below after testing }
end on

on note
  disallow_group($ALL_GROUPS)

  inc($at)

  { if all groups in the list have been played, fill the list with all groups in random }
  { order, and make sure the last played group is not the first in the new list }
  if($at >= num_elements(%list))

    { remember last played group }
    $last := %list[num_elements(%list) - 1]

    { fill list with all groups in random order }
    %list[0] := 0
    $at := 1
    while($at # num_elements(%list))
      $x := random(0, $at)
      %list[$at] := %list[$x]
      %list[$x] := $at
      inc($at)
    end while
    $at := 0

    { if the last played group is first in the new list, swap first and last in the list }
    if(%list[0] = $last)
      %list[0] := %list[num_elements(%list) - 1]
      %list[num_elements(%list) - 1] := $last
    end if

    { debug: show list }
    $x := 0
    @debug := "list:"
```

```

while($x # num_elements(%list))
  @debug := @debug & " " & %list[$x]
  inc($x)
end while
message(@debug)
{ debug end }

end if

{ enable a group from the list }
allow_group(%list[$at])
end on" normalsounds.com (2018)

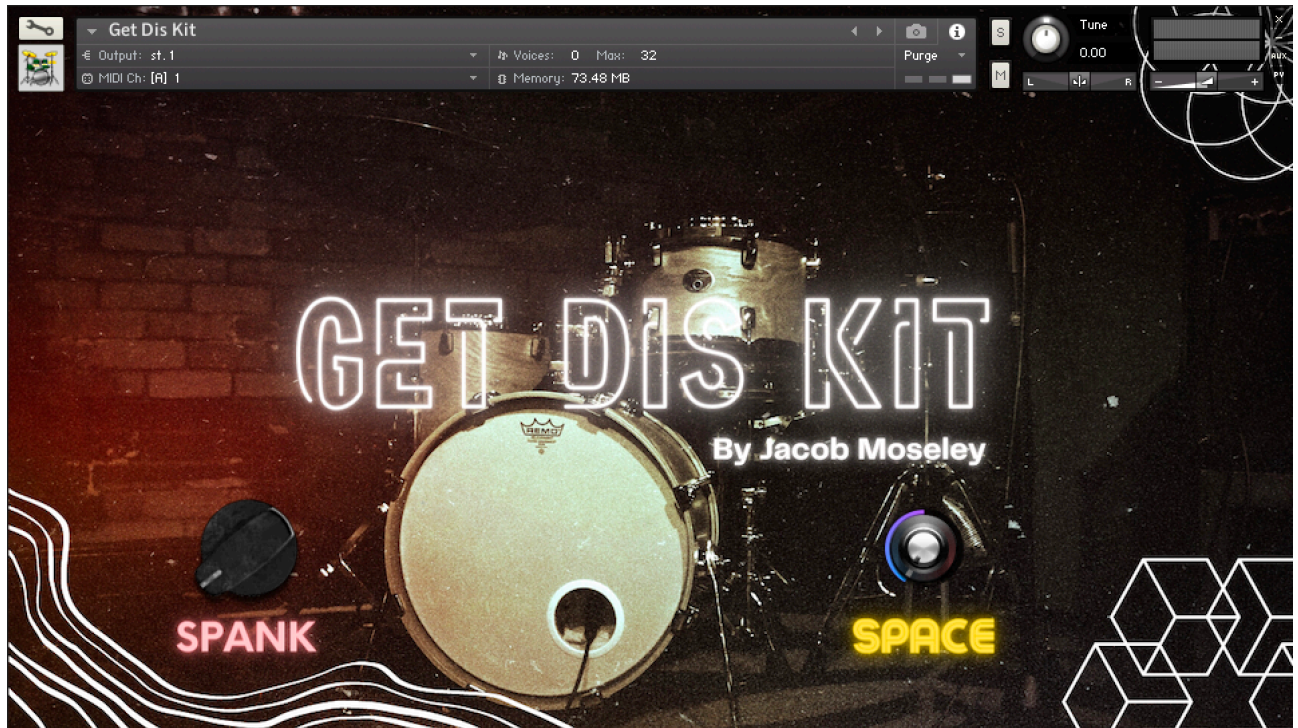
```

The next task was to resolve issues with the performance with the hi hats. Most drum samplers including the aforementioned Slate Drums operate in such a way that the open hi hat voicing will close once a closed hi hat, or a stepped hi hat is played. This is in order to create a more realistic performance as a real drum kit would operate. This is due to the hi hat being a single instrument and is either in a state of being open or closed. In order to achieve this, new groups had to be established for each of the hi hat voicings. These new groups then had to be routed to “exclusive groups” within Kontakt’s “voice groups” folder. The voice groups folder allows certain behaviours to be attributed to other groups. In this case, it would allow the open hi hat to be shut off once a closed hi hat or stepped hi hat is performed (Hilowitz, 2020). Once assigned, Kontakt carries the action out and the issue would be resolved. However, this only works with traditional Round Robins not with the randomised “no repeat” Round Robins that I previously established with customised code. In the future, I will aim to get a level and consistent recording for the Round Robins, so that the hi hats can operate as they normally would. The “Get Dis Kit” instrument in its current form allows the triggering of samples but has a limited capability as an instrument for performance. To control the sustain of the open hi hat, Kontakt’s built in ADSR envelope was assigned to all samples. This control of the sustain allows a recreation of the effect of a hit hat being closed without having to change the source code controlling the randomised “no repeat” Round Robins.

Once a functioning instrument was established, a custom user interface (UI) was constructed with visual assets created using a combination of Adobe Photoshop for layered filters, and Canva for text

graphics and other visual overlays. To add to the artistic value of the visual assets, an image of the drum kit that is sampled can be seen as the main feature of the instrument wallpaper. Additionally, source code was applied to set the dimensions of the UI.

Figure 5. The final visual assets implemented into the latest iteration of “Get Dis Kit.”



The image that is set as the instrument wallpaper was implemented via the “Instrument Options.”

This task can be operated on by using source code where finer details can be implemented, but I feel that once the dimensions of the original image were appropriate I was able to get a look that was effective to the brief I set myself when I set out construction the “Get Dis Kit” instrument.

The other visual assets that were created and needed implementing into the final product were the knobs for the saturation parameter and the “space” parameter controlling a convolution reverb that functions more as a modular like delay. In order to create the knob graphics that functioned properly, that being if a user clicks and drags on the knob it will rotate in a smooth manner, a series of knobs in different positions had to be created in sequence as a .png file.



Figure 6. A small section of the png file containing the visual assets for the saturation knob sourced from Webknobman.

A series of custom codes were compiled based on the work of Hilowitz (2019), and the KSP reference manual for Kontakt 6. In his YouTube video essay on constructing custom interactive “knob” graphics, Hilowitz (2019) uses source code to initially create a basic slider with no parameter controls on it. The following code sets out the creation of

performance view to host a wallpaper and a slider, as well as to set the scale for the slider between zero, and one million. The parameter declaring “make_persistent” instructs the slider to hold its value once its set by the user:

```
make_perfview
set_ui_height_px(472)
set_ui_width_px(960)

declare ui_slider $reverb (0, 1000000)
make_persistent ($reverb)
```

The following lines of code dictate that the reverb “slider” is to search for a pre-determined image, set its position on the X and Y axis, and set the speed of the sliders movement.

```
declare $reverbId
$reverbId := get_ui_id($reverb)
set_control_par_str($reverbId, $CONTROL_PAR_PICTURE, "verb_knob")

set_control_par($reverbId, $CONTROL_PAR_POS_X, 652)
set_control_par($reverbId, $CONTROL_PAR_POS_Y, 305)
set_control_par($reverbId, $CONTROL_PAR_MOUSE_BEHAVIOUR, -500)
```

The following lines of code also dictate that the saturation “slider” is to search for a pre-determined image, set its position on the X and Y axis, and set the speed of the sliders movement.

```
declare ui_slider $saturation (0, 1000000)
make_persistent ($saturation)

declare $saturationId
$saturationId := get_ui_id($saturation)
set_control_par_str($saturationId, $CONTROL_PAR_PICTURE, "sat_knob")

set_control_par($saturationId, $CONTROL_PAR_POS_X, 132)
```

```
set_control_par($saturationId, $CONTROL_PAR_POS_Y, 290)
set_control_par($saturationId, $CONTROL_PAR_MOUSE_BEHAVIOUR, -500)
```

Finally, these following lines of code dictate to Kontakt that its to set the controls the above lines of code establish to Kontakt's built in FX. In this case, the convolution reverb determined by

“\$ENGINE_PAR_SENLEVEL_0, \$reverb, -1, 7, 0,” and the “SuperGT” saturation parameter's mix level, which is determined by \$ENGINE_PAR_SUPERGT_MIX, \$saturation, -1, 0, 0)

end on

```
on ui_control($reverb)
    set_engine_par($ENGINE_PAR_SENLEVEL_0, $reverb, -1, 7, 0)
```

end on

```
on ui_control($saturation)
    set_engine_par($ENGINE_PAR_SUPERGT_MIX, $saturation, -1, 0, 0)
```

end on

Once these parameters were added, the instrument truly began to operate in the way I had envisaged when I first started planning. Not only did the randomised Round Robins make the instrument feel immersive and dynamic, but the added saturation and reverb parameters created a simple and effective way to manipulate the already diverse and unique selection of samples.

I do however, feel there is room for improvement for the “Get Dis Kit” sample instrument. Initial user feedback from producers and musicians yielded similar perceptions and comments. Kontakt 6, despite its powerful engine and detailed approach to instrument making, proved difficult for Kontakt users who did not possess Kontakt 6, but owned previous versions of Kontakt. The users who underwent alpha and beta testing typically used Kontakt 4 and 5, with some possessing Kontakt 6 by later upgrading at a reasonable cost. By owning Kontakt 6, a user can utilise instruments created on previous versions, but users who own older generations of Kontakt are limited by the generation in which the Kontakt instrument they open was created on (Magnus, 2019). This limiting nature of Kontakt would prompt me to use a software such as HISE in the future. HISE allows the creation of samplers, synthesisers, and plugins at no cost due to the platform being open source.

This would allow the creation of a file that would allow users to install a dedicated plugin as

opposed to acquiring Kontakt first and then sourcing third party samplers via Kontakt. Some users stated that the room sound on the samples was in certain instances overbearing on a mix. This lines up with my own results from testing the sampler after creation. The sampler perhaps suits the creation of a percussive loop to be included with more “up-front” samples to create sense of air in a mix, but does need reinforcement from drier sounding samples. This effect that the room sound brings is exacerbated once the saturation parameter is engaged. I plan to include a knob with the next iteration of this sampler instrument that will control the amount of dry/wet from the room sound.

Despite the challenges faced with creating “Get Dis Kit” the process was enjoyable and encouraging for me to explore coding and design deeper, especially within the music space. I believe that further market research is needed to get a better idea of what can be achieved with my instrument, as well as further development on concepts I have already implemented. Being able to carry my drums around on a hard drive is a great added bonus.

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