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## Research Article

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# Third City 2017: Improvisational Roles in Performances Using Live Sampling

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**Abstract:** The 2017 set by the electroacoustic duo Third City comprised five pieces, each defined by an audio path linking different acoustic musical instruments to digital musical instruments to enable live sampling. Performances were then improvised within structures developed in rehearsal. The authors here ask how the different instruments and audio paths influenced the improvisational roles taken by the performers. Previously established differences between acoustic musical instruments and digital musical instruments are highlighted, and questions regarding their use within improvisation are articulated. A taxonomy of improvisational roles is then selected and applied to the pieces. In identifying correlations between the instruments and audio paths of the five pieces and the improvisational roles used by the performers, conclusions are reached to serve as guidance in the setting up of audio paths for other electroacoustic improvisation pieces using live sampling. This article is the result of research into practice, an asynchronous post hoc consideration (Onsman and Burke 210) of the 2017 Third City set carried out by the duo having repositioned themselves relative to their music-making selves as researchers referring to both the experience of performers and the projected experience of the audience as inferred from archive footage.

**Keywords:** music, improvisation, electroacoustic, instruments

## Introduction

This paper concerns the way in which different improvisational roles were manifest in the musical lines generated within the 2017 set of Third City, a performance duo which incorporates digital musical instruments alongside the live performance of acoustic musical instruments. Digital musical instruments are those that, through the transfer of digital information, use an interface to trigger sounds from a sound generation unit. The interface may be an existing tool such as the keyboard or trackpad of a laptop, or maybe custom-built either in imitation of an existing acoustic musical instrument or to an original design. The sounds produced by the sound generation unit are usually synthesised, as in created from scratch, though may instead be sampled, as in recordings captured using microphones to be replayed with or without transformations applied through additional audio processing. The great variety of interface designs and the limitless variety of sounds that can be triggered offer enormous opportunity for musicians working with digital musical instruments.

Whilst there is some dispute about the extent to which acoustic musical instruments and digital musical instruments are entirely separate categories of instrument (Waters 4-14, Green 134-43, for

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example), there is general agreement that some distinction does exist. Magnusson and Hurtado Mendieta's 2007 survey of musicians identified positives and negatives attached to acoustic and digital musical instruments when compared to one another. The digital musical instruments referred to in the survey were primarily based in audio programming environments such as SuperCollider, Pure Data and Max/MSP. Beyond the technical definition of the difference between acoustic and digital musical instruments offered above, a summary of the results of this survey offers insight into the ways in which the approach of the performers can be significantly altered by the category of instrument they use. Additional comments and hypotheses regarding the application of these findings to improvised music and to audience reception will also be made.

Within the survey by Magnusson and Hurtado Mendieta, the limitless options available from digital musical instruments regarding timbres, pitch registers and tunings were identified (4). The statements provided in the survey do not comment on the agility with which it is possible to make use of the range of sounds available on either digital or acoustic musical instruments, something which itself varies from instrument to instrument in both categories. However, the greater versatility of sounds available on the digital musical instruments leads to the hypothesis that these instruments have a greater facility for adopting the different improvisational roles throughout a performance and for switching between improvisational roles within a performance. In contrast, the acoustic musical instruments, bound by their structure, materials and consequent affordances, were identified in the survey as less versatile though these limits were also considered by some musicians to be a source of inspiration.

According to the musicians surveyed by Magnusson and Hurtado Mendieta, the traditions and conventions attached to different acoustic musical instruments enabled musicians to build upon an existing legacy by drawing on techniques found in existing areas of music practice (4). These results are of particular importance when applied to improvisation. The legacy of recognisable music practices on a given instrument provides sets of techniques that can be appropriated both as a means by which the musician can generate material with little effort and a means by which tension, release and surprise can be generated through conforming to and denying expectation both within music traditions and in the combining of music traditions. However, the survey also identified the risk of clichéd playing on acoustic musical instruments as a result of those same traditions and conventions. As one of the survey respondents stated, "when playing an acoustic instrument, you are constantly referring to scales, styles, conventions, traditions and clichés that the instrument and the culture around it imposes on you. A musician can just play those conventions in autopilot without having to THINK at all. It's easy and unchallenging" (Magnusson and Hurtado Mendieta 4). Although this highlights the greater ease identified in generating material on an acoustic instrument, it is also the antithesis of improvised music in particular.

The survey found that the comparative lack of traditions and conventions attached to digital musical instruments provided freedom but meant a lack of legacy on which to build and the risk of merely imitating acoustic musical instruments. The freedom from tradition identified here complements the versatility of timbres, pitch registers and tunings identified above. Whereas the acoustic music instruments have traditions on which to draw and the limits of their own affordances against which to push, the digital musical instruments had freedom in their versatility regarding musical parameters and their lack of tradition. This could indicate that improvising performers using digital musical instruments are more likely to be required to take responsibility for generating the vocabulary and syntax of their performances.

Ingold states that "as fast as machines have been contrived to do what had previously been done by skilled hands, different skills have sprung up to cope with the machines themselves" (332). According to Djajadiningrat, Matthews and Stienstra, when working with digital devices, "it is exactly because button pushing is so simple from a motor point of view that learning is shifted almost completely to the cognitive domain" (659). Magnusson and Hurtado Mendieta (2007) expressed this as the difference between an extrovert state found in performers on acoustic musical instruments and the introvert state found in performers on digital musical instruments and considered by their surveyed musicians to be a deficiency of digital musical instrument performance (4). With the digital musical instrument performer defaulting to an introvert state, it could be hypothesized that his/her awareness and manipulation of the ongoing relationship with another performer might be less sensitive than that of other performers within the same

piece using acoustic musical instruments, that the acoustic musical instrument performer would be the one to manage the improvisational roles.

The audience experience of digital musical instrument performances is also significantly different from that of acoustic musical instrument performances. Gurevich and Fyans point out that digital musical instruments do not respect consistent, energetic exchange in the way that acoustic instruments do in that there is a weaker connection between the physical actions of the performer and the sounds produced (167). In performances making use of digital musical instruments, causality, the action that takes place to generate a sound, can be inferred from changes in the audio (Bown, Bell & Parkinson 17). But as Emerson and Egermann state, “conventional causalities between gesture and sound (e.g. that an action immediately results in a sound or that larger gestures result in louder sounds) are often absent” (96). The visible cues an audience receives might suggest greater prominence of an acoustic musical instrument in the music when, for the performers, this is not the case.

## Method

In order to identify the roles that the Third City musicians took within the improvised pieces, a number of approaches were considered. Healey, Leach and Bryan-Kinns use the notion of presentation, in which a new idea is introduced, and response, in which a new idea is accepted (4). Wilson and MacDonald, in asking musicians to review recordings of their trio improvisations, asked them whether they were choosing “to maintain what they were doing or change, either to initiate a new direction or to respond to another improviser” and that “responses were subjectively understood to adopt, augment or contrast the contributions of others” (1029).

As the authors were wanting to identify the roles used in multiple iterations of the same piece rather than across the duration of a single performance, they chose to make use of the taxonomy of roles within free improvisation presented by Jacqueline Walduck (39-42). The roles are broadly split into that of (i) the Solo musician who is playing music that positions itself as the focus of attention, along with (ii) those providing complementary parts, and (iii) those who are creating conflict.

The complementary roles are further split by Walduck into Background, Counterpart, Punctuation and Heckles. A musician offering Background music is providing complementary music in the form of something continuous that allows space for the Solo parts. Counterparts are lines of music that complement another line being played, a backgrounded solo. Punctuation breaks up long, sustained notes or coincides with the starts of new phrases and often comprises short, accented, rhythmic and repetitive gestures. Heckles come in the middle of phrases and contain an element of what they are heckling. Despite what the name may suggest, Heckles do not disrupt, they merely observe.

The conflict roles are split into Contrapart and Block. Contrapart lines operate as if in ignorance of the other lines of music. Blocks are provocative, interruptive and disruptive.

After Walduck, the authors maintain that in taking part in, or in listening to, ensemble improvisation, it is possible to align roles such as these with different musicians as the performance unfolds. The roles adopted can be maintained for long periods of time, even for a whole piece, or can be frequently exchanged; they can be clearly differentiated or less obvious.

The pieces found within the Third City 2017 set will be described, and the different improvisational roles the performers took in each piece will be identified. We will then try to describe what led to the different improvisational roles being taken in each piece and to consider several questions emerging from the Magnusson and Hurtado Mendieta survey: Did the greater versatility of the digital musical instrument with regards to register, timbre and tuning result in more switching between improvisational roles within the performances? Did the greater capacity for the acoustic musical instrument to draw upon traditions and conventions lead to it taking more Solo lines? Did the comparative lack of traditions and conventions for the digital musical instrument make it difficult for the two performers to take on Solo and Counterpart lines together? It has been identified that digital musical instruments are more likely to result in introverted performance. Has it been found that the digital musical instrument performer favoured those

roles that require less sensitivity to the other instrumental lines such as Background and even more so the conflict roles, as opposed to those dependent on engagement with the other lines of music such as the other complementary roles? Given the greater perceived gesture-sound causality typical of acoustic musical instruments, were there occasions when a Solo digital musical instrument is playing alongside a Background, Counterpart or Contrapart acoustic musical instrument, as intended by the musicians, was instead perceived by the audience as being the other way around?

## The Third City 2017 Set

The Third City electroacoustic improvisation duo comprises Jon Aveyard and Dan Wilkinson, henceforth identified as JA and DW. For the most part, acoustic musical instruments are performed by JA with the resulting sound being sampled, processed and played back by DW. For the 2017 set, the audio software Ableton Live was used for the sampling and processing, and an Ableton Push controller was used to trigger the samples. The Push controller uses MIDI, a digital protocol used by a wide variety of music electronics. The Push has a number of functional buttons and dials, but the primary interface is 64 pads arranged in an eight-by-eight grid formation and used, in this case, to select the playback pitch for samples chosen on the laptop in Ableton Live. The pads are illuminated in different colours indicating the different pitch shifts available according to a selected scale. Between the two musicians, phrases were presented both unmediated and transformed, both in real time and in delay.

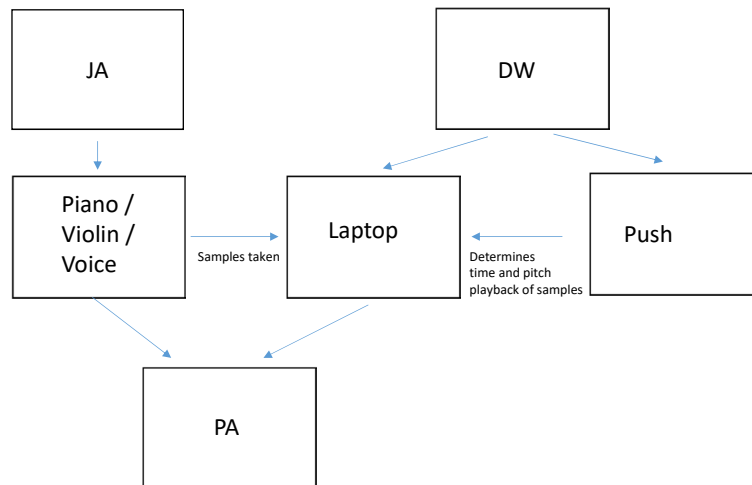
Devising the structures began with the two musicians bringing to rehearsals the tools they wanted to use. In JA's case, this was a selection of instruments, some found objects and some pedal effects. In DW's case, this was a selection of patches created in Ableton Live, the Ableton Push controller, and a homemade instrument. With only a little discussion, combinations of instruments and patches were tried. Within or between the improvisations, modifications could be made to the set-up of the Ableton Live patches or effects pedals, as well as to the techniques used to perform the instruments, found sound objects, Ableton Live and Push controller, and the pedals. It usually only took one or two improvisations for the structure of a piece to be agreed upon even if it was not fully verbally articulated. This structure would then be used in subsequent rehearsals with the option of further modification always kept open. At this stage, the characteristics of each structure had been explicitly or implicitly agreed, and later rehearsals were used to explore how the musicians might operate within them. The structures created by Third City were pre-determined agreements, always negotiable during the course of an improvisation to take into account both unintentional and inspired deviations.

The set that was developed for 2017 performances comprised the pieces *Pia-pia-know*, *Violinium*, *Due-utterance*, *Itchy-scratchy*, and *Drum-gatium*.

### *Pia-pia-know*

In this piece, the first of the Third City 2017 set to be considered, JA played electric stage piano with the output going directly to the PA but also sent to DW's laptop for live sampling in order that captured phrases could be played back in delay with further processing applied. See Figure 1.

In performances of *Pia-pia-know*, JA mostly stuck to a single major pentatonic scale. Whilst also exaggerating the fixed pitch nature of the instrument by further limiting the playing to five pitches per octave, the use of this scale meant that samples played back in delay would not create dissonances against the live piano. Pitch shifting was added using the Push controller but usually limited to movement in one direction or another by a number of octaves to avoid introducing unexpected dissonance. Whilst the two musicians are entirely comfortable creating atonal and dissonant music, consonance became one of the defining features of *Pia-pia-know*. However, JA's occasional introduction of pitches outside of the pentatonic scale and DW's occasional use of pitch shifting by amounts other than multiples of an octave permitted both performers to choose times at which to introduce dissonance.



**Figure 1.** Path for *Pia-pia-know*, *Violinium* and *Due-utterance*

The stage piano took the Solo role for most of the duration of all performances of this piece. The allocation of this role was never questioned by the performers and became part of the structure. With the stage piano in the Solo role, and the digital musical instrument being used to apply only limited amounts of processing and pitch shifting of an octave or multiples thereof, the sampler fulfilled complementary roles. These were typically Heckle, by introducing phrases timbrally matching the original piano, with occasional Counterpart contributions when the phrases were processed to be more distinct to the piano. As the piece progressed, it is believed that it would be found more difficult for the audience to distinguish between the piano and the digital musical instrument meaning that some of what might have been received as being a Solo line from the piano might actually have been from the digital musical instrument whilst the piano was offering a more discrete Background or Counterpart line.

## ***Violinium***

This piece employed the same audio path as that of *Pia-pia-know* but, as the name suggests, working with a violin rather than a stage piano as a sound source. The violin was played live with a signal being taken from a clip-on contact microphone. See Figure 1.

As with *Pia-pia-know*, phrases from the acoustic musical instrument were sampled, processed and sent in delay to the original. However, whereas *Pia-pia-know* worked mostly within a given scale, *Violinium* rarely did so and instead focused on changing pitch ranges and on changing the timbres of the sounds. A wide variety of performance techniques were used meaning that, whereas the sampled and processed phrases in *Pia-pia-know* began with the invariable timbre offered by the stage piano, for *Violinium*, a variety of timbres and types was already present in the musical phrases offered by the violin before processing took place.

Although some of the phrases were played within major or minor scales, the violin playing for this piece was, for the most part, intentionally ignorant of a given scale. Driven by the desire to create an identity for this piece that was in contrast to that of *Pia-pia-know*, the attention to pitch was instead on the range and on whether sequences of notes were ascending or descending. This sometimes happened in step through a series of tones, semitones or microtones, and sometimes happened through a gradual sliding of pitch in one direction or the other.

The violin usually began in the Solo role though sometimes offered what seemed more like a Background line waiting to be joined by a Solo. Once the sampler had entered, either part could be heard as taking the Solo role whilst the other operated as Background, Counterpart or occasionally Contrapart. Due to the non-idiomatic and fragmentary playing presented on the violin and used as material for the sampler,

when the Solo role was held by either instrument, it was not secure and could easily be taken by a moment of prominence from the other instrument. However, the greater gesture-sound causality visible on the violin meant it stood more chance of holding and retaining the Solo line regardless of the material either instrument presented. As with the piano piece, when the sampler brought in less processed sounds, it was considered to be more likely to take Solo or Heckle roles than when it used heavily processed sounds further removed from the sound of the onstage acoustic musical instrument.

### ***Due-utterance***

This piece used again the audio path from *Pia-pia-know* and *Violinium* but with JA speaking and providing other vocalisations into a microphone that was going to both the PA and to DW's laptop for sampling and processing. See Figure 1.

An additional layer can be reflected upon regarding the characteristics of the musical lines within this piece. If we consider, as does Chion that listening can be described as being of three types, causal listening used to understand the cause of a sound, reduced listening used to appreciate the properties of a sound, and semantic listening used to decipher a message, as in spoken conversation (25-30), the audience to this piece were encouraged to use all three.

The live voice began with spoken phrases introducing the piece. The first samples added were usually short phrases repeated in delay but these would then become more frequent, louder, and more highly processed. Eventually, the sampled sounds would be edited or processed in such a way that any words originally within the sample could no longer be decoded. As more samples were added, the obscuring of the live voice then emboldened the vocalist to move onto wordless sounds without codification. At any time the vocalist or sampler could choose to reintroduce recognisable words or sounds thereby encouraging semantic listening, however briefly, once more.

By incorporating semantic listening, the voice always presented itself as intending to be the Solo instrument though, particularly when it was lower in the mix, instead took Background, Counterpart or Contrapart roles, and sometimes assumed a Heckle role in responding to the sampled playback. The digital musical instrument moved between Solo, Background, Counterpart, Heckle or Contrapart, and sometimes assumed a Block role simply by overpowering the voice in volume.

Where words were no longer decipherable or where significant processing was applied, reduced listening was encouraged. As with the pieces using piano and violin, there were times when the source of sounds, the voice or the sampler, was in doubt and causal listening will have been encouraged in an attempt to identify the source of the different lines of music.

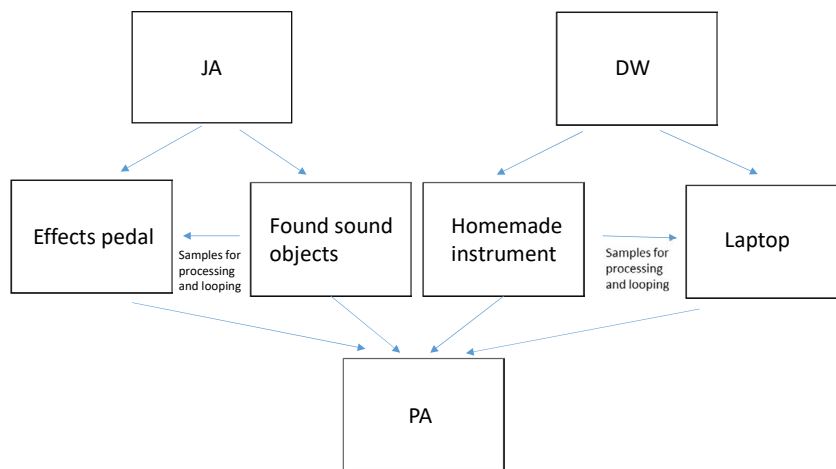
### ***Itchy-scratchy***

This piece used a combination of almost worthless found sound objects, an adapted high-tech homemade instrument featuring creatively misused computer parts and an electric toothbrush, a functional but graceless multi-effects pedal, and the laptop running Ableton Live. The set-up was intentionally lacking precision, each performer responding to their own, often unexpected sounds as much as they were to each other.

The homemade instrument built and performed by DW was amplified with contact microphones, activated using a number of buttons and switches, and controlled using an Arduino microprocessor, a type of circuit board that can be programmed using open source software. The instrument housed three sound sources. The first was known as the spoon-fed computer fan: when switched on, the exposed fan was sounded by holding an object, usually a plastic spoon, against it to create a pitched, granular sound. The second sound source was an Arduino controlled toothbrush: the back-and-forth rotation of the electric toothbrush was turned into sound by adding bulldog clips that rattled with each motion, and by holding unpitched and pitched percussion up to the toothbrush such that they were struck by the bulldog clips.

The third sound source was an open computer hard-drive driven by an Arduino controller: the buttons used to trigger the spinning of the drive led to unpredictable responses regarding the direction of rotation and occasionally resulted in rapid oscillation so that when objects such as small, metal beads were placed on the surface of the disc, its rotations created rapidly looping rhythms. The sounds created on this instrument were sent directly to the PA and also to DW's laptop where they could be sampled and processed, typically as pitch shifted loops.

JA performed using a collection of found sound objects to generate unpitched, timbrally diverse sounds. The found sound objects would ordinarily be considered of very little worth—screwed up paper and tin foil, polystyrene blocks, paper cups, plastic bags. By gathering the found sound objects closely together, simple hand gestures could be used to trigger multiple sound sources at once. In contrast to the granular and loop-based sounds from the homemade instrument, the found sound objects were usually non-repetitive, non-looping, and textural though occasionally the objects were manipulated to create short repeated phrases. The sounds from the found sound objects were captured on a microphone to be sent directly to the PA and also to a multi-effects pedal where they could be sampled and processed, typically as pitch shifted loops. See Figure 2.



**Figure 2.** Path for *Itchy-scratchy*

Unlike in the other structures, there was no audio path directly linking the two musicians whilst they were at their own instruments. Rather, each musician generated sound that was sent to their own effects station and to the PA.

The highly gestural, pointillistic performing provided on both instruments meant that sometimes there was no clear Solo, rather two fragmented lines in Counterpart to one another, or even Punctuation against silence. At other times whichever of the lines of music was more gestural, as opposed to textural, would take the Solo role.

The processed lines generated through the laptop and the effects pedal usually provided a Background or Counterpart lines though occasionally grew in prominence to sufficiently to take over the Solo role with the live found sound and homemade instrument as Punctuation, Counterpart or Contrapart.

Whilst it was not articulated as such at the time, the performers chose to build into the structure a way in which they could be linked as they were in the other pieces. Towards the end of the piece, JA would leave his found sound objects and join DW on the homemade instrument, moving a kalimba against the bulldog clip being shaken by the electric toothbrush whilst DW operated the buttons, drew sounds from elsewhere on the instrument, and sometimes continued to produce sounds on the laptop from new and existing samples. Thus, the two performers were heard and seen to be joined not by an audio path but by their shared use of the one instrument, albeit one with multiple sound-producing parts. See Figure 3.



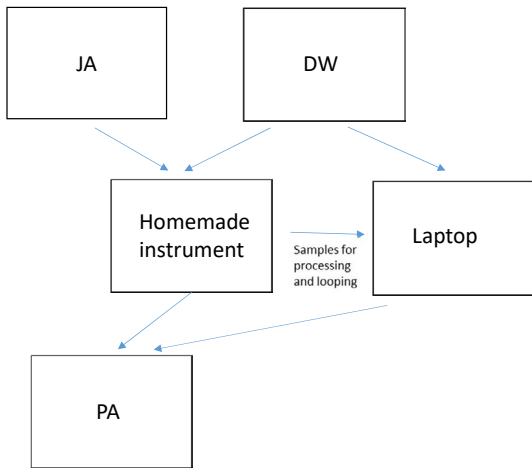


Figure 3. Path for the *Itchy-scratchy* ending

The live kalimba addition was heard as a Counterpart though may in performance have been perceived as a Solo because of the gesture-sound causality, though eventually the samples taken would overwhelm it.

### Drum-gatium

This piece made use of a timbau, a Brazilian hand drum, performed by JA. One microphone provided direct amplification whilst a contact microphone sent a signal to DW as part of an adaptive gate trigger. The term “gate” here refers to a process by which an audio signal is automatically monitored, and a different process is applied in response to the signal being above or below a predetermined level. Unlike the other pieces in which samples were almost immediately used within the performance—violin samples were heard against live violin, for example—this piece made use of samples of *Pia-pia-know* taken from earlier within the same performance resulting in piano samples against live drumming.

The threshold, floor and return settings of the gate affected the relationship between the two performers. When the floor was set to 0.00dB, the gate was effectively inactive, and the pitching and timing of the samples were under the control of DW using the Push controller. See Figure 4.

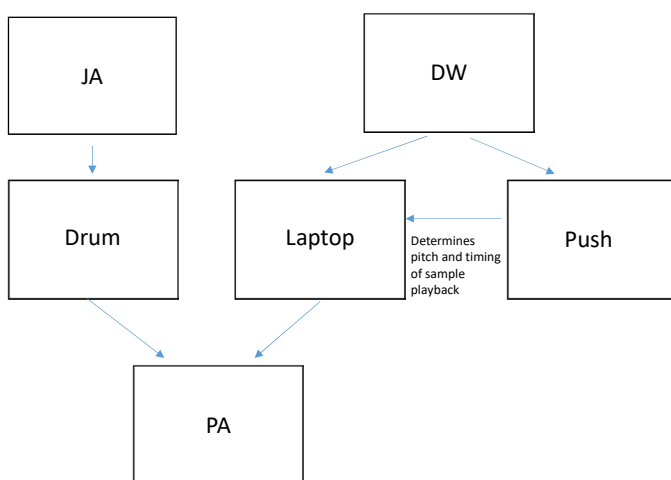


Figure 4. Path for *Drum-gatium* with gate floor at 0.00dB

When the gate floor was at 0.00dB, the pitched material generated by the sampler led to it taking the Solo role despite the greater gesture-sound causality of the drum which instead took a Counterpart role.

When the floor was set to -inf and pitches were selected by DW on the Push controller, strikes on the timbau above a certain level, determined by DW, triggered samples at those pitches. Consequently, both instruments were bound by the rhythm played on the drum, its louder notes joined by the samples. See Figure 5.

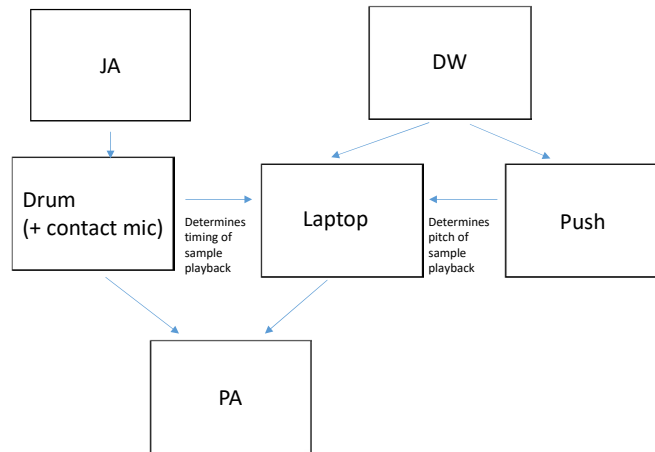


Figure 5. Path for *Drum-gatium* with gate floor at -inf

When the gate floor was at -inf, DW was able to adjust the threshold of the gate, but it was also possible for JA to acquire an awareness of this threshold and therefore decide whether to strike the drum in such a way as to fall just above or below the level that would trigger the samples. To an audience, the drum strikes might appear to be at the same level, their slight distinction obscured by the samples themselves. It was also possible for JA to trigger the samples by tapping the contact microphone so as to cause a momentary disconnect between the timbau and samples.

When the drum was used to trigger the sampler only infrequently, the drum took on the Solo role whilst the sampler was heard to provide Punctuation, timbrally different but rhythmically tied to the drum line for its occasional soundings. When the drum was used to trigger the sampler more frequently, the performer at the drum was still perceived as the Solo musician, but the pitched material generated was heard as the Solo line whilst the drum sounds were heard as Counterpart, accompanying and occasionally embellishing the Solo line.

The use of the gate meant that a visible interplay developed between the players with each monitoring the movements of the other in order to comply with or confound the other's expectations. This playfulness was most prevalent towards the end of the piece where JA would suggest but then fail to deliver drum strikes, and DW would release the Push just as JA delivered a drum strike expecting an associated pitch. Although the improvisational role of Block would ordinarily be a sound added to disrupt the flow of another line of music, here there were Blocks in the form of a failure to deliver offered sounds. In the absence of sight of the performers, this Blocking would not be evident.

## Discussion

Following Magnusson and Hurtado Mendieta's survey, the limitations of the acoustic musical instruments used were indeed felt to provide inspiration. These limits were then mitigated through the use of multiple instruments across the set but, however flexible acoustic musical instruments such as the violin or voice can be with regards to timbre and tuning, the use of live sampling meant that the digital musical instrument was always capable of greater timbral diversity and pitch range. Nevertheless, the restrictions of live sampling,

as opposed to other forms of music-making with digital musical instruments, reduced the possibility of the digital musical instrument performer feeling that the limitless possibilities of the instrument were a creative hindrance.

The use of the Push controller, with its grid of pitch-specific, touch-sensitive keys, alleviated some of the risk of the digital musical instrument performer resting in an introvert state. Similarly, the Push controller has far greater gesture-sound causality to be appreciated by the audience when compared to the laptop, but still far less when compared to any of the acoustic musical instruments used within the set.

Restricting use of the piano mainly to the pentatonic scale whilst the digital musical instrument was used mainly for limited processing and transpositions at the octave or multiples thereof meant that *Pia-pia-know* often remained consonant throughout. The limited timbre offered by the stage piano in the Solo role and the limited processing used by the digital musical instrument meant that the digital musical instrument was encouraged, though not bound, to stay within complementary roles, the timbre and scale of the samples matching that of the Solo line, as opposed to roles generating conflict. In comparison, the more fragmentary playing, greater timbral variation and non-idiomatic playing from the violin in *Violinium* encouraged greater improvisational role variation from the digital musical instrument and more likelihood of the Solo role being taken by the digital musical instrument even though its samples were drawn from source material that was itself more fragmented, more timbrally varied and less idiomatic in style.

In both *Pia-pia-know* and *Violinium*, the source of sounds became unclear as the acoustic musical instrument and the samples provided by the digital musical instrument were mixed together. This is not considered a weakness, rather than opportunity to encourage in the audience causal listening alongside reduced listening. This also applies to *Due-Utterance* in which the use of a speaking voice additionally led to the inclusion of semantic listening.

The use of looped samples in *Itchy-Scratchy*, as opposed to the individually triggered samples elsewhere in the set, meant that the two performers were able to generate additional musical lines to the ones being created live. These loop-based phrases usually took Background or Counterpart lines though could be allowed to grow in prominence to take the Solo role. Though the possibilities were not fully explored, it is considered possible that the performers, through the way they relate to the looped phrases, could place them in roles such as Heckle, Punctuation or Block. The use of audio paths linking the two performers elsewhere in the set likely contributed to the desire to join one another on a single instrument for a section of this piece.

Across *Pia-pia-know*, *Violinium*, *Due-utterance* and *Itchy-scratchy*, the digital musical instrument took the Solo role by re-presenting phrases taken from the earlier Solo lines of the acoustic musical instrument. It was observed, specifically in *Pia-pia-know* and *Violinium*, that the digital musical instrument was more likely to take on Solo or Heckle roles when little or no processing was applied to the samples taken from the acoustic musical instrument as opposed to when significant processing was applied. In *Pia-pia-know*, *Violinium* and *Due-utterance*, the acoustic musical instrument could have been perceived by the audience as being in the Solo role when the performers experienced it otherwise. The gesture-sound causality of the found sounds and homemade instrument in *Itchy-scratchy* was less clear than for the more traditional acoustic musical instruments and this, together with their unconventional nature, meant that they were less likely to be perceived as being in the Solo role except when intended so by the performers.

There were few observations of conflict roles being used by the performers though this is believed to be a reflection of the individual and collaborative improvisational style of the musicians rather than a consequence of the instruments and audio paths used. In *Due-utterance*, the digital musical instrument took on a Block role simply by overpowering the acoustic musical instrument in volume. In *Drum-gatium*, the requirement for both performers to engage in action in order to generate sound from the sampler, pitch selection by DA and a drum or contact mic strike by JA, meant that either performer could choose the Block role through preventing sound rather than adding. The playfulness of this also shows an example of an extroverted performance being elicited from a digital musical instrument performer.

The drum playing within *Drum-gatium* used traditional hand-to-hand performing techniques within conventional four-beat-to-the-bar metric rhythms; only the occasional tapping of the attached contact microphone was outside of typical timbau technique. However, as well as being an acoustic musical

instrument, the drum is also being used as the trigger for the digital musical instrument. This hybridised instrument has the limits of an acoustic musical instrument whilst also possessing the limitless timbral and pitch capacity of digital musical instruments; it has the traditions and conventions of timbau playing to draw upon whilst also possessing the capacity to move far beyond them; it allows the timbau performer to be in the extrovert state whilst the laptop/Push performer enables the advantages of digital musical instruments. These advantages can be found elsewhere in existing instruments that use acoustic musical instruments or their facsimiles to trigger sampled sound—for example, the stage piano used for *Pia-pia-know*, rather than produce piano sounds could instead be loaded with samples taken from any available source—but the inclusion of the performer at the laptop/Push means that samples can be selected and adjusted on-the-fly, and the improvisational roles available are expanded to include those found when the gate is switched to 0.00dB.

Although the samples for *Drumgatium* were taken from earlier in the same set, they were not of the acoustic musical instrument being performed at the time. *Drum-gatium*'s use of pitched samples against a percussive acoustic musical instrument meant that, when the gate was at 0.00dB, the pitched material from the digital musical instrument was perceived to be the Solo line even with the greater gesture-sound causality of the acoustic musical instrument. The improvisational roles heard to be taken by the instruments in *Drum-gatium* with the gate at -inf changed according to how often the drum went above the gate threshold, Solo drum to Punctuation sampler when infrequent, Solo sampler to Counterpart drum when more frequent.

## Conclusions

Based on the descriptions and additional observations made above, the following conclusions are offered regarding improvisation combining acoustic and digital musical instruments through the use of live sampling.

The creative hindrance of the limitless possibilities of digital musical instruments can be mitigated against through the challenge of relying on live sampling.

The use of live sampling means that the sound world and style initiated by the acoustic musical instrument becomes the starting point for the digital musical instrument which is believed to facilitate it overcoming any possible difficulty there might otherwise be in situating the acoustic and digital instruments together within the piece despite the comparative absence of digital musical instrument performance traditions. Re-presenting samples with little or no processing enables the digital musical instrument performer to easily take a Solo or Heckle role, even to confuse the source of the lines of music to encourage causal listening alongside reduced listening, and significant processing can be applied whilst still easily occupying a Counterpart role. It was observed that the digital musical instrument can more easily take the Solo role when the samples used are taken from earlier Solo lines of the acoustic musical instrument, when the acoustic musical instrument is more fragmented in its phrasing, or when the digital musical instrument offers pitched material against percussive material from an acoustic musical instrument.

It was noted that when there is clear gesture-sound causality in the acoustic musical instrument, the audience may perceive it as occupying the Solo role even though the performers might experience it otherwise.

It was not observed that the greater versatility of the digital musical instrument with regards to register, timbre and tuning resulted in more switching between improvisational roles within the performances but it was observed that the digital musical instrument can switch improvisational roles more easily when the acoustic musical instrument is offering fragmentary, non-idiomatic playing with great timbral variety.

It was found that looping samples allow for additional lines to be generated that have the capacity to operate in different improvisational roles—Solo, complementary and conflicting—according to their composition and the way in which the live musicians respond to them.

Linking an acoustic musical instrument to a digital musical instrument via a gate such that the acoustic musical instrument, when it reaches a given volume threshold, triggers sampled sounds enables the

addition of timbrally different but rhythmically synchronised musical events. The performer using the acoustic musical instrument can be in the typical extrovert state whilst also exploiting the advantages of the digital musical instrument: s/he can experience the inspiring limits of an acoustic musical instrument whilst also having access to the limitless timbral and pitch capacity of digital musical instruments; s/he can make use of the traditions and conventions of performing the acoustic musical instrument whilst also stepping outside of them in the music generated. The improvisational roles taken by both acoustic and digital musical instrument performers depend on the nature of the sounds used and on how frequently the threshold is exceeded. In the piece analysed here, infrequently exceeding the threshold meant a Solo acoustic instrument against Punctuation from the digital musical instrument, whereas more frequently exceeding the threshold led to a Solo digital musical instrument against a Counterpart acoustic musical instrument. These observations, however, are considered conditional on the choice of instrument and samples.

By linking an acoustic musical instrument to a digital musical instrument through a gate such that both performers are required to engage their instruments to produce sound from the sampler, either performer can Block the other through the absence of compliance in generating sound.

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