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Prototype "Kendang Jaipong" Virtual Instrument as Music Creativity Tools

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Abstract: Numerous organological discoveries in the form of virtual instruments have surfaced as a result of the impact of developing digital music technology. To conserve and promote music based on local culture, organological innovations in the form of virtual instruments, such as the *kendang jaipong*, must be implemented. The goal of this work is to describe the development of the *kendang jaipong* virtual instrument from organological investigations through the realization of a marketable prototype. By sampling from the *Kendang Jaipong*'s actual instrument and converting it into a virtual instrument based on the KONTAKT Library, the technique utilized is practice-led research, also known as practice-based research. Pre-production, production, and post-production are the three stages of the design process. This prototype makes use of 137 samples that are based on a variety of chosen kendang sounds. To enable each type of kendang sound to function as a virtual instrument in DAW and Digital Music Notation programs, the audio samples are organized in a placement system on the keyboard keys included in the KONTAKT feature. The *Kendang Jaipong* prototype has been successfully tested on several music productions using DAW-cast and video score. The usage of the multi-round robin's function to have a more diversified sample, as well as the addition of the midi files capability, are things that need to be developed on this prototype product so that it may be used as a machine learning by users.

Keywords: *kendang jaipong*, virtual instrument, prototype

1. INTRODUCTION

The evolution of music in society as a whole includes several attempts to produce new or modify existing musical instruments. As a result of the impact of the advancement of digital music technology, numerous organological breakthroughs in the form of virtual instruments have emerged. According to Tzevelekos et al. (2008:352), musical instruments are analogous to species and the natural environment in that they follow changing cultural settings and carry remnants of their "genetic past." In trying to keep up with a changing world, musical instruments can develop or go extinct. He underlined that the development of the "modern" world was greatly influenced by technology. Computers have such a profound impact on daily life that culture could not survive them. Musical instruments experienced that effect once more. Hyper-instruments and virtual musical instruments are two terms that proudly signal a new stage in the development of the orchestra.

Back in time, the evolution of virtual musical instruments cannot be isolated from the evolution of musical aesthetics, which was inspired by composers' ideas to experiment with new sounds to attain their creative goals. This has led to discoveries that follow organological findings, particularly the discovery or development of electronic musical instruments. An electronic device called an



oscillator, which could generate sounds with a specific height, was created in 1915 by American Lee De Forest. Theremin was a device created by Russian inventor Leon Termen in 1919. The ability to regulate electronic sounds makes it theoretically conceivable to create modern electronic musical instruments. Ondes Martenot, an electronic musical instrument created by Maurice Marteniot of France, and the Trautonium, a device created by Friederich Trautwein of Germany, both appeared in 1928. The first electronic organ, known as the Hammond Organ, was developed by American inventor Lorens Hammond in 1929. Many were shocked when Joerg Mager of Germany created an electronic bell for the Parsifal production at the Wagner opera festival in Bayreuth in 1931 (Hardjana, 2003:198).

In addition to the invention or construction of electronic musical instruments, there have been several acoustic musical instrument advances. According to Mack (2004:138), numerous composers' original ideas need the development of new musical instruments. Harry Partch, a composer from the United States, created a piece of music based on a unique tuning method that divides an octave into 43 notes using only intonation. Partch develops his instruments to realize his music with an outstanding ensemble because no musical instrument can realize the tuning formula. Another American composer, Conlon Nancarrow, had a musical idea with extremely intricate rhythmic-metric relationships that made it extremely difficult for humans to play. As a result, Nancarrow created the "Player Piano" or "Pianola," a piano with a mechanism shaped like a roller with perforated paper. These holes are made by a mechanism: when a pianist performs piano music, each stroke of a piano key creates a hole in the paper that rotates on the roller. This principle is then applied to the piano roll feature of DAW (Digital Audio Workstation) software, which is always available.

Aside from producing new musical instruments, organological innovation ideas include changing the sound of existing musical instruments. John Cage, an American composer, once altered the piano by covering the strings with various materials. Eventually, the piano's tone transformed, as if it were a new musical instrument. "Prepared Piano" is the name given to this updated concept (Perry, 2005). This was also done by the Dutch composer Sinta Wulur, who wrote the piece by converting a Javanese gamelan into 12 tones and naming it "Gamelan Multifoon" (Ramaer, 2004). All of the above musical instrument modification attempts are motivated not just by a desire to discover new sounds but also by a desire to generate creative ideas.

There are still many inventions or the creation of new musical instruments based on electrical and acoustic sounds as a process of developing and expanding musical instruments in cultural civilization. However, several of the above-mentioned musical instrument developments are still physically available. Virtual musical instrument goods focused on the improvement of artificial

intelligence and machine learning have emerged as a result of recent technological advancements. The Steinberg company developed and publicized this technology in 1996 as Virtual Sound Technology or VST. In the article under the heading "Our Technologies" on the company's website, among other things, Steinberg stated that VST enables the integration of virtual effect processors and instruments into the digital audio environment. In a VST system, these can be new creative effect components or software recreations of hardware effect units and instruments. All of these are smoothly incorporated into the host program. There is no need for unsightly audio or MIDI cabling because these connections are virtual. A VST effect processor or instrument can be readily integrated with external hardware and has direct control over all of its capabilities.

According to the perspective presented above, Steinberg's technical advancements are intended to increase the effectiveness and efficiency of music production on digital systems. This is since before the invention of MIDI technology, it was feasible to openly transfer data and audio signals from different gear, but only using a convoluted cable connection scheme. Musicians can become frustrated by technical issues if they discover damaged or subpar cables being used. The gadgets' ability to communicate is hampered as a result. These issues can be promptly and successfully solved with VST technology. Then, numerous parties supported VST technology. Additionally, different virtual instrument items from other businesses that made use of this technology came to be. The development of hardware-based virtual instruments in the form of audio effects and musical instruments is the sole focus of several businesses among the many virtual instrument products now on the market. Different words have been developed to distinguish between these two things. VST Audio Plugins are used for virtual instruments that take the form of audio effects, whereas VSTi Plugins are used for virtual instruments that take the form of musical instruments.

There are significant differences between the numerous VSTi plugin solutions currently on the market in terms of the audio signal sources used and how these sources are processed in the features created. Synthesized instruments are virtual instruments that use synthetic sounds, whereas sampled instruments are virtual instruments that use the sound of a genuine musical instrument. This second virtual instrument was created through a difficult procedure that involved meticulously recording each sound made by the artists themselves to produce an actual sound of the highest musical quality. The results of the recording are then created in a sampler-based program so that they can be played later through digital instrument devices. Sample libraries will be used in the remainder of this text to refer to this product (Schule, 2019).

The company "Native Instruments" is the most well-known for creating sample libraries and also offers its software in the form of an open sampler called KONTAKT (native-instruments.com, n.d.,

accessed on [August 14, 2022](#)). A musician can create an original instrument as part of the music creation process using KONTAKT, which utilizes VSTi technology. Because of this, numerous additional sample library development businesses, including Impact Soundworks, Output, Sonuscore, Vir2, Heavyocity, Strezov Sampling, and others, are currently using KONTAKT as an intermediary application (Joshi, 2022).

Various musician communities are providing a venue for discussing and conversing about virtual instrument items that can be accessed or downloaded free of charge, in addition to the virtual instrument products being offered commercially by developer companies. The Samplist community, sometimes known as the sound designer community, accomplishes this (pianobook.co.uk, n.d., viewed on [August 15, 2022](#)). The current state of affairs indicates that Pianobook is a group of musicians united by a passion for music creation. The site went live in 2018 thanks to Christian Henson, a co-founder of Spitfire Audio. Since then, it has grown to include more than 1000 free virtual instruments, providing a wide range of imaginative sounds.

Among existing sample library products, particularly those of a commercial kind, the design orientation is more toward developing sound quality for media music compositions (non-performing music). What sticks out the 16nstrum the sample library design, which offers cinematic sound qualities for film scoring production needs (Indrayuana, 2013; Setyowati et al., 2022). As a result, the impact of this technology on the film production process is enormous, particularly in terms of efficiency and effectiveness in time and cost management.

The intricacy of the KONTAKT sampler enables sound designers to create an unlimited number of virtual instruments, including designs for ethnic musical instruments from around the world, as Marcel Barsotti has done in his Ethno World 6 offering (Bodin, 2017). Bodin stated in his assessment that Ethno World 6 Complete includes a large and diversified variety of superb-sounding ethnic voices and instruments. Despite the lack of genuine legato and a few quirks, the combination of playable multi-sampled instruments with loops and patches for each makes this library simple to use and a complete toolkit for bringing world music to life.

Because No. has a very diversified musical tradition, there are many different sorts of ethnic musical instruments. In No., *gamelan* musical instruments can be found not only on the islands of No. and Bali but also on Sumatra, No., Sulawesi, and NTT (Siagian, 2006). Stringed musical instruments, both bowed and plucked, can also be found across the archipelago (Harahap, 2004).

To preserve and expand the archipelago's (Nusantara) culture, 16nstr vital to support re-production activities in the form of physical and virtual alterations to musical instruments. Meanwhile, sound designers have yet to pay close attention to Indonesian musical instruments for them to be commodified as virtual

instruments. Sani et al.'s research on the development of the Panting musical instrument through the VST form is one of the attempts that have been made to 17nstrumen happen (Sani & Ramadhani, 2020). This study created a prototype of the Panting virtual instrument, a South No. musical instrument. This virtual 17nstrumen tis 17nstrume sampling, which means that it uses sound sources from real musical instruments.

17nstr critical to conduct ethnomusicological research while converting ethnic musical instruments into virtual forms. This is because many parts of the concept of playing ethnic musical instruments still lack a quantitative understanding of all parametric musical features. Traditional Sundanese *kendang*, for example, features a variety of sound articulations, rhythmic sentences, and tapping patterns, as recognized by Sundanese musicians. However, how many sound articulations, rhythmic sentences, and smack patterns exist and how they are used remains unknown.

Suparli (2010:54) highlights that there are several pitch settings in Sundanese *kendang* depending on the kind of music being played. A *kendang* set comprises one large *kendang* that produces the sounds of *kumpyang/kemprang* and *gedug* as well as two *kulanter* (small *kendang*) that produce the sounds *kutiplak/keplak* and *ketipung/kentrung*. Pitch can be altered on *kemprang*, *keplak*, and *kentrung* depending on the aesthetics of the music being performed. The height setting for the *kendang*, when utilized for polished aesthetics, will be considerably different from the *jaipong* aesthetic. Similarly, it has variable pitch settings when utilized in the arts of *ketuk tilu*, *pencak silat*, *wayang* dancing, and so on. The formula is shown in table 1 below.

Table 1. Kendang articulations formula (Suparli, 2010:61)

Kendang Face	Sounds
Keplak	Peung Plak Pak
Kemprang	Phang Phak Ping Pong
Gedung	Dong Def Deded Ting
Kentrung	Tung

Meanwhile, Saepudin (2015) says that the *kendang Jaipong* recording industry's influence has had a considerable impact on the development of the diversity of *tepak*. In reality, he has attempted to discover a range of strokes and patterns that have a specific structure based on what Suwanda (*kendang* player) performs, which is spontaneous. This premise served as the foundation for the subsequent *Kendang Jaipong* plays. One of the

identifications is linked to the different types of *tepak kendang jaipong*, as according to Saepudin (2015: 11),

Each *goongan* is made 18nstr numerous steps, including *tepak bukaan*, *tepak pangjadi*, *tepak mincid*, and *tepak ngeureunkeun*. Each group contains a different set of patterns. *Tepak bukaan* is made 18nstr several *percugan*, *seredan*, *cindek*, and *ngagoongkeun*. There are *mincid kendor* variations, *mincid gancang* variations, and transitional *mincid* variations, or *tepak ngala* variations, in *tepak mincid*.

There is No. precise formulation that can describe parametrically how to exhibit the sound color articulately, so it becomes a guide or instruction for ordinary people who wish to know how to play this musical instrument among the numerous forms of *tepak* stated above. Despite the creation of *kendang* symbols and notations (Suparli, 2010:61), their application and use have not had a significant impact in practice.

When we look closely at the audio sampling data used for the Javanese drums for Ethno World 6 items, we can see a wide range of sound characteristics, as illustrated in figure 1.

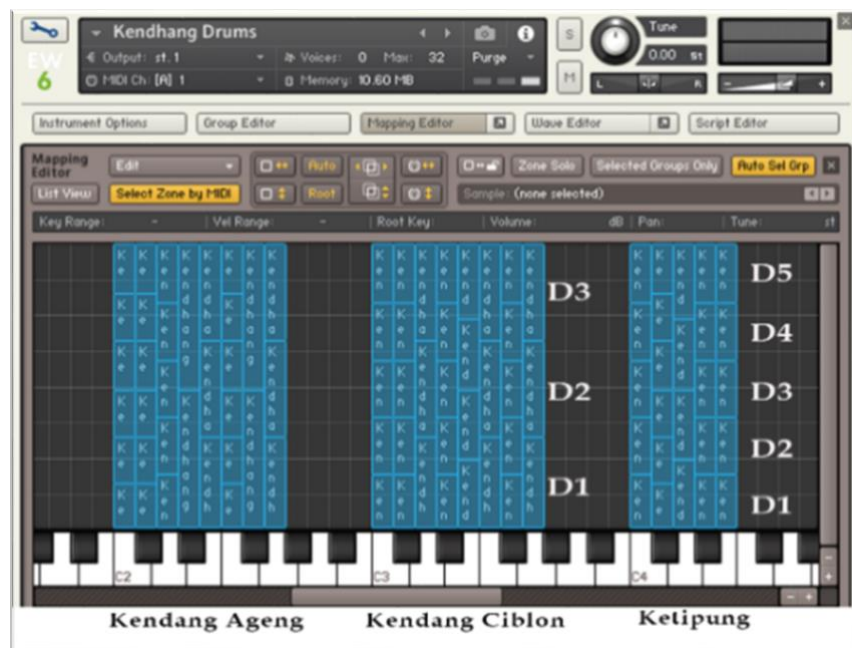


Figure 1. *Kendang* Jawa audio samples Ethno World 6 product data organization on KONTAKT (screenshot by the author, August 2022)

Visually, we can see that the virtual 18nstrumen tis divided into three sections, with *Kendang Ageng* audio samples placed on C2-G2 keys, *Kendang Ciblon* audio samples placed on C3-G3 keys, and *Ketipung* audio samples placed on C3-G3 keys. C4-E4. There are many dynamic layers emanating from each element of the instrument. There are five layers of dynamics in the *Ketipung* audio samples placed on the E4 key; however, only three dynamic layers are used in the *Kendang Ciblon* audio samples placed on the G3 key. Even the *Kendang Ageng* on C2 has six dynamic levels. According to auditory analysis, each sound dynamic on the

kendang has a particular sound color in addition to variances in loudness and softness.

Based on the virtual instrument concept, the author has an idea: what if the *kendang jaipong* is created as a virtual instrument in the form of a KONTAKT library, similar to the Ethno World 6 offers above? Considering that the color of the sound, articulation, and height of the sound of the jaipong drums are truly more varied parametrically, the qualities of the *kendang jaipong* are more adaptable because they are now used not only in the context of Sundanese music but also across musical genres and crossovers (Shafazhinskaya et al., 2019) and even across cultures (Harnish & Wallach, 2013). Thus, this virtual instrument prototype is expected to be used not only as a creative medium in the context of Sundanese music but also as an offer to music creators, in general, to develop *kendang jaipong* as a local musical instrument that will later become a global musical instrument known worldwide.

2. METHODS

A suitable method is required to design a prototype of the *kendang jaipong* virtual instrument. Practice-led research is the method employed. According to Hendriyana (2021:10), this method is also known as the way of designing or creating works as part of the pre-factum creative research method. According to Borgdorff (2016), creative research attempts to express and communicate content that is encased in aesthetic experience carried out in practical creativity, and embodied in artistic output.

When the research activity was carried out, the main object of the work or product under study did not exist. As a result, the components and aspects of the research must be designed in line with the objectives and benefits of the intended research, namely the construction of a virtual *kendang jaipong* prototype as a tool for digital music production, when carrying out this research activity.

The steps involved in constructing the *kendang jaipong* virtual instrument prototype are divided into three stages: pre-production, production, and post-production. This method is carried out through practical activities based on the study of *kendang jaipong* in Sundanese music and an ethnomusicological approach. The process flow can be conceptually illustrated as indicated in [charts 1, 2, and 3](#).

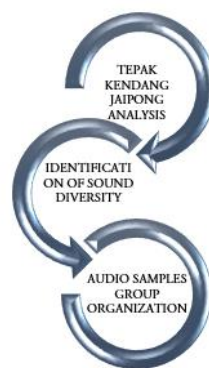


Chart 1. Pre-production flow

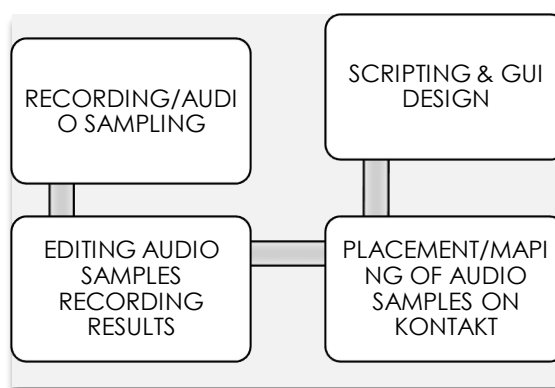


Chart 2. Production flow



Chart 3. Post-Production flow

3. RESULTS AND DISCUSSION

As for the method utilized, the author will outline the process of building a *kendang Jaipong* prototype based on the practice as a *kendang* player and practice as a sound designer. The stages of designing this prototype will be outlined as follows:

3.1 Pre-Production

Based on observations and experience with virtual instruments in the form of the KONTAKT Library, it is clear that realistic-sounding virtual instrument products usually use audio samples with specific and varied sound characteristics. Before beginning the production process, it is required to notice the various varieties of *kendang jaipong* by evaluating numerous *jaipong*

music recordings. The samples of *Kendang Jaipong* recordings utilized were chosen at random based on their intricacy. According to Saepudin (2015), the results of the examination of the variety of *tepak kendang* may be more easily categorized into two groups, namely the variety of *tepak pencugan* and the variety of *tepak mincid*. Various elements of the two groups of *kendang* styles were identified based on the sound color, pitch, and articulation of all the instruments in the *kendang jaipong* set. One set of *kendang jaipong* contains a big *kendang* with *kemprang* and *gedug* sounds, as well as two *kulanter*s (little *kendang*) called *keplak* and *kentrung* (Suparli, 2010). However, the *kulanter kentrung* should be added as an enrichment because it sometimes takes extra *kentrung* to play the *kendang jaipong* in practice. The result of pre-production is a range of audio samples that must be recorded. This concept will serve as fundamental guidance for the *kendang* player in terms of what sounds should be played during the recording process. Please see [table 2](#) (sound of *keplak*), [table 3](#) (sound of *kentrung*), [table 4](#) (sound of *kemprang*), and [table 5](#) (sound of *gedug*) to grasp the notion of the various audio samples.

Keplak Sounds

Table 2. The concept of audio samples (*keplak* sounds)

Articulation	Dynamic Velocity layers	Information
<i>Peung</i>	8 ppp-ff	Played in eight dynamic levels every two seconds
<i>Pak</i>	5 pp-f	Played in five dynamic levels every two seconds
<i>Plak</i>	3 mf-ff	Played in three levels of dynamics every two seconds

Kentrung Sounds

Table 3. The concept of audio samples (*kentrung* sounds)

Articulation	Dynamic Velocity layers	Information
<i>Tung</i>	8 ppp-ff	Played in eight dynamic levels every two seconds

Kemprang Sounds

Table 4. The concept of audio samples (*kemprang* sounds)

Artikulasi	Dynamic Velocity layers	Keterangan
<i>Phang</i>	4 mp-f	Played in four levels of dynamics every two seconds
<i>Phak</i>	3 mf-ff	Played in three levels of dynamics every two seconds
<i>Ping</i>	4 pp-f	Played in four levels of dynamics every two seconds
<i>Pong</i>	4 pp-f	Played in four levels of dynamics every two seconds

Gedug Sounds

Table 5. The concept of audio samples (*gedug* sounds)

Articulation	Dynamic Velocity layers	Information
<i>Dong</i>	8 ppp-ff	Played in eight dynamic levels every two seconds
<i>Det</i> 1 (low-tone muted)	3 p-mf	Played in three levels of dynamics every two seconds
<i>Det</i> 2 (mid-low-tone muted)	3 p-mf	Played in three levels of dynamics every two seconds
<i>Det</i> 3 (mid-tone muted)	3 p-mf	Played in three levels of dynamics every two seconds
<i>Det</i> 4 (high-tone muted)	3 p-mf	Played in three levels of dynamics every two seconds
<i>Det</i> gliss 1 (low-tone muted)	3 p-mf	Played in three levels of dynamics every two seconds
<i>Det</i> gliss 2 (mid-low-tone muted)	3 p-mf	Played in three levels of dynamics every two seconds
<i>Det</i> gliss 3 (mid-tone muted)	3 p-mf	Played in three levels of dynamics every two seconds
<i>Det</i> gliss 4 (mid-tone muted)	3 p-mf	Played in three levels of dynamics every two seconds
<i>Ting</i> (<i>sentug</i>)	4 pp-f	Played in four levels of dynamics every two seconds
<i>Deded</i> (3 variations based on differences in length, duration, and speed)	1 mf	Played in one level of dynamics every two seconds

3.2 Production

The realization of concepts established during the pre-production phase is a series of operations in the manufacturing process. The first step is to set up a digital recording facility for the sampling process that has spatial characteristics with minimal reflection and reverberation, sometimes known as "dry." Only one microphone, a "Sennheiser type e865", is used to provide the features of an intimate or close setting. Furthermore, as the concept is in pre-production, the author, who is a *kendang* player, performs sound by sound. The recording process starts with *keplak* and ends with *gedug*. To make things easier, each sound group is recorded on a separate track for each sound variation group. During the procedure, four recording sessions were carried out, notably for the tracks *keplak*, *kentrung*, *kemprang*, and *gedug*. Everything will be organized into four tracks. Throughout the recording process, the author attempts to convey himself by interpreting the numerous audio samples that have been generated.

As a result, when playing any variation of *kendang* sounds, there are various faults or times of dissatisfaction. The recording technique, however, continues until all of the various noises played on each track are satisfied. The recording process produces a

variety of results, including sound quality and musical quality. Because there is freedom of interpretation in the process, the number of strokes recorded on each track exceeds the previously stated concept. However, the audio sample results could be useful. Each sound is then chopped and exported one by one into a wav file in the following stage. As a result of the four-track recording, hundreds of WAV files were created. Because the KONTAKT system requires identification of the file name while loading samples, each file must be given a unique name.

Before the audio export procedure, each audio sample's sound quality, attack, and release location are edited. According to the analysis of Javanese *kendang* instrument data on Ethno World 6 (Bodin, 2017), there are critical settings in the ADSR parameters (attack, decay, sustain, and release) in virtual instrument designs. As a result, the attack position must be at the start of the waveform, whereas the release position must be toward the end. Figure 2 shows it in further detail.



Figure 2. Attack and release positions on the Javanese *Kendang* Ethno World 6 product (screenshot by the author, August 2022)

To make later mapping and placement of audio samples in KONTAKT easier, the audio data cut must be right at the start of the sound, while the reflected sound is extended and ends with a fade-out. The attack parameter is useful for improving the precision of sound response when playing, while the release function is utilized to release audio samples when playing. Even if the audio samples are organized with short tones, the data will be played as a whole. This approach is applied to all audio samples before export.

The procedure of picking audio samples through direct trials by mapping or placement at KONTAKT is the next phase. Each sound is assigned to specific keys using the newly developed dynamic layer velocity approach. Then try playing it using the keyboard controller so that the dynamic touch seems natural. This process is repeated for each audio sample until a selection is made to determine the best samples.

Based on the findings of the previous investigation, the number of audio samples used was 139 with basic groups, as shown in table 6 below.

appear during the work process are both arranged depending on the scripting that has been created. First and foremost, a background and icon for this virtual instrument must be created. A wallpaper with dimensions of 639 x 418 pixels was created using a graphic application. The icon's measurements are 34 by 33 pixels. Please see [figure 4](#) for more information.

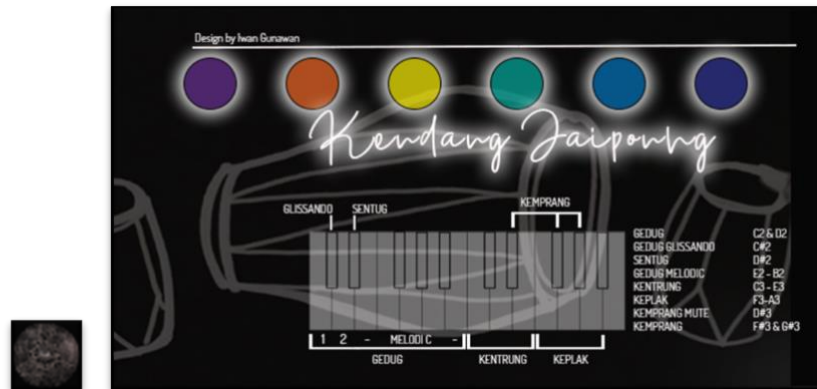


Figure 4. *Kandang Jaipong's* virtual instrument icon and wallpaper design (Image created by the author, June 2022)

The icon and wallpaper picture settings will depend on scripting commands. Similarly, when configuring other audio parameters, use simple audio parameters such as a three-band equalization, pan, volume, and tune. According to Suparli (2010:55–61), the tuning parameter refers to the variety of *kendang* tunings. As a result, it can be more versatile in detecting high and low sounds when used. [Figure 5](#) is an example of how the scripting layout looks.

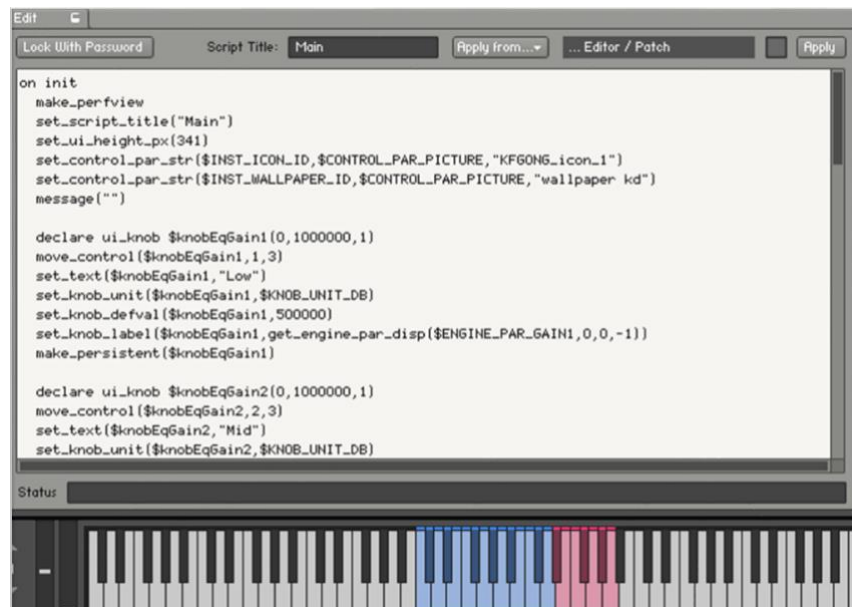


Figure 5. *Kandang Jaipong's* virtual instrument scripting (screenshot by the author, August 2022)

The display of this *jaipong* drum virtual instrument prototype is the result of the scripting and GUI design, as seen in [figure 6](#) below.



Figure 6. Display of the *Kendang Jaipong* virtual instrument prototype (screenshot by the author, August 2022)

Three crucial factors must be explained in the final display, as shown in the image above 1) Audio settings in the form of a knob All existing audio settings are based on the sample that has been picked. This means that none of these characteristics influence all samples; only the properties of the selected audio samples can be altered. For instance, if you want to increase the pitch of the *keplak* sound, first select the *keplak* sample from the sample's menu. As a result, the one that affects the tone will only rise, while the others will have no effect. The same is true of other audio parameters. 2) Data on the various slap sounds at important points. It will serve as a clear guide for the user to identify the positioning of the various drum sounds on each key. 3) The different colors on the keyboard keys indicate that the blue keys are the area of the variety of sounds played by the left hand, while the red color is for the right hand (or vice versa for left-handed *kendang* players) so that hand coordination matches the reality when playing through the keyboard controller, especially for *kendang* players.

3.3 Post-Production

The actions carried out in the post-production phase include testing this prototype in a digital music project. The first project involves creating jaipong music using the traditional song "Kastawa" and the opening sekar "Sruping Argo" on the DAW (Digital Audio Workstation) application. This song's repertoire has a complicated duration processing concept, ranging from the employment of rubato (*sekar irama merdika*) through fluctuating tempo shifts. However, the trial results of the DAW project show that the musical

quality of the *Kendang Jaipong* virtual instrument can be achieved, even though playing directly through the keyboard controller is difficult due to the different organological structures (especially the variety of complex strokes). However, simple steps can still be taken. However, unless he is a musician who can play *kendang* as well as the keyboard or piano, playing *kendang* in the shape of a keyboard is a bit tricky. As a result, compiling mid-data is more effective when done manually, utilizing the piano roll feature. It can be used as an example of the visual representation of midi piano roll data at this experimental level.

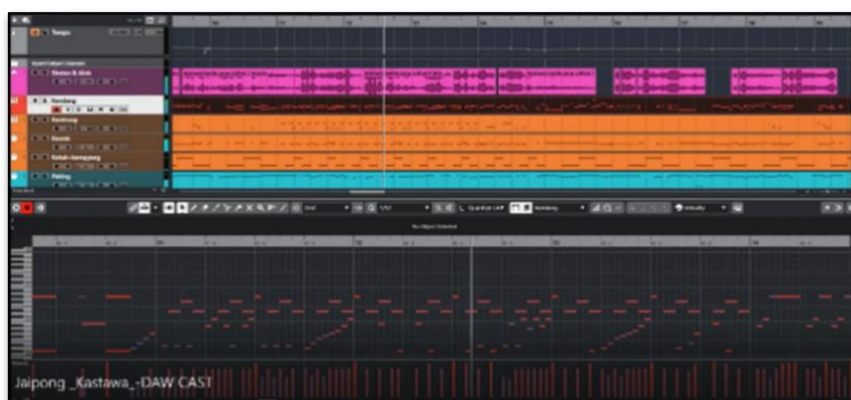


Figure 7. Display of a piano roll on a DAW music project (screenshot by the author, August 2022)

As previously stated concerning the Sundanese *Kendang* symbol or notation that has been developed (Suparli, 2010), the concept of the notation is still ineffective and is not widely adopted. A block notation-based technique for constructing notations is used to create symbols or notations that are generally understood by musicians. This virtual instrument was tested using a digital music notation application to accomplish this purpose. Steinberg's "Dorico" software was utilized. This software was chosen because it has efficient features for handling symbols and positioning percussion instruments.

The initial stage in this endeavor was to create a percussion/drum map on Dorico. Based on the position of the samples on the piano keys available in KONTAKT, we can place notes note by note and build various symbols as desired. Figure 8 shows the percussion/drum map design for Dorico's virtual drum *jaipong* instrument.

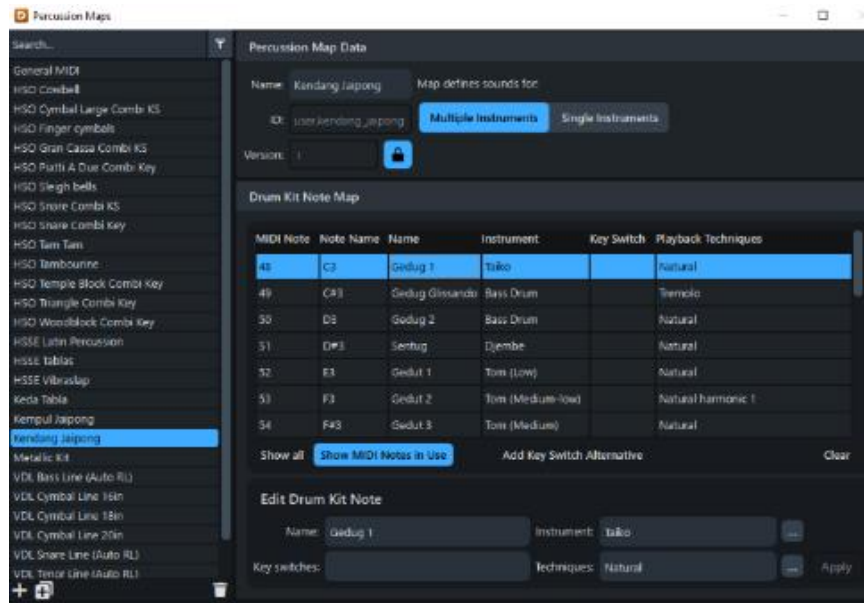


Figure 8. View of the percussion/drum map design for the virtual drum *jaipong* instrument on Dorico (screenshot by the author, August 2022)

To order the relationship between instrument note location and note numbers in the MIDI system, it must utilize the phrase standard percussion instrument throughout the note mapping procedure. The term instrument can then be replaced with the term diversity of *kendang* sounds so that it appears on the notation staff. Furthermore, the arrangement of notes on lines and spaces must be as we intended. [Figure 9](#) shows the results of adjusting the note placement.

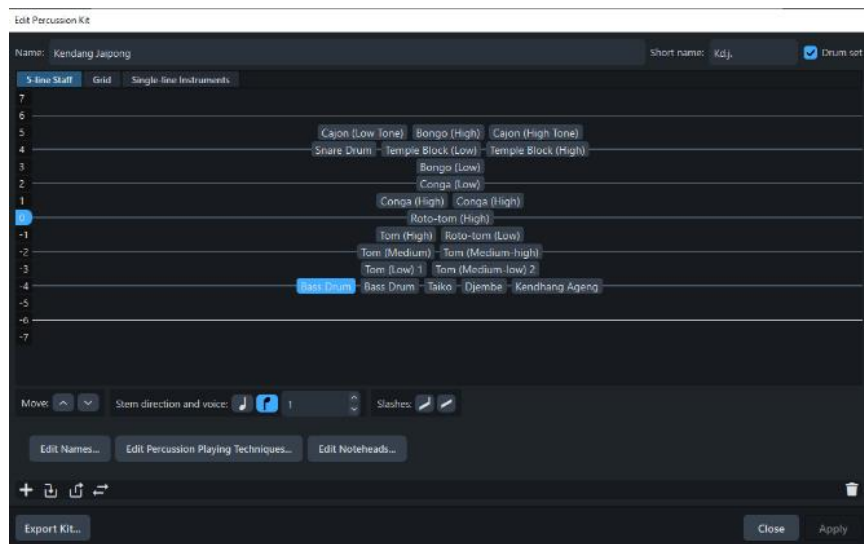


Figure 9. Display of the edited percussion kit of the *Kendang Jaipong* virtual instrument on Dorico (screenshot by the author, August 2022)

As a result of all of these settings, the notation staff can be used to write the following note symbols: The concept resulted in the *Kendang Jaipong* notation system, which is depicted below.

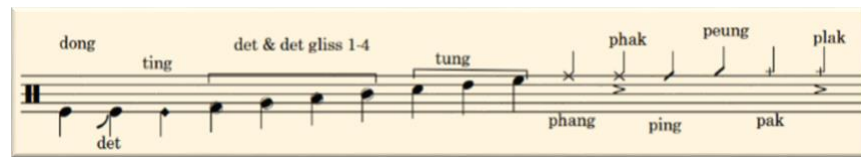


Figure 10. *Kendang Jaipong* notation for Dorico
(screenshot by the author, August 2022)

This notation technique is also used to notate numerous types of *Tepak Kendang Jaipong*. The notation for *tepak mincid* is one example, as seen below.



Figure 11. *Mincid kendang jaipong* notation on Dorico
(screenshot by the author, August 2022)

4. CONCLUSION

The virtual *Kendang Jaipong* prototype worked wonderfully. This is based on indicators of the outcomes of two types of projects: the digital audio workstation project and the digital music notation project.

To increase the musical quality of these virtual instruments, a sampling technique that uses a round-robin system must be developed so that the audio samples with a variety of *tepak* are more diverse and sound after sound always sounds original and unpredictable. Aside from that, for this product to be used as a learning machine, midi files and display notations for *Kendang Jaipong* styles that may provide assistance and insight into the variation of *tepak Kendang* styles for users who want to learn *Kendang Jaipong* are required.

The impact of this prototype in the future could create bigger concepts, such as documenting the local brilliance of *kendang* players and maestros in different Sundanese *kendang* genres. These maestros' creative musical ideas can be recorded in a digital system, producing not just standard recording documents but sophisticated applications that create artificial intelligence and learning machines, one of which is in the form of virtual instruments.

Music creators are not only aided in the process of designing their work effectively and efficiently by virtual musical instrument products but they can also be inspired by the traits or characteristics of these virtual musical instrument products.

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REFERENCES

- Bodin, D. (2017). Review: Ethno World 6 Complete, Instruments by Marcel Barsotti from BestService. Sample Library Review. <https://www.samplelibraryreview.com/the-reviews/review-ethno-world-6-complete-marcel-barsotti-bestservic/>
- Borgdorff, H. (2016). *The Conflict of the Faculties: Perspectives on Artistic Research and Academia* (Vol. 15, Issue 2). Leiden University Press. <https://library.oapen.org/handle/20.500.12657/32887>
- Harahap, I. (2004). *Alat Musik Dawai* (E. L. Siagian (ed.)). LPSN.
- Hardjana, S. (2003). *Corat Coret Musik Kontemporer Dulu dan Kini* (1st ed.). Ford Foundation & MSPI.
- Harnish, D., & Wallach, J. (2013). "Dance to Your Roots": Genre Fusions in the Music of Indonesia's Krakatau. *Asian Music*, 44(2), 115–134. <https://doi.org/10.1353/amu.2013.0014>
- Hendriyana, H. (2021). *Metodologi Penelitian Penciptaan Karya* (P. Christian (ed.); II). ANDI.
- Indrayuana, A. (2013). Penggunaan Software " Native Instrument Kontakt " Pada Scoring Film " Metodologi Sequence Midi sebagai pembelajaran di dalam ke- las Sound Design in Cine- matography. *ULTIMART Jurnal Komunikasi Visual*, V(01), 19–21.
- Joshi, K. M. (2022). 20 Best Kontakt Libraries For All Categories. <https://integraudio.com/20-best-kontakt-sample-library/>
- Mack, D. (2004). *Sejarah Musik Jilid IV* (4th ed.). Pusat Musik Liturgi.
- Native-instruments.com. (2022). Kontakt 6. Native Instruments. <https://www.native-instruments.com/en/products/komplete/samplers/kontakt-6/>
- Perry, J. (2005). Cage's Sonatas and interludes for prepared piano: Performance, hearing and analysis. *Music Theory Spectrum*, 27(1), 35–66. <https://doi.org/10.1525/mts.2005.27.1.35>
- pianobook.co.uk. (n.d.). Pianobook. Retrieved August 16, 2022, from <https://www.pianobook.co.uk/>
- Ramaer, H. (2004). Sinta Wullur and the Diatonic Gamelan. *Balungan*, 9–10, 30–33. [http://www.gamelan.org/balungan/back_issues/balungan\(9-10\)/](http://www.gamelan.org/balungan/back_issues/balungan(9-10)/)
- Saepudin, A. (2015). Perkembangan dan Perubahan Tepak Kendang Jaipongan Suwanda dalam Masyarakat Urban. *Journal of Urban Society's Arts*, 2(1), 9–17. <https://doi.org/10.24821/jousa.v2i1.1265>
- Sani, M. B. Z., & Ramadhani, A. M. (2020). Pengembangan Alat Musik Panting Melalui Bentuk VSTi. *Pelataran Seni*, 4(1), 49. <https://doi.org/10.20527/jps.v4i2.8990>
- Schule, N. (2019). What Are Virtual Instruments. *Pragmatic Sound*. <https://medium.com/pragmatic-sound/what-are-virtual-instruments-c762055ddf71>
- Setyowati, L. R., Lastoro Simatupang, G. L., & Irawanto, B. (2022). Narrative and Cinematic Aspects in Commercial and Art

- Films as Directors' Artistic Treatments: a Comparative Study. *Journal of Urban Society's Arts*, 8(2), 87–97.
<https://doi.org/10.24821/jousa.v8i2.5745>
- Shafazhinskaya, N. E., Kats, M. L., Smirnov, A. V., Ovsyannikova, V. A., & Kruglova, M. G. (2019). Integration of traditions in crossover music as a way to bridge the intergenerational gap. *Humanities and Social Sciences Reviews*, 7(6), 1230–1234. <https://doi.org/10.18510/HSSR.2019.76174>
- Siagian, E. L. (2006). *Gong*. LPSN.
- Suparli, L. (2010). *Gamelan Pelog Salendro-Induk Teori Karawitan Sunda*. Sunan Ambu Press.
- Tzevelekos, P., Georgaki, A., & Kouroupetroglou, G. (2008). HERON: A zournas digital virtual musical instrument. *Proceedings - 3rd International Conference on Digital Interactive Media in Entertainment and Arts, DIMEA 2008, May 2014*, 352–359. <https://doi.org/10.1145/1413634.1413698>