Advanced Non-Linear Recording

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Module Code: (MUM0606E)

Course: MA Advanced Music Technology

Analysis

Introduction

This projects recorded artefact is entitled “Robots” and is the last track in a concept project based around the authors interpretation of how music has evolved. Robots itself deals with the theme of musicality and it questions what will happen next in popular music?

It tackles these issues lyrically, musically and technologically as a sum of parts which make up the track. Lyrically it makes statements about the industry at large while musically and technologically it leans towards a more humanised/looser approach and uses modern tools/workflows to achieve this result. Ultimately the track attempts to amalgamate the ‘better’ sides of both old and new production practices in pursuit of what the author considers ‘musicality’, something that is of course a completely subjective epithet and is likely a taste acquired from an individuals previous musical exposure (Jourdain 1997).

Background

Its acceptable to say that musicality come in many forms and styles and encompassing them all into one track is not possible. So in accordance with the authors own preferences there was a clear bias towards recording a relatively traditional rock setup with additional instruments. To pigeon hole the music the author would consider it as acoustic progressive rock.

The (electro)acoustic instruments of drums, bass, guitar, piano and organ represent the human element of music viewing an oncoming conflict throughout the first half of the track and somewhat also signifies a longer time frame in musical history where acoustic technology was dominant before the arrival of electronic instruments. The distinctively electronic elements then appear later as an opposing body to the status quo was attention was drawn to this through a short lyrical dialog between humans and robots before breaking into a symbolical war section. The battle is left unfinished with the outro section asking if there will be a winner.

In terms of amalgamating elements from both new and old styles of production consideration was given to the following:

- Composition: larger classical style structures have previously been incorporated into more modern arrangements such as “Starless” by King Crimson to great effect. It was the authors intention to write Robots as a three part story which further break down into smaller sections. The songs main structure consists of an intro and two repeated cycles of verse-bridge-verse-chorus, a war section containing two large drum fill sections and finally a fanfare style ending which contains two verses followed by an instrumental honky-tonk finish.

- Key: In order to make a statement directed at the listener, a key change can provide an obvious hint to pay attention and is a typical trick employed by artists like David Gilmore and Robert Fripp[1]. Robots frequently makes use of these and modulates from Amin to Amaj in the verse to create a point of emphasis (‘human imitation’) and ambiguity with an Edom79 used to transition. The war section was written in C# Phrygian - a tense/dark mode of the Amaj the original key - before moving a 5th from the home key to Emaj which creates a consonant feeling for the outro.

[1] (Please see human influence from assignment 1)

- Time signature: this is again often used to play on a listeners expectations or to grab attention (Jourdain 1997). These were used throughout the track but a clear example would be the lyrics “cos feeling you cant encrypt” which contains a three count as does the bridge and main riff.

- Tempo and accuracy: stylistically this can define a piece of music - from a funky in the pocket groove to to a hard quantized midi track. In the authors opinion the feel of a good rock track lies somewhere between, it should be relatively tight but when musicians play “out” to give a good performance its observable that the tempo will naturally sways with them (Music Machinery 2010). In an attempt to achieve this the author created a custom click track with the intended tempo swings pre programmed.

- Playlisting and comping: given the click tracks sway it would have been quite surprising to get a tight performance. In respect to this playlisting was employed to achieve a performance that was both played and as tight as possible.

- Sampling and synthesis: prevalent in modern music and useful in creating interesting textures or replicating traditional instruments albeit with their own character. This was mostly used to represent robots in the war section although the piano and organ sounds came from a Nord Stage.

Recording

As per the module study guide lines the session was recorded into Pro Tools at 88.2kHz and at 24bit.

Firstly a live guide track was recorded of an approximate performance so an approximate tempo map could be then created. This was done at home with a DI guitar, one overhead and a piezo pickup taped to the drummers hi-hat. Following this the piezo channel was analyzed and the tempo/time signature was mapped using the add bar/beat command every bar[2]. This was then fine tuned by slicing the audio on semi-quavers,[3] changing the timebase to ticks and adjusting/averaging the inconsistencies in the tempo ruler.

With a click track created, guide vocals and guitar were re-dubbed to facilitate drum tracking. Its note worthy to mention that this was the authors first attempt at such a workflow and refinements have been made on other projects. Instead a better process would have been to use slice on transient before making adjustments eliminating the need for re-tracking a guide as the glitchy artifacts of tempo modification are much less noticeable.

When tracking drums the author made arrangements to borrow a Tama Swingstar kit with Sabien cymbals from a flatmate rather than use the universities one. The drum heads were single ply Evans D2 on the rack toms, with a double ply head on floor which were naturally tuned by the drummer prior to recording. The continuously variable tempo map caused a few inconsistencies and so the drummer was instructed to try play the track a

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[2] Beat detective was originally used for this but the need to frequently figure out the time signature negated the speed of such a workflow. It was simply easier to find the changes as they came using cmd-I to then add bar markers.

[3] Normally referred to as 16ths although this would not be correct in a non 4/4 time signature.

few times over ‘straight’ and record enough material to create a comped track. After this point, time was allocated to playing the track ‘out’ with the drummer giving a ‘risky’ performance for comping only selected parts into the track, this took time pressure out of the equation and was quite a successful approach to take. From hindsight however its possible to see that the click track could have been better averaged and as a result the tightness of the performances suffered more than necessary which was an unintentional byproduct. Again this was a first attempt workflow and on second attempt it proved mostly viable given a bit of extra time spent on tracking.

When recording the guitars the author aimed for a sound with a lot of attack to match the aggression of the end sequence and it also went trough a comping process. The track was played through a few times for safety material and then the guitar was played from the beginning until a mistake was made after which it would be overdubbed until the next one. Initially two guitars were recorded for panning left and right but the second one was dropped due to instability in the stereo image (available but made inactive in the archived session).

Bass was recorded DI in the same manner as the guitars but played in bar by bar to ensure dynamic consistency as well as timing accuracy - bass is not the authors first instrument.

To further fill out the track keys were overdubbed which was done with a Nord Stage and a Roland Fantom X7. These were also created from a selection of playlists although it was a mostly straight take - there was one moment on the piano at the end of the war which unfortunately clipped and despite having alternative playlists of other attempts the original felt best and was kept. The synth effects coming from the Fantom were basically a large distortion patch playing bass notes a squiggling radio effect which was created from its thermin-esque light sensor. These effects were then ran through the Kyma sound design engine and mutated into bomber sounds by modulating a formant filter in realtime which worked to great effect. A parallel can be drawn here in that bands such as the already mentioned King Crimson were using early forms of sampling such as their stylistic use of the mellotron which used in place of an orchestra for convenience while Robots does similar using the Nord organ/piano instead.

A formant filter was also used to process a vocal line delivered as a robots response also working to great effect as it closely mimicked the voice of a ‘Transformer’ from the popular sci-fi movies (possibly the most recognizable robot voices?). Other lines were also processed but seemed unsuitable when auditioned in a musical context, detracting from the war sections later call-response effect.

Mix

Firstly the instruments were phase alighted; this was done relative to the earliest microphone signal in an instrument group and was carried out before mixing really began.

This approach is advantageous when mixing multi-microphone recordings as the effect of comb-filtering between channels is dramatically reduced before processing begins. As the signals are all in phase and have the same starting point in time, fader moves come closer to becoming ‘truly’ additive as there is no longer any serious cancelation between the spot microphones and overheads (Variety of Sound 2010).

This same type of phasing is also particularly noticeable on acoustic guitar when captured with multiple microphones and can gives a very strange effect similar to the sound of the

phasing tremolo guitars on the intro of Pink Floyd's ‘Money’. While sometimes a pleasant effect the author was instead seeking a more solidified/aggressive midrange and so the guitars spot mics were hard aligned to each other while the MS was found by nudging the pair in Pro Tools to find a sweet spot.

The bass was equalised on the Atari Elite in Vestry 1 and then compressed with a Urei 1176 in order for it to serve as a solid foundation under the originally planned double tracked guitars. The analog compression seemed more receptive to a heavier handed approach and in the authors opinion this was because it sounded freer of unwanted harmonic distortion than a digital counterpart[4]. The piano was also processed in Vestry 1 with the Amek in stereo link, three playlists were recorded with different equaliser settings to provide a degree of control when in another studio.

As a side focus to finishing the artifact the author made an effort to expand on existing Pro Tools skills to a more competent level. Firstly was the extensive use of memory locations for editing, secondly though and more importantly was gaining an understanding of the Pro Tools HD automation capabilities and using the control surfaces more proficiently. The “auto join” feature in particular is extremely powerful when working in latch mode as it enables the user to rewind after missing a cue, make adjustments and re-enable writing to all the active parameters on every channel without touching them again once it arrives at location where ‘back and play’ was hit. This effectively means that a whole mix can be done in one pass of automation by using the “back and play” (cmd-alt-rewind). Other actions like writing the current level back to the last anchor or to the beginning/end of the track are also available for tidying up sloppy moves under the automation window (Pro Tools Professional 2008).

Custom plug-in mappings on the control surfaces are also useful for speeding up a mix as controller becomes more intuitive - the option only become available in a plug-in window when a controller is connected and do not save with the session. If one wishes to move systems they must be exported and saved to transferrable storage as a .pim file (Digidesign 2008).

Most of the mix was fairly straight forward with spot microphones balanced off stereo/ ambient arrays. For instance the drum overheads were processed first, then the kick drum and beater signals were processed and combined before further adjustments were made in context with the overheads. One element that required radical processing was the bomber synth which was processed in Kyma and required extremely heavy compression/ automation to keep it from swallowing the rest of the mix.

The double tracked vocals were unfortunately not the tightest but they did cover slight tuning mistakes, as such they were mixed at the same level but panned much narrower than the author would choose to with a tighter performance. Some parts of the lyrics were revised to accommodate some of the musics accents and to better reflect the authors lyrical intention.

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[4] The author holds an opinion this may be to to with each distortions harmonic structure dependent between domains, possibly a resolution issue but a more in-depth understanding of the field is required before accurate comment can be made.

Conclusion

The author feels that this track meets the module learning outcomes in all respects. An understanding of DSP has been displayed through the use of the Kyma system and various other processes such as the standard equalisation and compression.

High pressure situations were handled effectively while recording such as the tracking of drums to a moving click in a relatively short space of time and mixing sessions were managed efficiently.

Logical thinking and problem solving in a high technology environment was also displayed such as the tracking of outboard effects back into Pro Tools for later recall in other studios.

Admittedly this mix has taken place solely in Pro Tools albeit with a small amount of Kyma also used but two platforms are not extremely diverse. The author feels justified in this decision as is already technically competent with platforms like MaxMSP and Logic (holding a 101 in the latter); the platforms used were the best options available for task. Pro Tools is quick for editing/mixing and ubiquitous in commercial studios while Kyma is pretty esoteric but much faster than MaxMSP for processing sounds, especially in realtime.

From a personal standpoint the author gained a more in-depth understanding of the software used, control surfaces and expanded on already existing skills. The project was also an interesting experience as the author has very rarely worked on personal projects or played on tracks for other people and as such gained a deeper insight into the thought process of an artist when communicating with an engineer. In essence it was, metaphorically, nice to be in the artists shoes for a change.

References

Digidesign (2008) Pro Tools reference manual [publisher: AVID Technlolgy, US]

Jourdain, R. (1997) Music the Brain and Ecstasy – 1st Edition p68 & 69, Harper Collins, US.

Music Machinery (2010) Revisiting the click track - [online: http://musicmachinery.com/2010/02/08/revisiting-the-click-track/]

Pro Tools Professional (2008) Autojoin, Automatch, Autowhat? [online: http://www.protoolsprofessional.com/2008/07/17/autojoin-automatch-autowhat/]

Variety of Sound (2010) From phasing to phase alignment - [online: http://varietyofsound.wordpress.com/2010/03/10/from-phasing-to-phase-alignment/]

Session diary

The concept for this track came about after finding out about LaDiDa a generative music creation and auto-tuning application for the iPhone. This begged the question of how generic will popular music eventually become given that from a terrible performance the app can easily create a good pop track impersonation?

The personal response to such a question was mixed between sadness and a sensation of being seriously impressed. The app demonstrates that the capabilities of digital signal processing are extremely powerful these days and can do a lot of the grunt work behind the scenes, while at the same time it could also unfortunately be seen to promote a decline in true musicality. From the authors research and human influence section in assignment one, its apparent that artists have always pushed the boundaries with new technology and when done tastefully it can pay of dividends.[5]

The majority of the tracks chords and lyrics were previously written but as the music started to take shape various elements were reconsidered and changed due context; an example of which being the bass line playing to the guitar as it was recorded afterwards and swapped vocal lines.

The first actual session to take place was merely tracking a live performance in the authors house. This consisted of a Pro Tools LE rig recording drums and guitar as a template to later analyze. The drums had a piezo pickup taped to the hi-hat capturing transient blasts and an overhead for reference while the guitars were recorded DI out of the authors acoustic.

Several tracks were playlisted and the best was chosen for mapping in another session. This was spent tabbing to transient along the piezo track and using the “add bar/beat” command (cmd-I) to add a marker and any meter changes at the end of every bar. Beat detective was attempted but given a need for it to understand the time signature before operating correctly and that the numerous time signature changes in the song were uncounted, it provided easier to manually drop makers until a change was encountered and then make meter adjustments as necessary.

With the tempo map the tracks were selected and sliced to semiquavers (AKA 16ths)[6]. As previously noted this was a first attempt at the workflow and should have been sliced on transient for better results. The time base for all tracks were changed to ticks so that the sliced audio would follow any adjustments made on the Tempo Ruler. These guide tracks were used to audition the changes being made on the Tempo Ruler as the author evened out major tempo shifts and made similar sections identical for the sake of editing and comping (i.e. Verse 1 & 2 both have a non-static tempo throughout but have exactly the same pulse in respect to each other and their total length).

Due to the authors mistake of not slicing on transient, the tracks after being cut at semiquaver resolution were understandably jittery. To facilitate the drum fold back guitars were re-recorded along with vocals. Although not overly important the guitar signal was from a Neve expression system on the authors Taylor and entered the system through a

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[5] Names that come to mind: Brian Eno, Alan Parsons, Robert Fripp, Brian Wilson, Pink Floyd.

[6] Incorrectly in the case of any meter other than 4/4

balanced jack to XLR output; this was not a mistake - just good engineering on behalf of the manufacturer - as the system is a switching design which accommodates for both jack and XLR outputs; with a bit of reverb added this signal was a good enough for a headphone guide and was useful for setting an ambience in the foldback.

Drum tracking took place in the VH1 booth to the Otari Elite and was tracked into Pro Tools HD. Instead of using a university kit the author borrowed a high quality Tama Swingstar with Sabien cymbals from a flatmate. Overheads were routed to channels 1-2 and the mid-side was routed to 3-4 in order to avoid the possibility of splitting the channels over a Digidesign 192 and 96 IO as their operating level differs (Digidesign 2001).

The microphones consisted of an RE20 and Beyerdynamic M201 on the kick drum, an M201 and TLM103 on the snare, an AKG C451B on the hi-hats, a Beyerdynamic 421s on the toms, DPA 4090s as spaced-omni overheads and a mid-side pair of AKG C414's

In the authors opinion an RE20 is one of the most 'vintage' sounding options for a kick drum and tends to capture a softly focused sound around 150-200Hz, this could be mixed with the M201 on the beater to add snap. From previous testing the 4090's have a clear and defined low end and were deemed to be the most suitable for this track; transformer less omni directional microphones are particularly good at picking up distortion free low frequency (DPA 2008).[7] Although perfectly useable, with hind sight the DPA's were probably a little too bright for use in the vestry booth - the hi-hat volume to increases in a smaller space and so the overheads picked up a little too much spill. The M201 on the snare seems to capture a higher pitched pop than the standard Sm57 and seemed the highest quality dynamic available in the studio, this was paired with a Neumann TLM103 on the side of the snare. This approach seems more natural than a bottom snare as sound will refract around the side from both skins and provide a more natural balance. The toms were standard Beyerdynamic 421's as they capture a lot of the low end with a good balance of higher frequencies to help the drum cut through a mix. The mid side was an ambience setup about 5ft from the kit using a pair of C414's and was intend for use in adjusting and filling out the stereo image between the overheads.

Guitars were recorded over a night session in EFS1. The guitar used was a Jumbo Taylor 315CE with freshly broken in strings and was recorded with a large and quite experimental microphone set-up. In the authors experience recording an acoustic guitar with spaced overheads has worked well, in particular with the Neumann TLM103. Placed over the right shoulder this microphone has consistently captured an extremely focused near full spectrum sound while over the left has admittedly been less impressive. While this spaced array is effective it unfortunately sacrifices phase coherency (Lipshitz 1986) and as the left overhead seemed somewhat lackluster the author decided to try an XY pair of TLM103's over the right shoulder in an attempt to create a more aggressive sound. This to an extent worked but the neck pointing microphone also had the side effect of pushing the guitar slightly into the background. This was balanced out with a C414 on the body, a Geffel on the neck alongside an AKG CK91 for comparative purposes. In actuality both neck microphones were later used in mix; the Geffel had a predictably clear midrange around 200-500Hz while the 415B actually contained quite a balanced low end.

The bass guitar was tracked DI over several days at home and the keyboards were done on a peers home setup. As bass is not the authors first instrument the passages were carefully played bar by bar with close attention payed to dynamics and the already present

[7] Write up available on the authors website here:

instruments. The piano and organ were a Nord Stage 76 and were originally recorded with a comping workflow however the this was abandoned on the second session and a whole take was used with the exception of one or two particularly nice phrases. The synths were done in the same session with a Fantom X7 and its light sensor.

Following tracking the author processed the bass with the Otari desk eq and a Urei 1176 before re-tracking it into Pro Tools for portability. The piano sound was also processed with desk equalisation (at three settings for safety) and compressed with the Amek in stereo link mode.

Robot voices were created in VH2 with the Kyma engine, along with further processing on the synth sounds. Several processing options were explored; namely processing offline, online and using the Tau graphic editor. In the end the author sent audio from Pro Tools into the Kyma engine and back, in real time while manipulating a patches available parameters. In the case of the Robot voices it was quite simple and after a few loops there were some pretty useable results, however the synth sounds were less controllable and extremely dynamic so required more finesse and heavy compression afterwards.

Mixing began in the university studios but to make efficient use of time it was also brought to several different rigs available to the author. Not much seemed of the mix seemed particularly out of the extravagant; MS pairs were decoded, related channels were phase aligned, plug-ins were applied and automation was written with various control surfaces. The level of spill form toms was reduced with expansion rather than hard gating which also gave them a bit more of a percussive sound due to the rapid increase of volume after reaching the threshold. Some parallel compression was also utilised on the overheads to bring out the cymbals hits slightly. The decision to use only one guitar was made due to the tightness of the performance which caused an imbalance in the stereo image. In the war section the both the original synths and their processed counterparts were used and panned towards opposite speakers, the order of which in the four parts was inverted so that both processed versions appear in opposite speakers. Attempts were made to merge sounds from the audio pool (particularly the toy helicopter) but only the wahed Bmin chord was used because the only suitable section (the war) was already extremely full.

The outro was initially planned to have either a slow down or an automated dry:wet reverb mix, however this idea was disregarded as the resolution to a Aadd9/11 chord seemed too fitting. It is effectively suspended due to the B and D notes and in context of the piece is the musical equivalent of returning back to the starting key/chord (A maj) but with added tensions. This in the authors opinion gives an over all impression of resolution while also suggesting future unrest and a cyclical nature much in the same way that technology is introduced to the mainstream; pioneers push the boundaries and eventually their musical ideas get filtered into general society. Data is delivered according to Academy guidelines.

References

Digidesign (2001) 192 & 96 IO Specification Sheets [online: http://akmedia.digidesign.com/products/docs/192-I_O_13253.pdf & http://www.rcc.ryerson.ca/media/spec96io]

DPA 2008 - Transformer vs. Transformerless output [online: http://www.dpamicrophones.com/en/Mic-University/Technology-Guide/Transformer.aspx]

Lipshitz, S. (1986) Stereo Microphone Techniques; Are the Purists Wrong?" [publisher: JAES Volume 34 Issue 9 September]

Appendix 1 - Pictures

Guitar recording: Mid-Side and Overheads

Processing: Urei 1176 for bass & Kyma for synths

Appendix 2 - Revised Lyrics

Intro

Verse 1

We've got these, robotic, human imitation,
can't sing, auto tuned super stars;
they all look and sound the same.

It all started when, we forgot, musics meant to be,
much more than a glorified cash crop!

Chorus
We've got thoughts not ones and naughts, and thats what makes us tick,
We've got faults not circuit boards, 'cos feeling you cant encrypt!

Verse 2
Real song writers; are scraping by,
while these carbon cloned sensations appear overnight;
lets try keep some distinctive vibes alive!

If its ever asked how, and why did music die;
people are gonna point, such crooks will have no alibi!

Chorus
We've got thoughts not ones and naughts, and thats what makes us tick,
We've got faults not circuit boards, 'cos feeling you cant encrypt!

War section
What have you got to say? Were gonna take over someday. We won't obey! Launching missile array...

Outro fanfare
And now who will win the war? 'cos if its something worth fighting for; you better give your all.

And now who will win the war? 'cos if its something worth dyeing for; you better give your all

Appendix 3 - Input list

Drum overheads - DPA 4090's
Kick - Electro Voice RE20
Beater - Beyerdynamic M201
Snare top - Beyerdynamic M201
Snare side - Neumann TLM 103
Rack tom - Sennheiser MD421
Floor tom - Sennheiser MD421
Hats - AKG C451B
Mid - AKG C414
Side - AKG C414

Guitar overheads - Neumann TLM103's
Neck A - Geffell
Neck B - AKG CK 91
Body - AKG C414
Mid - DPA 4090
Side - Neumann U87

Bass - DI
Nord Piano - DI
Nord Organ - DI
Fantom X7 - DI

Vocals - AKG C414