2. Looping Technology

This chapter will outline the technical capabilities of a selection of hardware and software devices and look at how these devices can and have been used in various contexts.

I. Basic Functions

The most basic function required of a looping device is the ability to record and play back live audio. Many devices offer a number of Jack, XLR, Phono inputs, most accept line level inputs and a few offer 3.5mm Jack input. This enables the looping from microphones, instruments and other audio devices such as CD players. Outputs are often the same connection type as the inputs and some devices offer stereo or multiple outputs.

The next basic function is the ability to overdub or add more layers to the loop. This will retain the audio in the first loop while adding additional audio. Sometimes due to the way in which this audio is re-recorded degradation can occur after a number of overdubs and this method, known as the feedback loop, can result in the amplification of troublesome or undesired frequency feedback. Pedals that just offer these two functions are often primarily delay units such as the Boss DD-6 and DD-20. The multiply function works in a similar way to overdub except that you can record new loops that span over multiples of the original, so you could play and subsequently loop over two or more repeats of the first loop.

2. 2

The following is a common method for recording and overdubbing loops on a simple device:

1. Start recording loop at 'a'

2. Start playback of loop at 'b'

3. By pressing the record button at 'c', anywhere before 'd', recording of the first overdub begins at 'd'

4. Overdubbing continues recording, layer-by-layer, until the record button is pressed again at 'e' and the loop plays continuously until stopped
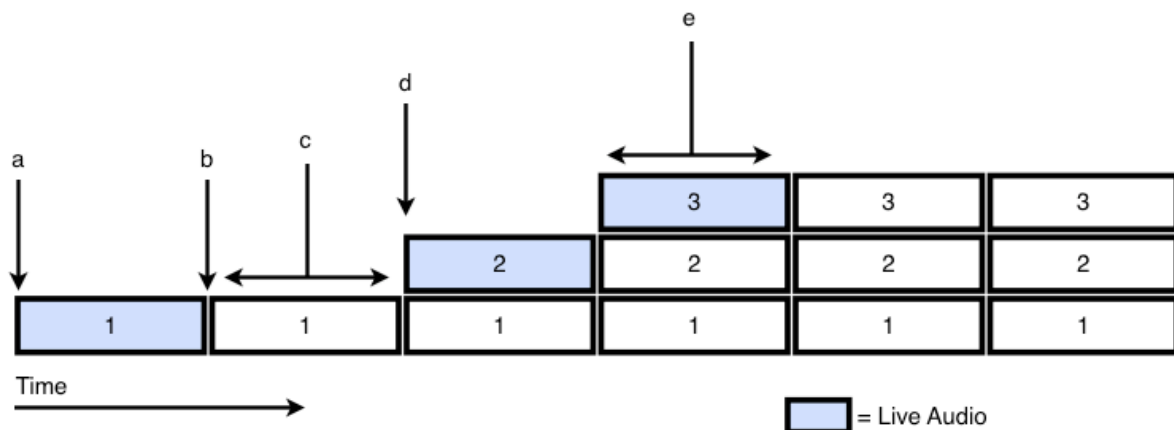

Fig 1.1

During recording and playback of loops, audio from the instrument is constantly output live through the device. This means that while a recorded loop is playing the instrument can be played over the top without affecting the recording until the record button is pressed again.

The simplest loop pedals work in a similar way to original magnetic tape looping. An overdub is achieved by feeding the first loop back into the recording of the overdub, along with the new live audio. The overdub then becomes one single loop in its own right, incorporating the previous and new audio. This method is similar to 'bouncing' tracks in multi-track recording.

The reverse feature is fairly self explanatory, giving you the ability to reverse a loop of audio. The implementation of this function varies from device to device but is usually in common with the Gibson Echplex Digital Pro, which allows you to reverse a loop as soon as you loop it for the first time, and then do the same with a second loop which puts the original loop back to its original direction while the second layer plays backwards and so on. Another common feature is the half-speed function, which will alter your loop's playback to half its original speed, taking the pitch down with the speed. Some devices also offer time stretching and manipulation without altering pitch.

A quantise function gives the player the ability to have their actions occur in time with a built in metronome, so if the record button is pressed just before the start of a new bar, it will start recording as the new bar begins, the same goes for ending the recording and any other actions. Quantise is normally specific to either a bar or a beat.

II. Basic Hardware Looping Devices

Two of the more affordable devices I will look at are the Boss RC-20 and Line 6 DL-4. From two major guitar effects manufacturers, these pedals are widely used by guitarists and bassists but have also found singers, cellists, saxophonists and many other types of musician as users.

Boss RC-20 and the RC Series

The RC-20 was released in 2001 by Boss. It has 5.5 minutes of total recording time which can be divided into 11 separate loops or "phrase tracks". It also offers overdub, reverse and quantise. The device is not designed for advanced looping capabilities in realtime

performance but offers a good insight into basic looping functions and is most useful for practising. [1]

There are two other devices in the RC series. The RC-50 is the next step up offering added features such as undo/redo and updated memory offering 49 minutes over 99 phrase tracks. The RC-2 is a compact version of the RC-20 (occupying a single standard boss pedal footprint instead of more than double that) aimed as a complimentary tool for a guitar effects rack. Although ranked sixth in usage (30% Straschill 2005), four places below the DL-4 (42%), the RC series are great basic looping devices used by many musicians that don't substantiate their work with looping.

Line 6 DL4

The DL-4 is primarily a digital modelling delay device. Released in 1999, it quickly set a standard for affordable hardware looping devices. Line 6 are renowned for their digitally emulated versions of classic equipment, the DL-4 is no exception emulating tube, tape, multi-head, sweep, analogue, stereo, ping-pong delay and more as part of their Digital Modeler Effects Pedal range. The 'Loop Sampler' is a rather different feature of the unit utilising its built in memory, modelled on the Boomerang Phrase Sampler. The unit has the main features of record and overdub but also offers reverse, half-speed and play-once (one-shot). It offers 14 seconds of recording memory, into one memory bank but does not allow the storing of loops.

These two devices are still manufactured today and are available for around £150-£250 making them very affordable devices (Google Product Search - 24th April 2008). This

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[1] 2004 saw the introduction of the RC-20XL, raising the specification of the RC-20 to 16 minutes of recording time and giving the ability to stop loops immediately with one foot press.

basic form of looping technology can be applied across the board to nearly all types of music. The method described in Fig 1.1 gives the basic premise for how this technology can be implemented. Here is one example of how it can be implemented in a slightly different way.

The following can be achieved with either the RC-20XL or the DL4 or any device that allows record, overdub and stop/start.

Song Style - Solo Performer - Guitar and Vocals with Basic Loop Pedal

Introduction	Record a 'hook' loop that can underpin chorus. Guitar or Vocals
Verse 1	Stop loop, play and sing verse 1
Chorus	Play loop, play and sing chorus
Verse 2	Stop loop, play and sing verse 2
Middle 8/Bridge	Play loop and add more layers and/or sing
Chorus	Continue loop, play and sing extended chorus
Outro	Play loop on its own and fade with volume control

III. Advanced Hardware Looping Devices

In this section I will look at the technical possibilities of the Gibson Echoplex Digital Pro, the Electrix Repeater and the Looperlative LP1 and explain their usage by looking at artists that currently use these devices.

2. 6

Gibson Echoplex Digital Pro

The Echoplex was first introduced in 1994 as the Oberheim EDP, in 2001 it became the Gibson Echoplex Digital Pro and in 2003 it became the Gibson Echoplex Digital Pro Plus.

One feature of the Echoplex that is also inherent to digital delay devices is the feedback control. This control acts in the same way is it would on a delay or echo device, when set to 100% the repetition of audio continues and does not fade. When set to anything less, the repetitions slowly fade in volume, or quickly fade if the value is low enough. 0% feedback would give you no repetition at all. There is also a mute function which allows you to silence your loop without stopping it and then un-mute it later on without altering the loop at all.

The undo feature of the Echoplex is more advanced than the simple pedals in that it allows you to undo more than one layer, depending on how much of the memory is used up. Rather than always giving you the option to undo, available memory is used to store previous versions of loops, therefore undo cannot be used if more than half the memory is used but, for example if a loop only takes up a third of the memory available then you can undo two previous overdubs as there is enough space to store two other versions of the loop.

Additional to overdubbing is the multiply function which, as previously described, enables new loops to span over multiple repeats of the original. This function is important and useful when loops become an integral part of a musician's work as it allows more development to be explored. The implementation of this feature on the Echoplex utilises a similarity to the quantise feature also previously described. As the Multiply button is

pressed for the second time, restarting the new longer loop, the restart doesn't occur until the completion of the last original loop cycle. By using the 'RoundMode' feature you can also decide whether or not the audio that you play after pressing the Mutliply button for the second time is included or not. Andre LaFosse mentions this on his personal web site when talking about the Echoplex:

> *"Building loops off of relatively small initial cycle lengths is a favorite technique*
> *of mine, largely because it offers a powerful and effective way of breaking out of*
> *a lot of the standard conventions (or "traps") of loop-based music"*

There are a number of different 'modes' that the insert function can have. InsertMode=Insert is the default and lets you insert a cycle of audio that is of the same length of the original cycle into the loop, playing at the same start or end point as the original or not depending on the quantise setting. With InsertMode=Replace you can replace any length of the original loop, dependant on the quantise setting. The following diagram is from the Gibson Echoplex Digital Pro User's Manual (Fig 4.1 Pg 111), utilising the insert function without quantise:
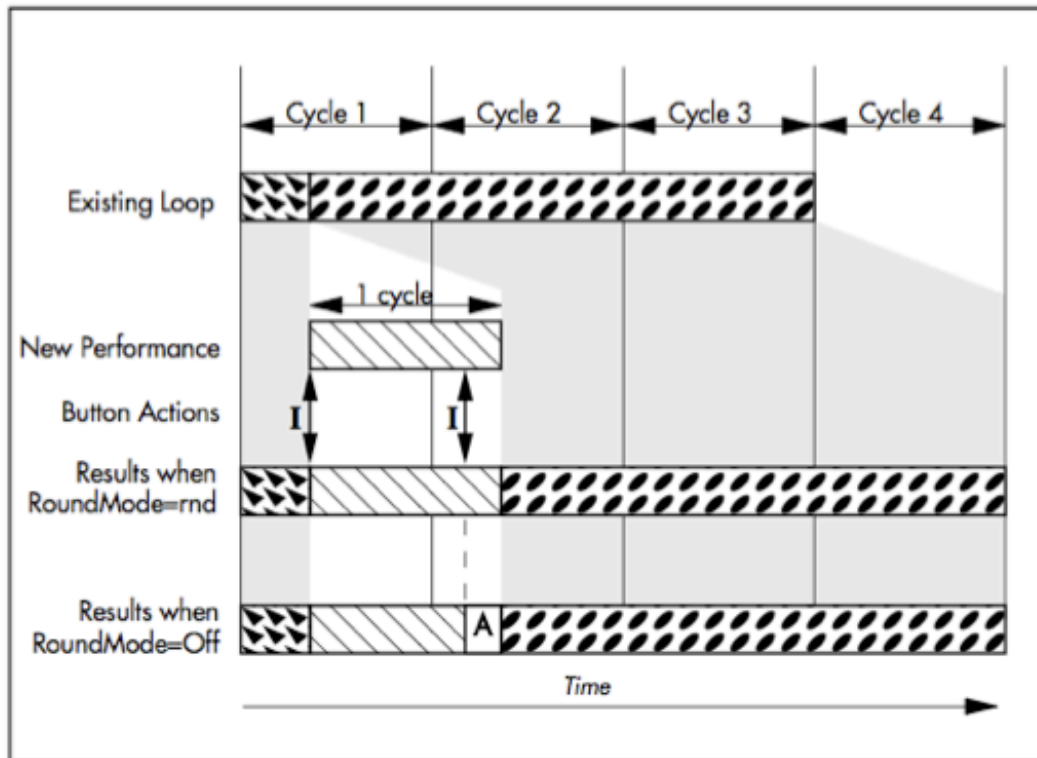
Fig 1.2

These are some of the features that set the Echoplex apart from basic devices but there are many more features and possibilities.

Andy Butler

Andy Butler is a guitarist who has been using the Echoplex for many years now and has released an album called 'livelooping' as well as organising the Norwich Live Looping Festival. I will take a look at the introduction to one of his tracks, Ro-Sham-Bo to give a demonstration of how some of the Echoplex's functions can be combined to create complex structures. [Track One on Accompanying Audio CD]

The track starts with an opening riff (1) that is 12 beats long, this is then repeated once on its own. Then over the first 4 beats of the third repeat, a second line is added (2). At the end of the fourth beat, the 4 beats containing the first and second lines is reversed (1REV/

2REV) and played back in reverse 2 times. On the third repeat of the reversed audio a
third line is played over the top (3) as the first 12 beat phrase is brought back after the third
beat of the reversed loop. Hopefully this diagram will make it easier to understand:
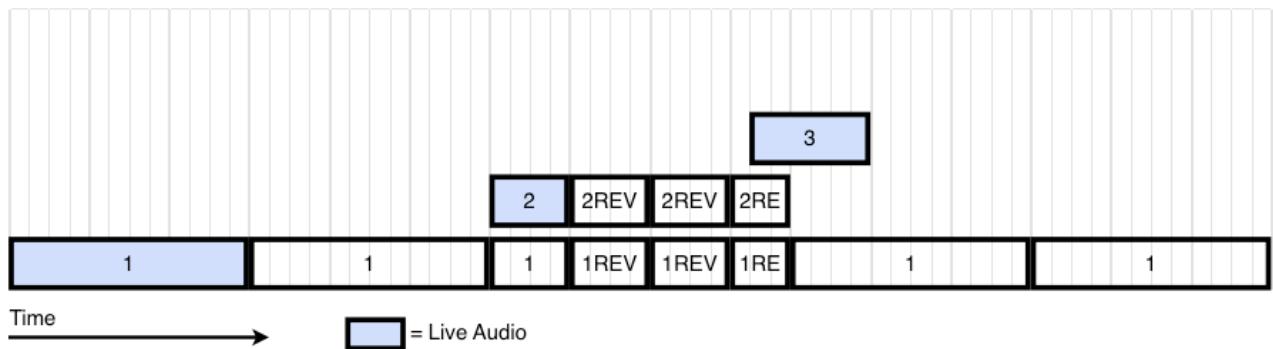

Fig 2.1

Butler utilises the functions of an upgraded version (LoopIV) of the software contained in
the Echoplex. With this software, many more complex techniques and procedures can be
implemented. In this example, Butler uses a method called 'Reverse Sniplets' in which a
shorter period of audio can be extracted from the original, placed into a new track, added
to and subsequently reversed instantaneously.

There are a number of key techniques used in just this short period of music (13 seconds).
Firstly, moving from a 12 beat loop to a 4 beat loop and then back again instantly creates
an interest far above that of the repeat of a 12 beat loop, breaking the loop cycle and
avoiding the pit falls of monotony often associated with loops. Secondly, the use of the
reverse function in such a fluid manner enables a short deviation from the main phrase
which gives the listener the feeling that the music is going somewhere but is also pinned to
the original phrase as it is replayed. Thirdly, the use of a bridging phrase that anchors the
two sections as the original phrase comes back in is an excellent method to establishing
real fluidity over the musical changes. This exact structure is repeated four times with
varied notes and harmonies until a new idea is introduced.

Andre LaFosse

The second example I will give is by Andre LaFosse, this information can be found on his website. The example used is an excerpt 'Echoplex Solo' from the track 'Disruption Theory'. [Track Two on Accompanying Audio CD]

The solo begins with a very short loop of 1 beat at 180bpm (1). Then with the insert function this loop is expanded with an extra cycle of audio (2), creating a longer loop (1 + 2). This loop is then multiplied to last twice as long (1 + 2 1 + 2) so that long overdubs can be added (3 and 4).
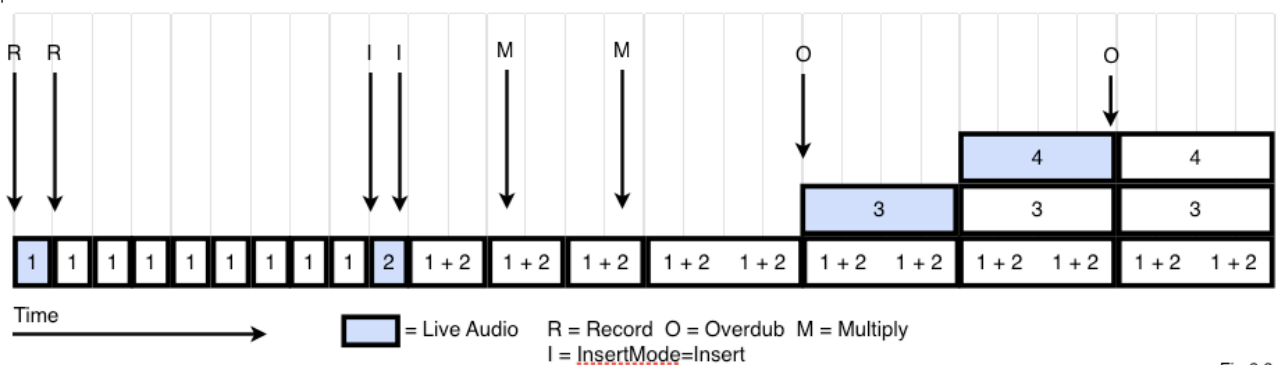

Fig 2.2

LaFosse keenly uses short loops as building blocks to expand into larger complex loops. He has gained notoriety for his original approach and it's easy to see why when you compare this structure style with the style associated with simple looping devices. The method described above is not far from a miniaturised version of that achieved in the 'Song Style' example given earlier. The interest here is that it happens very quickly, meaning that the audience has a much harder job keeping up with the changes which results in their interest not straying.

These methods of looping put the technology right into the fore-front of the music. Here the technology is being *played* as much as the instrument that's played through it.

Electrix Repeater

The Repeater, released in 2001 and discontinued in 2002, shares many features with the Echoplex but also offers multi-track looping. It allows four separate loop tracks to play simultaneously and all four can be controlled independently. Another major feature of this device, that is also shared with the Echoplex, is the ability to control its functions via MIDI signals. These MIDI signal can be sent from other hardware devices such as foot controllers or from a computer enabling sequence control over the devices. Multiples units can also be linked together to operate in sync. The Repeater also offers the ability to trim, pitch shift and time stretch loops after they've been recorded.

Looperlative LP1

The LP1 is a very recent device and is currently backed only by the creator, Robert Amstadt. The unit is similar to the Echoplex and Repeater in all the advanced looping features and is also controllable via MIDI signals but also offers 8 separate stereo tracks. The unit is still constantly being upgraded and today has reached version 1.32 [2] (the updates are available as downloads and can then be installed via ethernet cable).

The LP1 only occupies 10% of users (Strasschill Survey) but is comparatively a very new device. The Echoplex occupies the top spot with 54% of users and the Repeater is in third place (behind the DL4) with 40%. However the LP1, Echoplex and Repeater score 94%, 89% and 79% respectively in user's rating of the devices.

The Repeater is no longer in production and second hand sales are rare. The Echoplex is currently retailing at between $600 and $1000 (http://www.zzounds.com/item--GIBTGE05

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[2] 25th April 2008

and http://www.musiciansfriend.com 20 April 2008) and the LP1 $1499 (http://www.looperlative.com 20 April 2008) making these very much in the higher regions of affordability.

IV. Looping Software

The basic minimum requirements for software looping are roughly as follows:

Computer:

    Macintosh:

- G3 or faster
- 512MB RAM
- Mac OS 9 or OS X

    PC:

- 1GHz CPU
- 512MB RAM
- Windows 98/2000/XP/Vista

These specifications fall well below the standards of computers being produced today meaning that software looping is still very affordable.

Audio Interface:

For audio to be input and output from the computer, Analogue to Digital and Digital to Analogue converters are necessary. There are built in Sound Cards in most computers but these often lack the quality of separate dedicated hardware. An External Audio Interface is

ideal, connected via USB or Firewire or an Internal Audio Interface Card. There are many different devices available for widely ranging prices, suffice to say, usually the higher the price, the better the quality and versatility.

The interface will usually have a mix of XLR, 1/4" Jack (balanced TRS and/or unbalanced), phono and digital inputs and outputs, often with an option for phantom power (+48v) on XLR inputs giving a similar amount of input options to hardware devices.

As with hardware looping devices, it is normally essential to have foot control over functions. There are many options for foot controls including the Behringer FCB1010, Voodoo Labs Gounrd Control, Yamaha MFC10 and some musicians also build their own custom controllers. Foot controllers either send MIDI or Keystroke messages to the computer.

Ableton Live

Live was first introduced in 2001 by Ableton and is currently in version 7. It is piece of multi-track recording and sequencing software that offers an alternative method for recording and accessing audio and MIDI called 'Session View'. The session view is designed to facilitate the development of new musical ideas by allowing recording, playback and simple arrangement of samples or clips of audio and MIDI on-the-fly. The session view breaks down to a grid of audio clips. Columns are different tracks or instruments arranged and managed in the same way as in most DAW (Digital Audio Workshop) software such as Logic and Pro Tools. Each track has a group of rows, in each row a clip can be recorded and played back.

The initial blank configuration of Live isn't immediately indicative of live looping technology. There is the ability to record and playback loops of audio but not the ability to overdub into the same loop or even on the same track. Only one 'clip' loop can play at one time on each track but all tracks can be played together and the number of tracks available is only really limited by the power of the computer. Overdubs can be achieved by having two identical tracks and recording a clip into each. The clips are totally independent of each other and so can be of any length and can start and repeat at any point depending on quantise settings. The quantise function sets all actions to occur in time with the metronome, either to one, two, four or eight bars or any division of one bar up to demisemiquavers (32nd). The tempo can be set with 'tap-tempo' quantise cannot be set to the first loop's length as in the Echoplex.

As Live is a DAW software package it also contains many options for manipulation of audio through built in and third party plugin effects. It also offers an integration between Session and Arrangement view, allowing sequenced audio to play while new clips are recorded and/or played back over the top.

Kid Beyond

Also known as Andrew Chaikin, Kid Beyond, from San Francisco, is a beat boxer using Live as a looping tool. With just a microphone, audio interface, laptop and foot controller he creates whole band-style songs with his voice. As the first example of Live's use I'll take a look at the live version of Kid Beyond's track 'Mothership'. Track Three on Accompanying Audio CD.

First a pre-recorded 1 bar loop of clicks (1) is played as a metronome (a). A 2 bar kick drum type loop (2) is recorded (b) and played back (c). A 4 bar bass line (3) is recorded (d)

and played back (e). An 8 bar beat boxing rhythm (4) is recorded (f) and played back (g), this consists of 4 similar repetitions of a 2 bar beat. The beat box rhythm also starts a beat early but the quantise function means only the audio within the bars is captured for playback.

Fig 3.1

After the beat box rhythm a 4 bar DJ scratch style sound (5) is played (h) but not recorded. A 4 bar horn style part (6) is recorded (i) and played back (j). Immediately a harmony to that part (7) is recorded (j) and played back (k) and a third harmony (8) is recorded (k). Then the three horn style parts (6,7,8) are dropped and a horn style interlude (9) is recorded (l) but stopped (n).

Fig 3.2

Now that all these parts are set up Live can show off its more complex capabilities.

The verse is sang/rapped over (10) until some parts are dropped (o) and the drum beat (4) has effects applied to it to create a break. Parts 2 and 3 are reinstated and the second part of the verse is played and sang/rapped over (p).
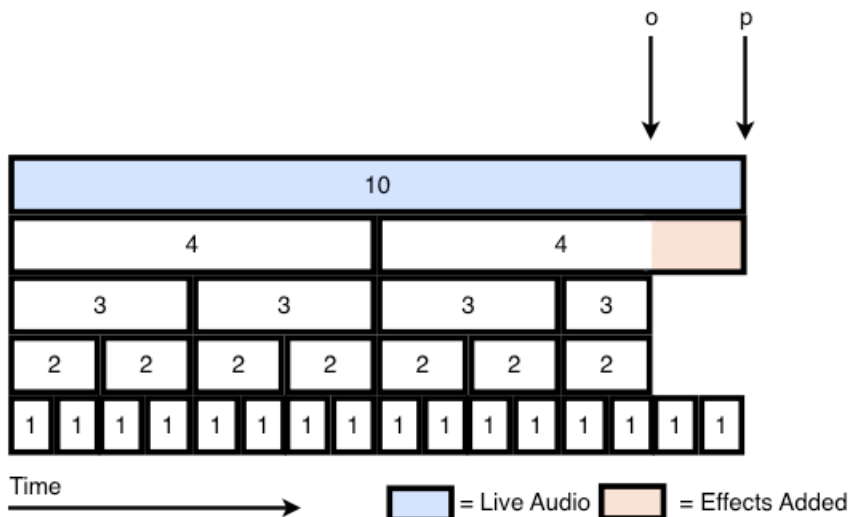

Fig 3.3

After another verse the chorus is brought in (q), bringing back the horn harmonies (6,7,8). Later on a new section is played (r) where Kid Beyond talks to the audience, a break
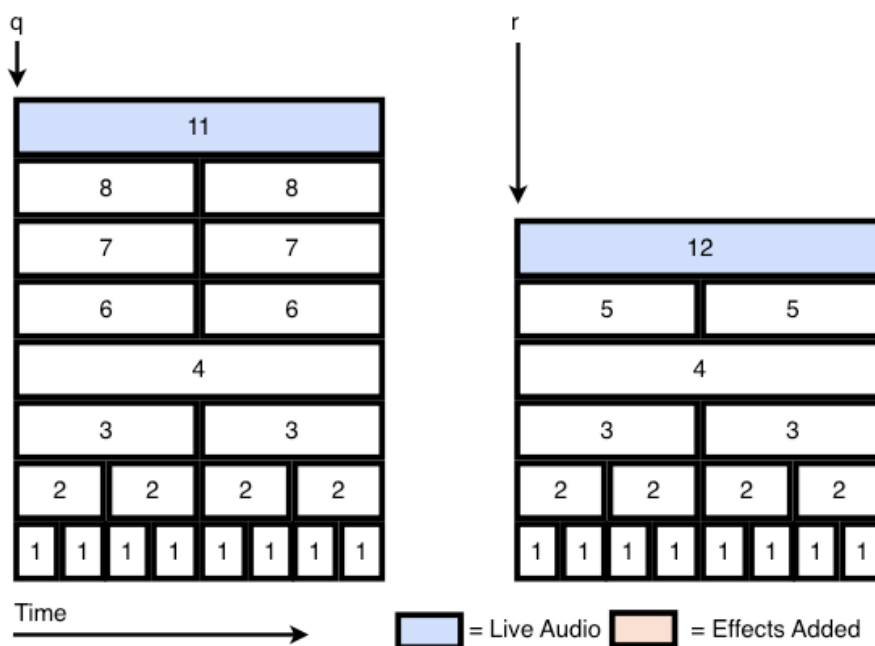

Fig 3.4

section which brings back the horn interlude (5) over the basic backing.

Live enables the implementation of many complex musical structures into live performance and allows innovative sequence like control over live looped audio and MIDI. Above is just one very basic example of how versatile Live is, the only draw back to having a piece of technology this versatile is that there is a lot to learn in order to utilise its full potential.

Zoe Keating

Keating is a cellist also from San Francisco, also using Live as a solo looping tool. In addition to Live she uses two Electrix Repeaters. This combination of hardware and software stands out in my research as a complex and innovative use of looping technology.

In her standard setup for her album 'One Cello x 16: Natoma' she uses eight separate tracks in Live and the eight separate tracks of the two Repeaters. Both Live and the Repeaters are controlled via the Behringer FCB1010 foot controller which sends MIDI signals routed through MIDIPipe software. Keating also uses AppleScript in conjunction with MIDIPipe to launch new Live 'Sets' or files, eliminating the need to touch the computer throughout a performance. As Live can also record and play MIDI clips for synthesised instruments, Keating uses pre-programmed clips of MIDI sequences that are sent to the Repeaters to initiate an automated string of commands, enabling very complex structures to evolve.

Max/Msp/Jitter

Max/Msp/Jitter is an Interactive Graphical Programming Environment for Music, Audio, and Media, an environment otherwise known as Object Oriented Programming. Max is the programming environment where Msp enables real-time audio synthesis and DSP (Digital Signal Processing) and Jitter enables video and matrix data processing.

A program written in Max is called a patch. Patches can stay in their user-editable mode and are often distributed as such to allow development by many users or they can be packaged into Applications. I mentioned Kaiser Looper previously, this is an example of a simple looping patch that is distributed in an editable form. Max/Msp is another more complex program to get to grips with, but as with Live its potential is extremely vast. Along with Steim's LiSa X, Max/Msp is the most versatile solution for live looping as you are limited only by your programming ability, however as programming is a skill that many musicians don't involve themselves with, other software and hardware is normally preferable.

Other Software

Mobius (win) and SooperLooper (mac) are built on the features of the Echoplex, are both free to download and both operate as VST or AU plugins, which means they can be used within other software packages such as Ableton Live. Mobius was rated joint first with Live scoring 31% in percentage of users (Strasschill Survey), Mobius also scoring the highest in user satisfaction with 90%.

Other software options include Expert Sleepers Augustus Loop, Ambiloop, PSP Audioware Lexicon Emulations, Native Instruments Reaktor, Sony Acid, Audiomulch, all offering many

of the same functions as hardware devices but many also include saving of settings and

saving of loops.