

# numerical sound

## archaeological sound engineering

## DNA Groove Templates as they relate to Drum Loops

Includes an analysis of a Phil Collins Drum Groove

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What follows is a discussion of groove templates and how to apply them as a tool to humanize midi sequences. An analysis of timing of a drum performance by Phil Collins is included to illustrate the complex subtleties of real world acoustic performances.

To help generate this subtle feel most midi sequencers have added a groove quantize feature to their programs to assist the midi composers in duplicating the element of human feel. Rather than simply quantizing or playing sequences in perfectly an alternative is available through Numerical Sound and WC Music Research, it is a type of groove template based on real world performances called DNA Grooves Templates.

## Sequencing History

As sequencers evolved in the late 80's the timing resolution as defined as the number of clicks per quarter notes rose from 24 and 96 clicks to 192,384 and 480. This was truly a breakthrough, allowing individual style, feel, and the groove of a musician to be recorded with greater accuracy. Even with this higher resolution, most users, acclimatized by now to the rhythmic perfection of the drum machine, still quantized. Quantization had become an absolute necessity in sequencing. The bottom line was convenience. It reduced the number of takes an average musician had to make to one or two. This time saving factor entrenched quantization into the core of the sequencing process in the 80's. Musicians were given two stark choices, to quantize the performance or play it in right in one or two takes.

By the late 80's and early 90's many musicians started to look for other ways to incorporate feel into their midi compositions. One popular technique was the use of drum loops in midi sequences via a sampler. What was interesting is that most of the popular drum loops were real acoustic performances pre the drum machine era (before 1978).

There were several factors that helped contribute to the widespread use of re-sampled acoustic material - especially drum loops. The timing in a drum loop is not quantized but has small signature variations in the timing of each drum element. The need for an alternative to

quantization became even more apparent as sampled acoustic drum loops were mix in with midi sequences.

## What DNA Groove Templates Are ?

Groove Quantization allows for the movement of notes to a predefined grid. Each point in the grid is defined as the number of clock pulse (ticks) ahead or behind the groove event is relative to the quantized point. To create a certain feel , it is not uncommon for a composer to move notes individually. Applying a DNA groove template is an efficient way to create a feel. It's feel is "real" because it is based on real human performances. For example if you want to create a feel with Beat 2 being late by 20 ticks and beat 4 to be early by 15 ticks then create a groove template with these qualities. Regardless of how the drum track or any other parts are played in if you apply your groove to the snare and say bass parts then all the bass and snare beat 2 events that exist will be late by 20 tick and the all the beat 4 events will be early by 15 ticks.

## Groove Example

The first 12 bars of the Phil Collins song "Just Another Story" from his CD Dance Into The Light was sampled into the computer. The first 2 bars are shown in fig 5. The loop is then processed with a proprietary process to expose its rhythmic foundation as you can see in Fig. 6. This process is done for each instrument in this example the hihat, snare, kick and bass. The result is a precise series of timing points for the rhythm. The combination of this series of points for each instrument (drum kit and bass) represents the groove part of this song.

Groove Timing of the HiHat in Phil Collins Just Another Story

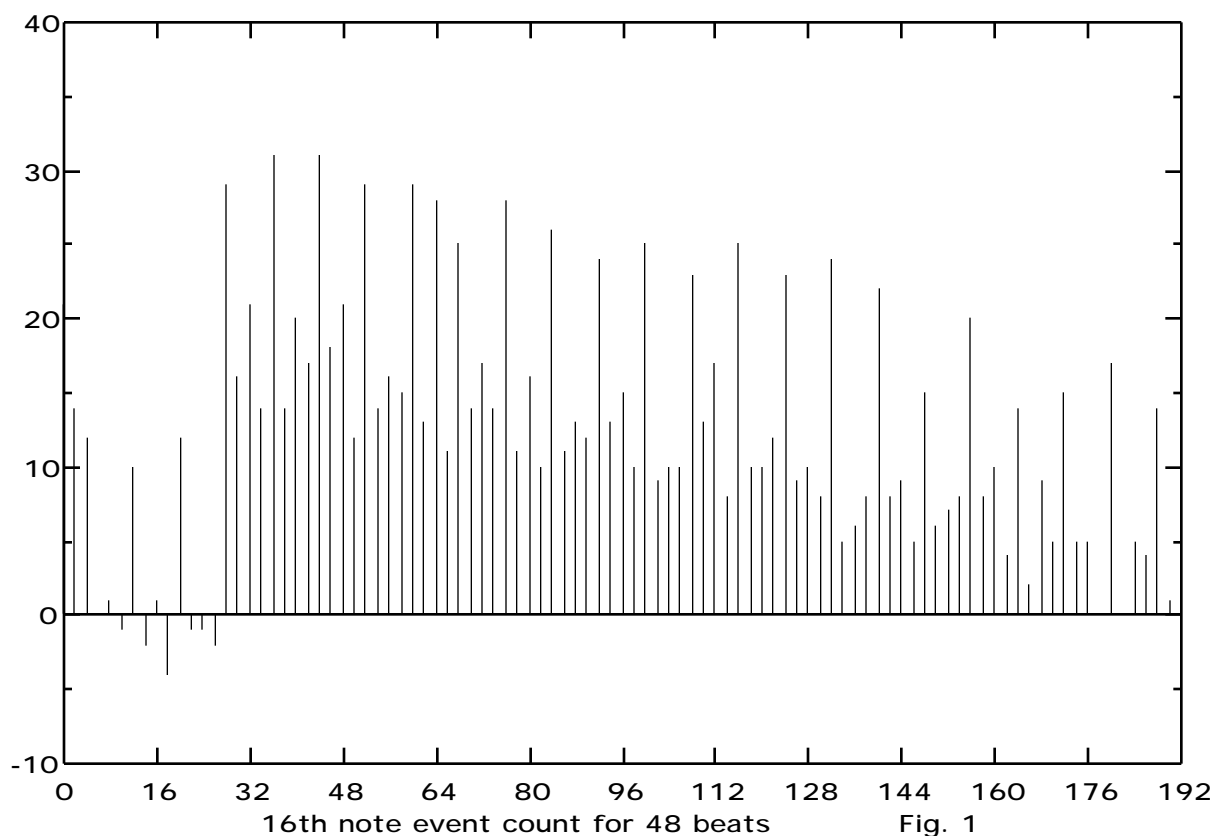
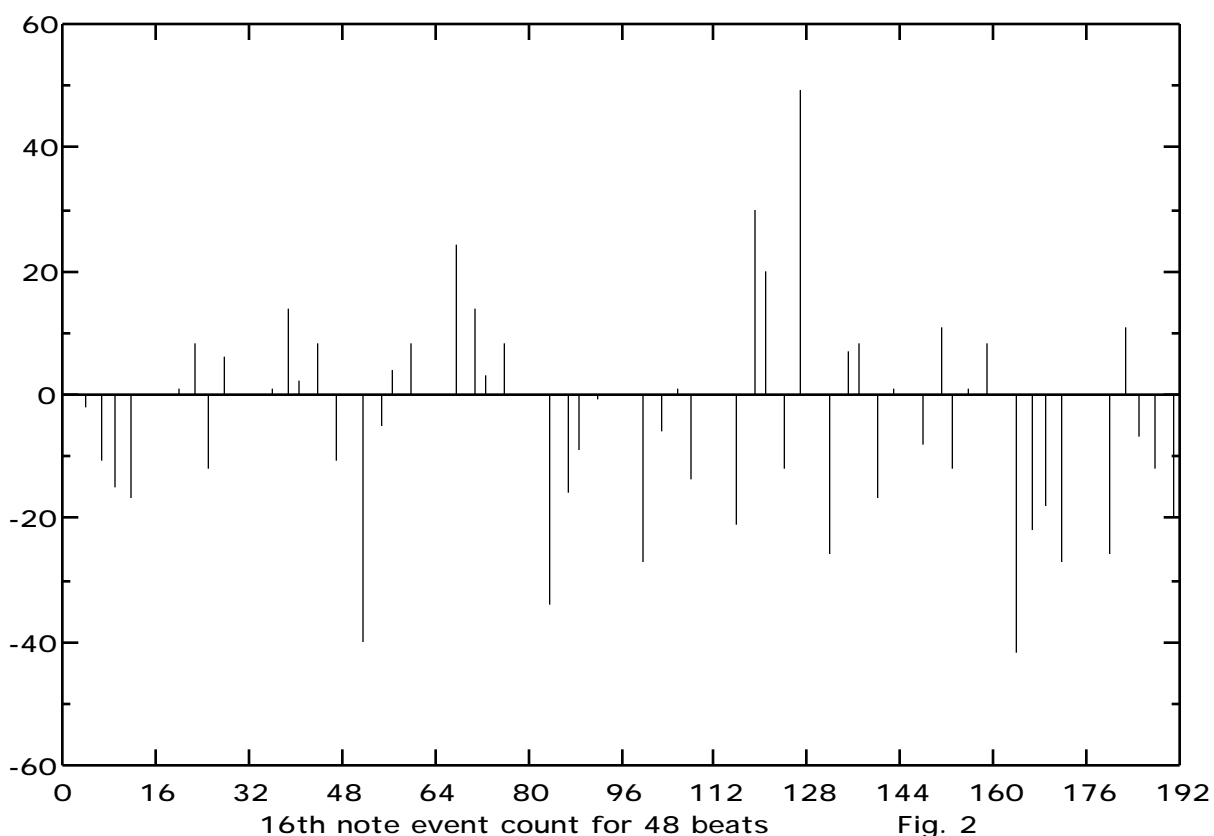


Fig. 1

If we graph a quantized performance it would simply be a straight line along the horizontal axis, however, real performances have an incredible variety of timing variations as you can see from the Figs 1 to 4 from the first 12 bars of the Phil Collins drum performance. The vertical axis has the timing variation in units of a 1000 per beat or quarter note. Thus the downbeats would be 1000 2000 3000 .. to 48000 . If you include 16th notes then the sequence would be 1000 1250 1500 1750 2000 2250 ... If Collins' snare plays behind the beat at 2020 units then the timing shown on the vertical axis on beat 2 is 20. If he plays ahead of the beat at 1940 the value at that point is -60. The graphs illustrate the timing difference relative to the quantized points. To calculate the timing in sequencer ticks simple multiply  $(ppqn/1000)*value$  from the graph. If you sequencer has 480 ticks per quarter note then 20 units late would result in  $20*(480/1000)=20*0.48=9.6$  tick late.

### Groove Timing of the Snare in Phil Collins Just Another Story



This section of music is composed of 12 bars of 4/4. The tempo per quarter note is 84.858 bpm, resulting in every quarter note being 0.707 seconds long.

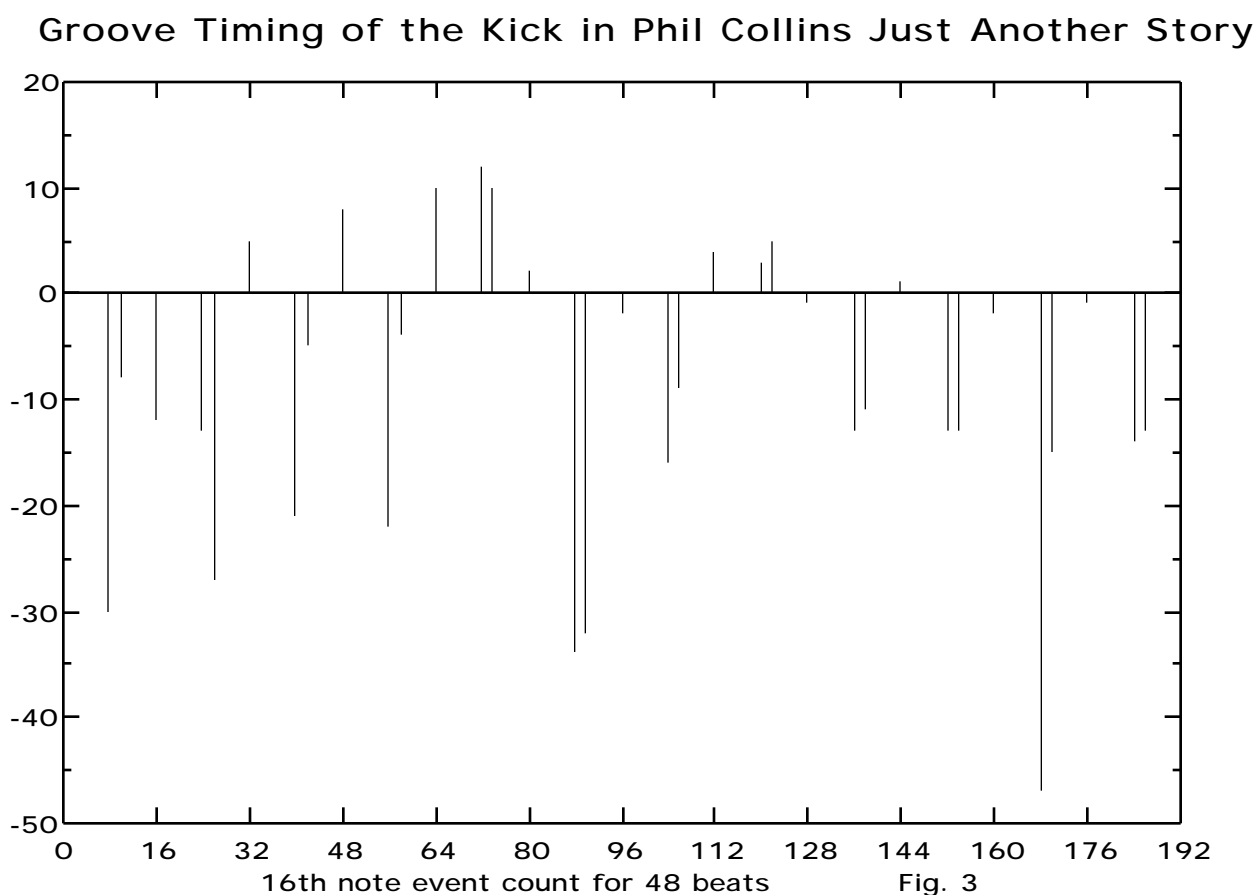
As you can tell by observing the feel charts there are specific timing or feels patterns with different patterns for each instrument. Look at the hihat in fig 1 with its overall shape of a beginning, middle, and end. A clear graphic representation of a music phrase. Timing is an very important element used by great musicians in their performances. Also notice that each instrument's (fig 1-4) feel chart has its own unique feel pattern and no two are the same.

Another very important feature in this groove is when two drum sound are played together. For example, the kick and hihat or the snare and hihat, show small timing difference between

there attacks (typically 10-30 milli seconds). The hihat is noticeably and consistently behind the beat and the snare is closer and tighter to the beat, the kick is ahead of the beat and also closer to the beat. The kick and snare are closer to the metronome beats but rarely conflict with each other because they are seldom played simultaneously. I have seen similar characteristic in other great drummers such as Bernard Purdie and Clyde Stubblefield.

When the attacks of two drum sounds happen simultaneously they fight (flange). If they are not precisely played simultaneously then each attack can breath and is not unduly infringed upon by each other. Notice in the feel chart of the hihat that there is a shape which it is not a smooth shape there are plenty of micro details. Great drummer such as Phil Collins do this on the fly. To recreate this feature almost every midi note must be edited. Note if the next 12 bars were analyzed they would have similarities with the previous 12 bars but would also have some different timing features. So no copying and pasting midi sections if you want an acoustic feel in your composition.

Although subtle timing is important the strength at which the drummer hits the drums also effects the outcome. A lighter touch gives a different sound to the drums. When the snare



and hihats are hit too hard they go into overdrive, meaning they have stronger low frequency components and the transient of each hit lasts longer. Playing forte increases the likelihood that the various transients will fight with each other for space. Using samples played softer. It will help your music breath especially in busy or complex passages.

This analysis of a passage from a Phil Collins' "Just Another Story" illustrates the vast amount of subtle timing detail evident in any good acoustic performance. To apply these

## Groove Timing of the Bass in Phil Collins Just Another Story

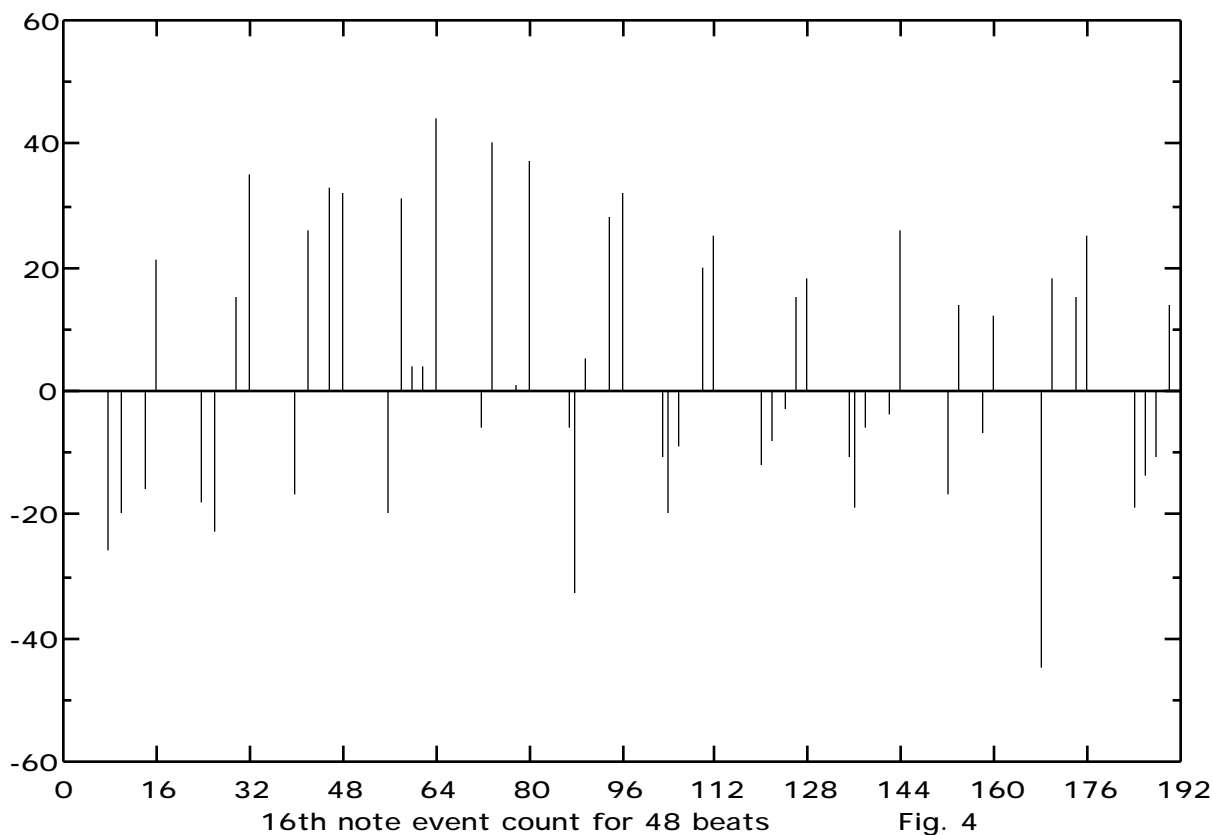


Fig. 4

## Original Waveform in Phil Collins song Just Another Story

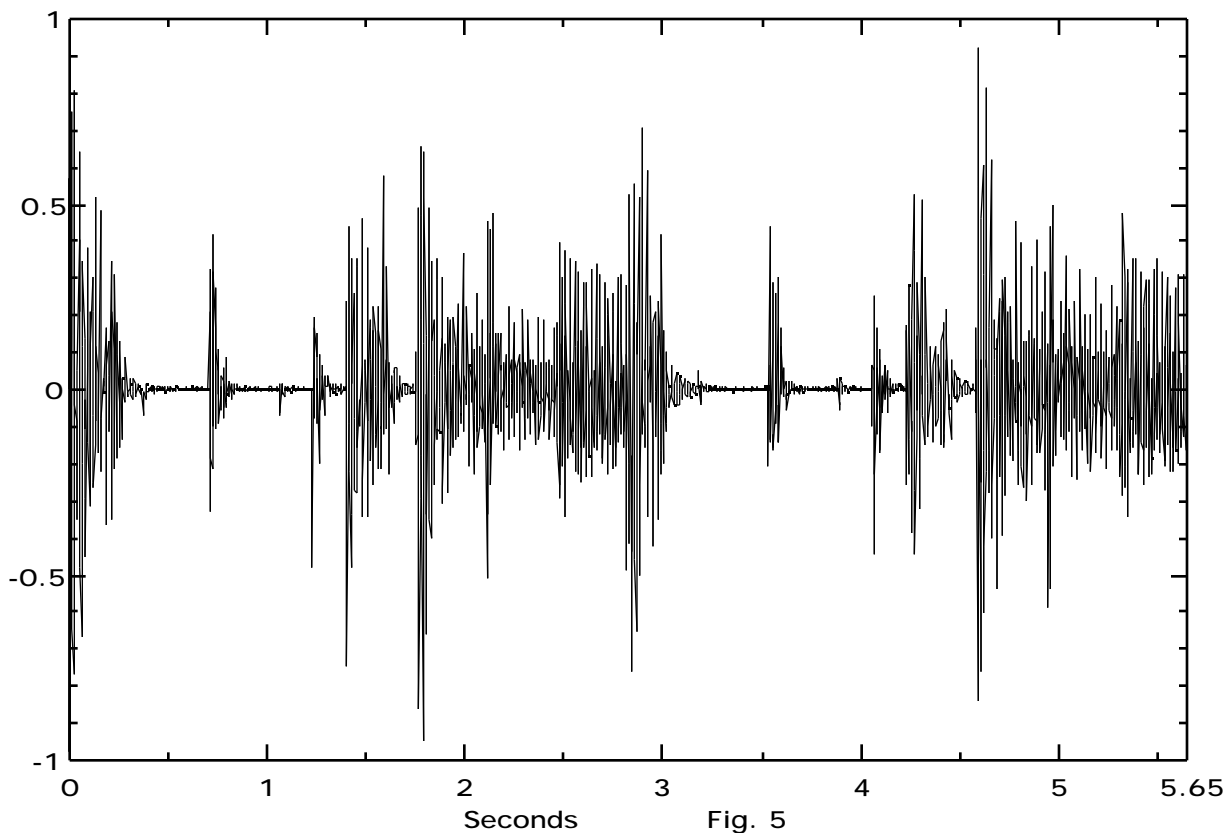
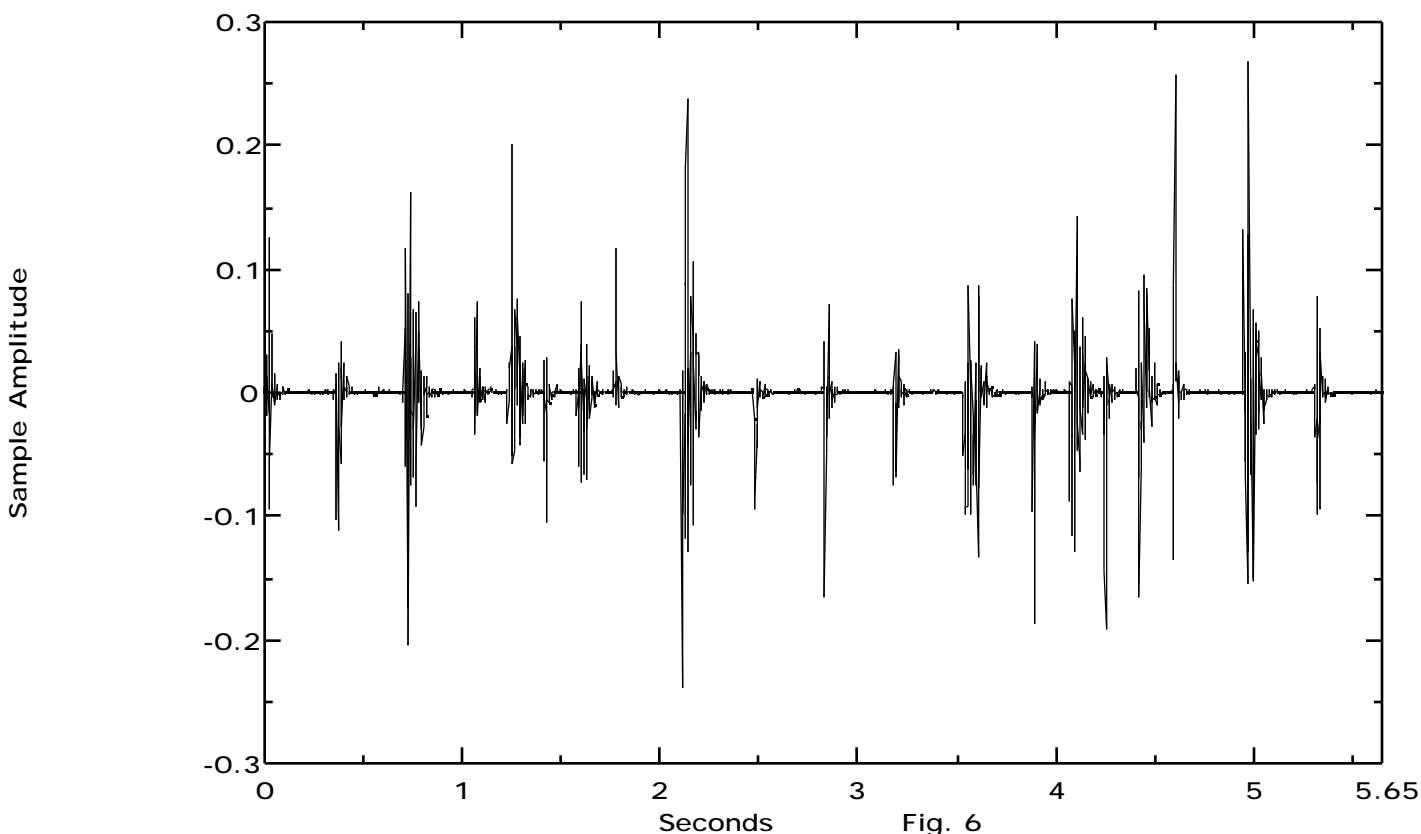


Fig. 5

acoustic traits to your midi sequence use DNA groove templates. They can be used to adjust the feel of any midi instrument. Apply a different groove template on to each instrument of your song and change them subtly through the course of your song (no wholesale copy and pasting sections of music). For the hihat track apply a groove then shift the track a couple of ticks to simulate the behind the beat hihat feel as in fig. 1. Make sure that instruments do not

### DNA Waveform in Phil Collins song Just Another Story



fight with each other because of similar attack times, especially if they occupy similar parts of the music spectrum. For example if you add a tambourine to a track with a hihat already playing 16th notes then apply a harder shuffle and a different groove to the tambourine so that each sound can blend and coexist with the other.

## Creating a Groove Template

The timing ratios of each drum element and bass (fig 1-4) are used to create each groove template(s). Often not all the events of a groove are defined - some 16th or triplet notes are missing due to this a further analysis of the groove timing parameters is done and the missing notes are filled in with a consistent feel. Once a groove template is created then a user can access the feel of a real acoustic performance by applying various grooves to various passages of his/her music.

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