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An Analytical Approach for Practice-based Research of the Compositional Process

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Abstract

This paper presents a process of analysis that has been developed via a practice-based, autoethnographic study of the processes of popular electronic music composition. The mediating effects of the tools of the music-maker are examined from an Ecological Approach to Perception (EAP) perspective, with particular reference to the theory of affordances. Concepts from Actor-Network Theory, such as nonhuman agency and translation, are used to build a framework that conceptualises how these mediating effects impact the processes of composition.

KEYWORDS: composition, practice-based, actor-network theory, translations, affordance

Affordance

The tools of the electronic music composer are often considered in terms of affordance, and hence, their mediating effect on the processes of music production. Gibson (1986: 127) states that "the affordances of the environment are what it offers the animal, what it provides or furnishes, either for good or for ill". The digital audio workstation, in particular, has been explored from this perspective (e.g. Bell 2015; Marrington 2017; Strachan 2017). These texts have varied widely in their focus and have provided what Marrington (2019: 53) describes as a "detailed inventory of characteristics [...] that potentially inform creative practice". However, the processes of composition are highly intricate and personal, which leads to difficulty in identifying how this mediating effect manifests within compositional praxis.

Mooney (2010) discusses the concept of a spectrum of affordance, which essentially positions the various affordances within a framework as being more or less difficult to achieve. A framework is whatever system is being used to achieve a certain goal, and includes the physical (e.g. a violin) as well as the conceptual (e.g. tonal systems). Frameworks can be grouped together to form larger frameworks. For example, the framework of the Digital Audio Workstation (DAW) in part consists of both the arrange page (used for structuring the composition's constituent segments of audio and MIDI) and the mixer, which themselves can be broken down into smaller elements. Within a given framework, the higher up the spectrum a certain affordance is, the more experience or skill it will require to achieve. Some affordances might be so far up this scale as to be too difficult, or even impossible, to attempt within the given framework. Applying this idea to the DAW, Mooney argues that due to a newly opened session having a particular set of default parameters (e.g. tempo and time signature), composing music using these settings is lower down the spectrum (and hence marginally easier) than composing music that does not. Bell (2015) considers a similar notion that poses affordances of the DAW as sitting within different levels of accessibility, ranging from the presumed (for example, those requiring computer literacy), and then on to the privileged, provided, protected and prevented. Here, due to the design of the DAW, some actions are presented as being preferable, whereas others are hidden, or simply impossible; again, the notion of mediating effect of the tool is highlighted.

Strachan (2017) presents a more complex theorisation of the DAW and considers how it, and computer use in general, has become naturalised and embedded within our culture. He differentiates between musical affordance as that based on the intrinsic structure of what we call music, and sonic affordance, which relates to sound itself (its timbre and dynamics), and the meaning we perceive through this. The affordances of technology, music, and sound all inform our creative processes and help mould the ways in which we work with it. Whilst, as in the above examples, taking these notions of affordance and applying them to the tools of music production has become common place, identifying specific ways in which the affordances are bound up with the compositional process becomes trickier.

Concepts from Actor-Network Theory

Applying an Actor-Network Theory (ANT) perspective (e.g. Latour 2005), the concept of translation is used to identify how and where points of development alter the affordances within the compositional environment and hence shape the compositional process. To allow for this effect, the ANT principle of nonhuman agency suggests that things other than the composer (in this case, the technology) can have an effect on how the compositional process unfolds. Definitions of the term translation come in various guises: Callon (1984) discusses the moments of a translation, where a multiplicity of representations, interpretations, and impositions, fall into this particularly broad category, whilst Law (1992: 386) defines translation as a "verb which implies transformation and the possibility of equivalence", and

Cressman (2009: 9) considers translation as the "general movement of technological development over time". Although the term might have a multitude of variations, the essence of it is to identify points of change within a network, and that where there is change, an actor has been involved in bringing that change about. A variation on the notion of translation is that of delegation (Latour 1992), where an object or piece of technology is used to generate an outcome that might have otherwise been achieved by a human. Latour (1991) uses the example of the block of wood attached to a door key to prevent those it is loaned to from accidentally walking off with it. The translation of the role from human to object will have effects that are prescribed by the object, which is aligned with the affordances of a given framework.

For example, Zagorski-Thomas (2018) has adopted an ANT approach in an analysis of how studio techniques affected the production of the Miles Davis album, *Bitches Brew*. He shows that it was not just the desires of those involved in the processes of production, but also the affordances of the technology at hand that gave rise to an innovative style of editing that itself became an important part of the creative process. Here, a similar approach is intended to illuminate how my own compositional practice has been shaped by the tools at hand.

An Analysis of the Compositional Process

Journaling was used to document the practice that took place across the composition of a number of my own popular electronic music pieces. These journals become the object of analysis, with the intent to explore how particular techniques develop across, and become integral to, the compositional processes.

Applying the various concepts discussed above within an analysis of my own practice, points of translation can be identified, along with how the affordances of a given framework have been altered by these. As such, the translational effect becomes that of the development of the compositional process. Nonhuman agency allows the actants involved in this translational development to be in part distributed across the various technologies of the music-making process. Because the definition of translation is incredibly broad, it is necessary to focus on those that are of particular importance, either due to the magnitude of the change in they bring about, or in how they fit into a chain of translations that together create a more significant whole.

Tracking Translations: The LFO Example

The following is a simple example from my own compositional practice, that describes how particular pieces of technology were engaged with to produce a desired outcome. This delegation altered the affordances of the technological framework which in turn affected the gestural content. Here, the term *gesture* (e.g. Godøy and Leman 2010) is used to denote any sort of *movement* that might be perceived in sound, be that melodic, rhythmic, timbral, or dynamic. A video that recreates the steps described in this example is available to view online (1).

The composition was initially created entirely within a modular synthesiser setup. To provide one of the parts with more movement, the decay of the VCA envelope was manually modulated as part of a performance of the piece. Here, the envelope decay parameter being presented on a physical knob afforded the ability to do this. Unlike a virtual synthesiser, its permanence within the environment means the affordances it offers are always available, and given these affordances make it easy to performatively manipulate (at least more so than using a mouse to control a virtual knob), this activity is brought further down Mooney's (2010) spectrum of affordance.

No matter how desirable this type of performative activity might be, should more than one other parameter need to be simultaneously altered, the composer will simply run out of hands to do so, and the modulation must at least be deferred whilst other tasks are attended to. Wishing this modulation to continue uninterrupted led to the notion that an automated process could instead be used to provide it, and so a low frequency oscillator (LFO) was brought into service to do just this. Unlike my own performative technique, the LFO is steadfast in the regularity of its oscillations, which itself brings something unique to the synthesised part's shifting, dynamic shape, and in this case affords an enhanced groove to the part. The addition of the LFO to the framework I have been working within makes further parameters available for manipulation, such as the amount of the LFO signal being sent to the envelope decay, as well the rate the LFO is oscillating at. These then provide further means of interacting with the system, which in turn might encourage further alterations to it, and so on.

In this example, the initial manual movement of a knob controlling a particular parameter is assigned to an LFO. This translation, where the LFO has replaced the performed action, is also a delegation, and one which affords a different feel to the part in question. Each translation can be considered as part of a chain, with each step altering the affordances of the technology as well as the resultant sound. The newly configured framework is interacted with differently, which again provides further affordances. This example can appear rather insignificant when compared with the compositional processes as a whole, but it does provide a means to examine how this particular instrument had its gestural characteristics developed. It is these small developmental steps of adjusting, assessing, selecting, and assimilating, that make up the majority of my compositional work. It also demonstrates how the creative process is not something that materialises as a complete and consistent whole, but as something that is contingent on the affordances of the compositional framework. These affordances are altered by translations to the framework, and so it is through these very translations that the compositional process unfolds.

Tracking Translations: Rate Changing Patterns

The Rate Changing Patterns (RCP) technique was initially begun as a means to emulate a musical form used by Aphex Twin, for his track, "Bucephalus Bouncing Ball" (Aphex Twin 1997), and Roly Porter, in "Mass" (Roly Porter 2016). As Aphex Twin's song title makes explicit, these tracks utilise a bouncing ball morphology, where the pulse begins slowly and then speeds up, much as a bouncing ball will do as it gradually loses energy to each bounce, causing subsequent bounces to be of shorter and shorter durations. This can be heard in Aphex Twin's track from 3:03, and within Roly Porter's from 1:19.

Analysis of the waveform of "Bucephalus Bouncing Ball" (see Figure 1) shows that its accelerating pattern is quantised to sixty-fourth note divisions and consists of twenty pulses across what had been two bars of the track's initial tempo. Considering how this might have been produced, one possibility is that it was programmed manually within a DAW MIDI sequencer. Given the relative smoothness that the accelerating pulse speeds up with, should the composer wish to adjust the overall shape of the pattern every note would have to be manually realigned. This would not be particularly conducive to creating variations to the pattern.

FIGURE 1. Waveform of excerpt from "Bucephalus Bouncing Ball" (Aphex Twin, 1997).

Recreating this bouncing ball gesture, I wished to be able to have access to high-level characteristics, which are not typically available within a DAW. For example, were the acceleration of a pattern available to alter, this translation would afford a far simpler way of manipulating the pattern than moving each note individually, bringing this further down the spectrum of affordance. For these reasons, I chose to develop the concept outside of the traditional DAW environment.

The following is a discussion of the development of my RCP compositional technique, which took place across a number of compositions. It includes the principles behind this technique, along with how these were developed through processes of experimentation that trialled the concept. The discussion then moves on to three compositions, "Ex-metric" (3), "Modular RCP" (4), and "Antinomy" (5), each using a particular implementation of the RCP technique. Each step consisted of various translations to the system used to generate the RCP, and highlights how these changes affected the manner in which it was employed.

The first attempt was within a Eurorack modular synthesiser setup. A module consisting of two identical *rise and fall* generators was used for what will be referred to as the *control* and *trigger* functions. Whilst these rise and fall times can be adjusted manually, they can also be altered with an input voltage. The trigger function provided the signal to activate a sound synthesis module (in this case, an analogue bass drum) and so had a very short rising edge (the trigger) with the fall time then dictating how long it would take to complete the cycle and retrigger. The control function was set to a much slower fall time and was patched into the trigger function's fall time, and so altered its rate of repeat. Configured in such a manner, it was possible to create a bouncing ball morphology where the pulse would start slowly and gradually speed up over a few seconds. An online video of a recreation of this example has been created for demonstration purposes (2).

A significant implication of this implementation was that because the control function was modulating the fall time of the trigger, it had a *linear* effect with regards to the inter-onset interval (IOI) between pulses. Taken to an extreme, should the IOI approach zero, the density of repeats would approach infinity, which is a *nonlinear* behaviour with regards to frequency. The control and trigger frequencies are shown in Figure 2, with the control in blue, and the trigger in green. It can be seen how, as the blue control reaches zero, the density of triggers becomes incredibly high.

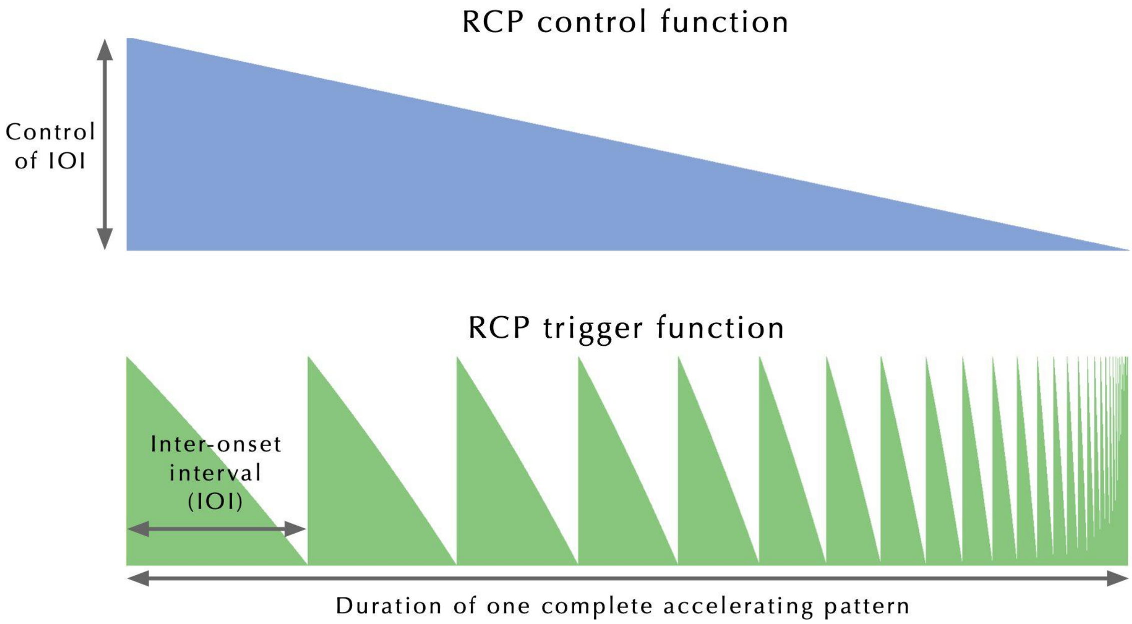

FIGURE 2. Linear control of inter-onset interval (IOI).

The function generators also had variable rise and fall curves that afforded the possibility of applying different shapes to the accelerating pattern. This would allow it to either start with a very slow acceleration which then increased towards the end, or vice versa. However, due to idiosyncrasies of the module, changing this shape also changed the duration of the cycling pattern, meaning that a minor adjustment to shape meant readjusting the other parameters to maintain the overall feel. This additional work interrupted the process to the extent that it became awkward to work with.

Despite the issues that were faced with this mechanism, it had demonstrated that the bouncing ball pattern could be recreated, so was deemed a successful proof of concept. However, due to the problems with this Eurorack implementation, I turned to the programming environment, Max. Max afforded the ability to precisely set, measure, and monitor the various signals that were in use. The move to this framework had provided an important translation that was imperative in aiding my understanding of the mechanics of the system. Within Max, a ramp generating object called a *phasor* replaced the rise and fall function used in the Eurorack example, and as with any signal within Max, it could also be displayed visually. Indeed, the control and trigger functions shown here consist of screenshots from Max. Rather than having the aforementioned nonlinear relation, phasor frequency has a direct linear response to its input signal. What might initially appear to be a simple translation from an analogue to digital environment had in fact created an inversely proportional relation with respect to the control signal.

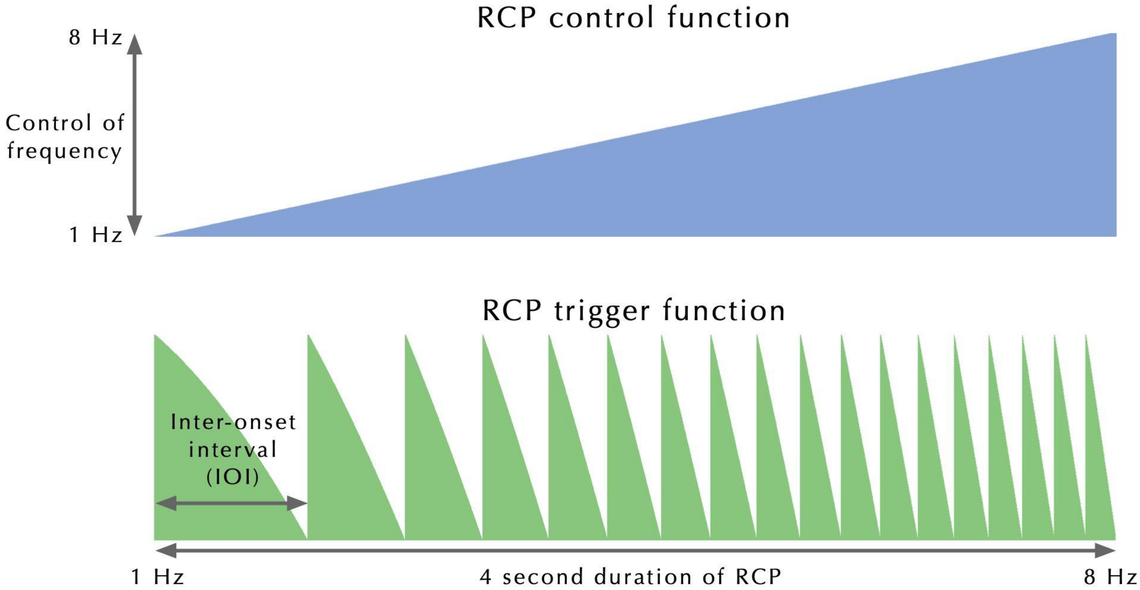

FIGURE 3. Linear control of frequency.

This difference is illustrated in Figure 3, which shows the result of the blue control signal directly modulating the frequency (rather than the IOI) of the green trigger signal. An offset has also been added to the control signal, providing an output that accelerates the trigger signal from 1 Hz to 8 Hz. Comparing the change in IOI across the duration of the trigger pattern, it can be seen that the change is far more exaggerated in the first half, whilst it is barely perceptible towards the end of the pattern, where each trigger cycle appears to have little difference between each repeat. Compare this with Figure 2, where a significant change can be seen in the duration of each trigger cycle. The result of the rate of change diminishing towards the end of the pattern was that it became less noticeable, and as such, became less engaging to listen to. It just did not sound as interesting.

Whilst an implementation could have been devised that was similar to the Eurorack configuration, the variables that were already in use afforded a simpler method to inject the desired nonlinearity: given that before any scaling, the output of the control signal moves from zero to one, multiplying this by itself (i.e., squaring it) produces a curve with similar characteristics to the nonlinear response shown in Figure 2. Raising the control signal to a power of three (i.e., cubed), or higher, increasingly alters the shape of the contour such that it is shallower when close to zero, and becomes steeper as it approaches one. Raising it to power less than one, the resultant curve begins steep and then flattens out. The various contours created by raising the control signal output to 0.5, and then integer powers between 1 and 5, are shown in Figure 4.

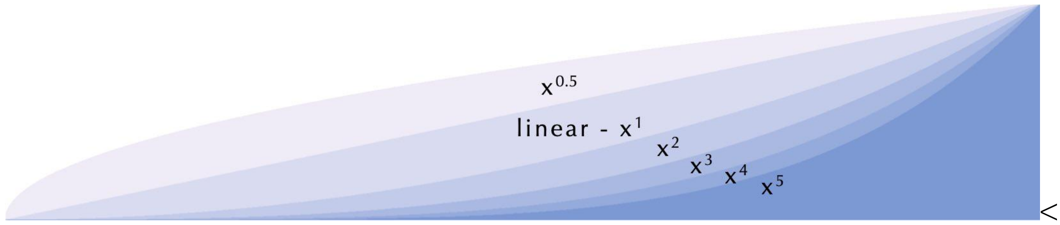

FIGURE 4. The control signal (x) raised to various powers.

This mathematical operation provided a simple method for generating variations of the accelerating pattern, which were used in an early rate changing composition, titled “Ex-metric”. Variations of the predominant rate changing pattern can be heard in an excerpt from the full track, available online (3, 02:05–02:20).

Whilst this method did allow some variation to the rate of change of acceleration, and could generate decelerating as well as accelerating patterns, I wished to have greater control over the form the RCP took. To achieve this, a more graphical style of manipulating the RCP was implemented. This translation of the system involved Max’s *function* object. Figure 5 shows the function graph with a curved line drawn between two points. Rather than controlling the frequency, this implementation has the height of the line controlling the inter-onset interval, so is inherently nonlinear with respect to frequency. The steepness of the slope of the line is proportional to the rate of change, so in the example shown, reading from left to right the rate of change begins slowly, and then speeds up towards the end of the line.

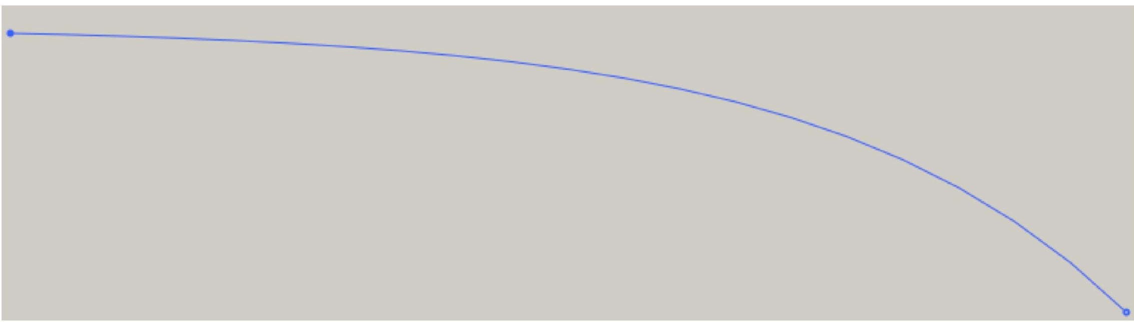

FIGURE 5: Max function object used to draw the RCP contour.

This graphical translation to the generation of the rate changing pattern afforded complex editing through a simple click and drag interface. Where the previous design only had numerical input for start and finish values and so only had the rate of change moving in one direction, the graphical version allowed multiple points to define different sections of the contour, allowing the rate of change to be altered from section to section. This now meant the pulse could also speed up and slow down within a single RCP contour. Whilst this type of complex curve *could* have been constructed using the previous mechanism, this type of activity had now been brought much further down the spectrum of affordance. In this sense, although the system was redesigned through human agency, it is the nonhuman agency of the RCP system itself that led to significant experimentation with what it could achieve.

The function object required a multiplier to convert the output to useable time values, which was soon adopted as a performative parameter. This allowed the overall density of onsets to still follow the contour, but for the value generated by this to also be adjusted in real-time. Whilst a simple multiplication would not generally be considered as a translation (it is after all entirely predictable and has no effect that requires an actor), here, the fact that this presented a *variable* that could be accessed and altered, led to a new technique for interacting with the rate changing pattern.

The Max patch was ultimately used for a composition that had several instances of the RCP generator triggering a Eurorack modular system. Melodic lines were provided by step sequencers that advanced through their patterns upon each trigger from the RCP generator. A sixteen-step melody would take sixteen consecutive triggers to play the entire pattern, irrespective of the time it might take for those sixteen triggers to be generated. Given this disconnect between the onset and melodic patterns, this resulted in gestural shapes that would not necessarily repeat themselves, nor would one melodic part stay in the same harmonic relation to others. The piece of music that resulted was rather freeform, titled "Modular RCP", often lacked a solid tonal centre, and due to the improvised performative nature of the piece it was also somewhat meandering. An excerpt from this composition features an example of the manually modulated rate changing pattern. This can be heard in the repeated eight-note phrase, played by the part in the upper register (4, 3:10–3:40).

The next significant advance (and translation) for the RCP technique utilised Max for Live, which is essentially a version of the Max programming environment that integrates with, and operates within, Ableton Live. The RCP contour could now be synchronised to play over a specific duration, controlled by Live's transport. This synchronisation became an incredibly important factor in the development of the compositional approach, since it was now possible for a sequenced MIDI clip to play a series of notes triggered by the RCP. Given the MIDI sequence and RCP contour could remain locked in the same temporal relation, the resultant melodic form could be reliably repeated, which afforded it to not just be edited, but edited with a precision that was not previously possible.

Given the graphical method of editing the contour allowed multiple points to be set within the contour: its shape took on greater complexity, and synchronisation meant that it could now be edited such that it would follow the sequenced MIDI notes. Figure 6 shows two screenshots, one of the RCP contour, and the other of a MIDI sequence being triggered by it, each being sixteen bars long.

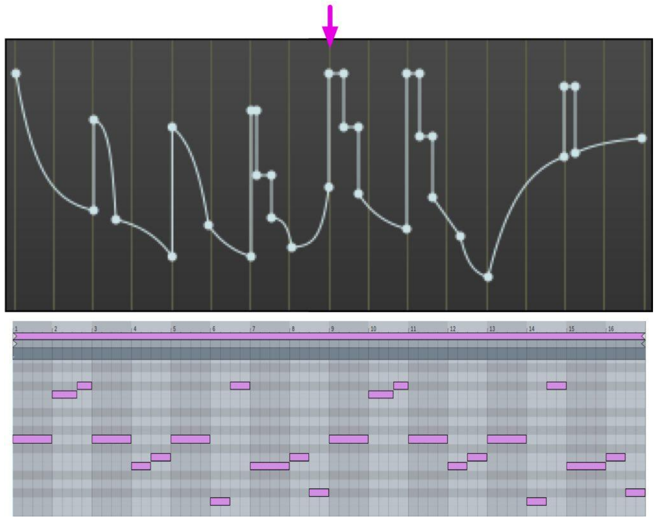

FIGURE 6. Function contour shown in synchronisation with MIDI sequence.

The RCP could now be programmed such that a particular part of the contour would always play with its respective set of MIDI notes, and this resulted in particular gestural features. One example of this was to have the RCP suddenly increase the IOI every two bars. A pronounced version of this is marked by the pink arrow in figure 6, where the RCP contour can be seen to make a sudden jump upwards, resulting in the RCP pausing for a moment before outputting the next trigger. A short online video demonstrates the contour being played through with sound generated by the synthesiser it is triggering (6).

This implementation of the RCP technique was ultimately used in an introduction to the composition "Antinomy" that began with the RCP following the contour shown above, but over the duration of a couple of minutes was altered to take on the rhythmic characteristics of a metric version of the same harmonic progression. The programmed manipulation of the RCP transformed it from what could be described as a rather languorous rubato, to an upbeat, tightly quantised rhythm. The transformation of the RCP into the metric version can be heard in an excerpt from the full track (5, 02:53–03:16).

The RCP Max for Live device had to be taken through several modifications to allow this transformation to take place. If the RCP contour is considered, implicitly, as a delegation from the composer to the computer, it can be seen how further alterations to the system can also be considered as translations. Whilst I had hoped to find a simple means of changing the rate changing pulse to the desired metric rhythm, it in fact involved a number of methods being employed simultaneously, and each of these translations provided its own means of interacting with the RCP, and hence its gestural output.

The ability to change the overall density of onsets could often result in the trigger rate becoming far too fast for the DAW to cope with and would cause the sound to break up or cease completely. To prevent this, an offset was added to IOI generated by the contour, which meant it could not repeat faster than this value. At some point, this offset began to be used as a preset value that could be easily and precisely returned to as part of the performance of the RCP. Setting this offset to a value that was metrically related opened up a means to have the RCP move from following the contour, to a steady metrically related pulse. Ultimately, this flattening of the trigger rate led to an *actual* flattening of the contour, where it was morphed from the rate changing shape, to a flat horizontal line, giving the same effect. To then achieve the metric rhythm, a delay was implemented that acted on certain onsets within a repeated pattern. By continually increasing this delay, the affected onsets eventually reach a metrically related position, and a new metric rhythm is formed. In summary, to move between RCP and metric patterns, the effect of the rate changing contour is first reduced to nothing, and then certain onsets are gradually delayed until they reach the positions that formed the desired metric pattern. Whilst both of these methods were programmed to provide very specific transformations of the onset pattern, these parameters were also under performative control, and the translations to the system became the means to interact with it.

Conclusion

The development of the RCP technique that has been described through this series of translations did not take place in the easy fashion that this paper could be seen as presenting it in, but in fact happened in fits and starts over approximately a year's duration. The concepts that were being dealt with were often not understood well, but working within Max, every parameter was available to set precisely, monitor, and be represented in a variety of visual forms, and this was imperative to an understanding the underlying mechanics of the problem. In this sense, it can be considered that the translation to the Max environment supported a translation to my conceptualisation of the RCP mechanisms.

As these mechanisms were developed, their altered affordances provided new ways of working, which in turn led to further development to the mechanisms as well as insights that gave an improved understanding of them. Where the first composition "Ex-metric" had a rather static harmonic structure with little to no development, the "Modular RCP" composition provided a meandering progression, with only a vague tonal centre. Once the later iteration of the RCP technique allowed note pitch and RCP onsets to be programmed independently, the complex harmonic development within the composition "Antinomy" became possible. This would have been very difficult to achieve using the earlier iterations of the RCP mechanisms, but developments to the framework brought this further down the spectrum of affordance, and hence encouraged engagement with it.

For reasons of brevity, I have omitted many of the missteps and dead ends that occurred during the development of the rate changing patterns technique, but through having identified some of the salient translations, I hope to have shed some light on how the compositional process evolved, and where its important turning points were. Whilst this has been a very technical account of my practice, this was intended to show how the technology has frequent and significant effect on the compositional process, and in doing so becomes an actor within the network formed of myself along with my chosen tools. The composer might decide upon the compositional direction as the composition itself unfolds. Here, this activity is not confined to the harmonic structure, rhythmic patterning, or timbre of the music, but is extended to how the composer engages with the music-making environment.

The composer explores the possibilities that are afforded by the technology and might alter it to bring a certain affordance closer to reach or alter the musical objective to better fit what the tools afford. Identifying the moments of translation within this ever-evolving network helps to understand how and why it developed in the way it did, and in doing so, provides a perspective on the processes of music composition.

Endnotes

1. Link to online video – Using an LFO to Modulate Decay: https://vimeo.com/761514480
2. Link to online video – Recreation of an Early Experiment in Eurorack RCP Implementation: https://vimeo.com/761517514
3. Link to online streamed version of the rate changing patterns composition, *Ex-metric*: https://soundcloud.com/sub-harmonic/023-ex-metric, excerpt (02:05-02:20)
4. Link to online streamed version of the rate changing patterns composition, *Modular RCP*: https://soundcloud.com/sub-harmonic/036-modular-rcp, excerpt (03:10-03:40)
5. Link to online streamed version of the rate changing patterns composition, *Antinomy:* https://soundcloud.com/sub-harmonic/038-antinomy, excerpt (02:53-03:16)
6. Link to online video – A Playthrough of the Rate Changing Pattern Contour: https://vimeo.com/893065137

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