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AUDIO RESTORATION OF DUBPLATES: CLEANING AND DIGITAL PROCESSING LACQUER RECORDS FROM REGGAE/DANCEHALL CULTURE

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Abstract: This paper discusses the cleaning and digital restoration of lacquer records from the Reggae/Dancehall culture known as Dubplates. The paper evaluates the use of certain digital restoration tools used in the processing of the digital audio file. It also discusses the merits of using household goods in the cleaning of these records. The paper also evaluates the use and overuse of certain digital processing tools. This paper is intended to educate laypeople to save these artefacts from further deterioration, and to interest people who are familiar with Reggae culture as well as those who are interested in audio restoration.
Key words: Audio Restoration, Digital Restoration, Dubplates.

1. INTRODUCTION

The archiving of legacy audio formats is an activity that has been recognised as important for many years. Institutions such as the US Library of Congress and others have been participating in this process for many years to save sounds that represent the many different cultures and peoples of the world for future generations to enjoy, appreciate and study [1]. This process obviously varies depending on the media being preserved, however the digitising and digital processing of said media is largely the same. The United States Library of Congress [2] suggests a sample rate of 96 kHz/ second and a bit rate of 24-bits to future proof the digital file and allow for detailed digital restoration. Since the digital files for these legacy formats are relatively large, it leads to the question 'which pieces of legacy media should we be saving?'.

Along with the issues with finding legacy playback equipment and physical deterioration the materials, the question of which media is more important to process is a complicated one. Although the endeavour is to save every piece of audio on legacy formats, this is not something that is currently possible owing to the loss of

playback equipment, fatal deterioration of the media and lack of sufficient digital storage space [1]. Furthermore, deciding which specific media to restore digitally also brings up ethical issues such as what is important to society to keep versus what is not [3]. Legal issues regarding copyright ownership can also create problems for restoration laboratories if artists, media owners or other interested parties do not agree to the processing [3].

There are several reasons for not digitally restoring a specific piece of legacy analogue media. Arguably, the most important reason is the pre-existence of a digital copy of the audio with a high enough bit and sample rate. As stated, storage space in the digital domain should always be considered. Taking this idea into account, if the audio held on a specific piece of analogue media exists in another format that has fewer negative issues (such as playback equipment availability and/or physical condition), it would be pragmatic for the restorer to digitise the audio on the less problematic format. For example, if there is a specific song that is to be digitised, it would be better for the restoration engineer to transfer the original multitrack tapes over the vinyl version of the audio because the options for digital processing are greater using individual instruments or stems, especially if the vinyl is damaged and would require extensive physical restoration.

However, where certain tracks are being digitised to preserve the overall mix version (such as a remix by a certain producer), the vinyl would be the preferred [4]. In these instances, it is the art of the producer or mix engineer that is being preserved. In an ideal situation, both would be transferred, however digital storage space could, again, become a problem.

2. HISTORY OF DUBPLATES AND REGGAE SOUND SYSTEMS

Sound Systems (or Sounds) have been an integral part of the Jamaican music scene since the 1940s when they were employed to play music in clubs instead of live bands. There were two main reasons for this: firstly, the appetite of the audience in the dancehalls at the time was leaning more towards the new music coming out of America on vinyl and shellac discs. This meant that local live bands usually could not keep up with audience demand for this new American music where Sound Systems, could import the newest music and play it. Secondly, live musicians were much more expensive to promote, whether it was a band being flown into the country to play or a local live band. Sound Systems, at the time, employed fewer people than a live band.

The way that Sound Systems differentiated from each other was, firstly and most importantly, by what music they played. Owners of Sounds would go to great lengths to get the newest and most exclusive records they could, often flying to America or using mail orders to achieve this. This meant that only those with the financial means would have a public following. It was also a very secretive affair as many Sounds would go to great lengths to hide what music they had. This was so that other Sounds could not simply look at the label of the record and purchase their own copy [5].

A sound system, historically, is made up of many parts and members, each of which has a specific role. Firstly, there are the physical parts such as turntables, amplifiers, and speakers, which can be used to specifically characterise a Sound. Everything from clarity of the sound, to what it looks like when stacked can be the difference between whether a Sound has a following or not. Each Sound historically would have its own set of equipment, some emphasising bass, others clarity, while others still would focus on the higher end of the frequency spectrum (Fig. 1). This would lead to vastly different speaker constructions, amp selections, placement, and stack structure. This whole system was usually controlled and set up by the 'Box man' or 'sound man'. Other members of the collective include the ‘Selector’ who chooses the music that will be played. The ‘Mixer’ who actually plays the tracks selected and the ‘Deejay’ who is the voice of the sound [5].

Fig. 1 The “Richochet Sound System (Bermuda)” in front of their Box.

The secrecy around the music owned by a Sound continued into the next phase of Sound culture. In the early 1960s, when Jamaican music was being played far more often than the American Rhythm and Blues or Jazz from the previous era, promoters and owners of Sounds began expanding into record production. The use of the lacquer master records from the vinyl production process became a vital part of any Sound. These records (known as Dubplates) were played in the dancehall to gauge crowd reaction to a new production. This way, as record production materials were scarce in Jamaica due to expense, the producers would only commercially press the tracks they knew would sell. Dubplate cutting studios became more prevalent, often run by a single person who was the mastermind of how the dubplate was cut. Again, these methods were often a closely guarded secret as the cutting studios would also be in competition with each other. The cutter would also be able to adjust his methods so that the dubplate sounded its best when played specifically on a

Sound's box. As the boxes were all so radically different, it meant that each dubplate produced could possibly have its own signature EQ curve applied to it [6].

As time and technology has moved on, the use of the lacquer disc for these 'dubplate specials' has become less prevalent, with Sound Systems moving to digital media, resulting in the lacquer dubplates being placed into long storage and/or simply forgotten.

3. OVERVIEW OF THE RESTORATOIN PROCESS

When creating a workspace for audio restoration there are several pieces of equipment required, as well as an adequate space. Once a suitable digitising station, peripherals and space are obtained, one can turn their efforts to finding appropriate equipment for playback of the legacy formats to be restored since the media is, in essence, obsolete thus playback equipment is also disappearing.

3.1. Workstation

The workstation for the restoration should consist of a suitable computer, audio card, monitors and headphones. An illustrative set is given in Table 1. These pieces of equipment should be, at minimum, able to run an application for the ingestion of audio without losing any data. It must also have an adequate amount of storage since file sizes involved in restoration can be large. The audio card should be able to ingest at a rate of 96 kHz and a bit depth of 24-bits at line level [1].

Table 1 Example Restoration Set-up

	Manufacturer	**Specifications**
Computer	Apple Mac Mini (2018)	**Processor:** 3GHz 6-Core Intel Core i5 **Memory:** 32GB 2667 MHz DDR4 Storage: 1TB SSD **OS:** MacOS Catalina version 10.15.7
Digitiser	Focusrite Scarlett 2i2	**Supported Sample Rates :** 44.1kHz, 48kHz, 88.2kHz, 96kHz, 176.4kHz, 192kHz Frequency Response: 20Hz- 20kHz ± 0.1dB **THD+N:** <0.002%
Headphones	Beyerdynami DTT770 Pro (80 Ohm)	Frequency Response: 5-35,000Hz Nominal T.H.D.: <0.2% Ambient noise isolation: approx. 18 dBA Transducer type: Dynamic
Monitors	Alesis M1 Active 520	**Design:** Bi-amplified Design/Tweeter - 25W, woofer - 50W **Frequency Response:** 56 Hz-20 kHz **Signal-to-Noise Ratio:** >100 dB below full output, unweighted **Input Sensitivity:** 85 mV noise (pink) produces 90 dB(A) output SPL at 1 meter. Gain knob turned fully clockwise (maximum)

The main characteristic that any output device requires is transparency - the speaker or headphone do not add extraneous frequencies to the audio output. If this is not possible, then knowledge of the limitations of the output device should be readily available.

3.2. Equipment for Grooved Disc Restoration

For restoration of grooved discs, the equipment required is easily sourced owing to the resurgence or vinyl sales. However, when obtaining the relevant equipment there is a need to refer to the media to be restored. Similar is true for styli that tracks the groove. The groove widths on discs can vary, so it is important to have styli available of varied diameters and shapes. This will ensure the best possible signal. There are 4 main shapes of stylus defined by their shape [7]:

- Spherical: Cheapest and most durable of shapes, but generally least accurate.
- Elliptical: Less durable, but more accurate than spherical.
- Hyper Elliptical: Better output quality, although more expensive than elliptical.
- Micro-Ridge: Most accurate and most expensive.

A second important stylus characteristic is the needle tip. These tips are generally made from diamond because it is a hard-wearing material. For vinyl records from the 1950s onward, when the microgroove became standard, tips are required to be between 1 and 3 millimetres in diameter [7].

The next part of the chain for playing vinyl is the turntable, for which there are several characteristics to be accounted for. Everything from the shape of the tone arm to the noise the motors make can change the signal produced. There are 3 main parts of the turntable: the tonearm, the platter and the plinth. The plinth tends to be made from a dense material to avoid resonance that may be picked up by the stylus.

There are 3 main shapes of tone arms, S-Shaped, J-Shaped and Straight. S-Shaped tone arms are slightly longer and hence have more mass than straight tone arms. There are negligible differences between these tonearms once they are correctly set up and balanced. The platter is what the record sits on and spins in order for the stylus to track the groove. There are 2 main ways which platters are turned: direct drive turntables use gearing to directly connect the motor to the platter, and belt drive turntables that use a belt to connect the platter to the motor. Direct drive turntables are also less susceptible to fluctuations in platter speed. In contrast, belts can wear out, causing platter speed fluctuations, although the advantage is the motor can be further away from the platter which means less motor noise is audible through the stylus. Another characteristic of belt driven turntables is a heavier platter which helps to avoid audible jumps and skips.

Turntable usage also takes into account other considerations. One of these is where the turntable is set up. Turntables are susceptible to outside stimuli which can affect output. Generally, for optimum output, they should be placed on a flat, dense

platform that is isolated from power cables and physical vibrations. Measurable characteristics such as wow, flutter and rumble should have low values when choosing a turntable.

Another piece of equipment necessary for grooved disc restoration is a preamplifier which is necessary when playing vinyl since the output produced by the stylus is much lower than line level (normally approximately 0.005V versus 0.3V respectively) [7]. Table 2 illustrates typical equipment. Some amplifiers and turntables have built in preamplifiers to overcome this problem. For restoration, this can be the source of an issue because many inbuilt phono preamplifiers employ the RIAA (Recording Industry Association of America) EQ curve [8], which has been standard for vinyl since 1950. For restoration, it is important to have a phono preamp with a flat EQ setting, because prior to the adoption of the RIAA curve as standard, each record company employed its own bespoke EQ curve for their releases. Applying an RIAA curve to some records may result in incorrect frequency reproduction. This is similar to the Dubplate cutting studios employing their own curves for specific cuttings. The possibility of removing the RIAA curve from the output signal can improve the digital processing that may occur later [6].

Table 2 Example list of equipment.

	Manufacturer	**Specifications**
Turntable	Audio-Technica AT-LP120XBT-USB	Drive Type: Direct Drive Speeds: 33 1/3, 45, 78 Outputs: Phono Level, Line Level Wow & Flutter: <0.2% (WTD) @3 kHz Signal-to-Noise Ratio: > 50 dB
Stylus 1	Ortofon 2M 78	Spherical Type: Moving Magnet Tip Radius 65µm Tracking force, recommended: 1.8 g Frequency Response: 20-20.000 Hz +3 /-1 dB Speed: 78 RPM
Stylus 2	Ortofon MC Quinet Blue	Nude Elliptical Type: Moving Coil Tip Radius: r/R 8/18 µm Tracking force, recommended: 2.3 g Frequency Response: 20-20.000 Hz +/-2 .5 dB
Preamp	REK O KUT Ultra Phono Preamp	Curves: Flat, RIM

3.3. Software

To properly restore the digital files, ingestion of the analogue audio must take place. There are several software options for this and the processing of the audio. It is a good idea to have more than one option for processing as many applications have their own unique strengths. This work used Izotope RX8 Advanced (isotope.com) which provides a spectrograph of the audio file making it simpler to see where audio defects occur within the frequency spectrum.

3.4. Logging Procedure

Logging vinyl for restoration purposes needs care and preparation. Some of the important information to be held on this form are [9]:

- **Date of release:** This gives vital information about how it was produced, leading to details such as the composition of the physical record and probably groove widths. This will help with stylus choice as well as the probability of RIAA curve use in production.
- **Label (Record Company):** Knowing which label released a particular record will inform which playback curve may be in use. Before the RIAA curve became standard, each label had their own curve [6].
- **Cleaning:** The method of cleaning used should be recorded.
- **Digital Transfer Details**: Currently, standard practice widely accepted is that analogue materials are ingested at 96 kHZ sample rate and 24-bit depth.
- **Equipment Used:** Each piece of equipment used in analogue restoration adds its own characteristics to the end result file.
- **RPM:** Both the intended RPM and the RPM used at ingestion are recorded [10]. It is possible to ingest at a lower RPM if there are defects on the record that will cause inaccurate groove adherence. The slower speed will give the stylus a greater chance of staying in the groove and picking an accurate audio signal. The digital file can then be adjusted using software.

3.5. Care, Storage and Maintenance of Grooved Format Discs

3.5.1. Storage

Care of vinyl records begins with storage of the media. Since these records are susceptible to certain environmental fluctuations, it is important to store them in appropriate places [11]:

- **Cool:** Rooms holding vinyl records should be relatively cool to avoid damage from heat. For long term storage, recommended temperature should be 8°C to 12°C, for short term storage the room should be lower than 20°C [1].
- **Dry:** By 'dry' it is understood that the storage facility should be between 30% and 50% relative humidity for short term storage, and 25% to 30% humidity for long term storage.

3.5.2. Care

The care of vinyl can be relatively simple if storage concerns are heeded. There are two main ways of cleaning, wet cleaning, and dry cleaning. As the names

suggest, one involves liquid cleaning solutions, and one does not. The main characteristics of any cleaning method should be that they are:

- **Non-abrasive:** Brushes, cloths and other cleaning materials should not create scratches or marks on the surface the vinyl which can lead to audible defects in the playing surface.
- **Chemically inert:** The cleaning product, especially any solution used, should not react with the playing surface of the record. Some solutions can break down the chemicals in the record leading to deterioration of the vinyl.
- **Leaves no residues or liquids:** The cleaning process should leave the surface dry and free of residue when complete. This could lead to further contamination and audible defects when played back [1].

Dry cleaning is relatively simple and should be the first method used, especially on physically damaged records. Cleaning should happen in a circular motion, following the grooves of the record, from inside (nearest the label) to outside (edge of the record). Fig. 2 illustrates dirt removed from a Dubplate.

Wet cleaning involves the use of water or a cleaning solution. Any water used should be distilled and/or deionised water. Selection of which cleaning solution should be dictated by the composition of the record to be cleaned. The chemical makeup of these solutions should always be checked before use. Cleaning machines can also be employed. Keith Monks machine (keithmonks-rcm.co.uk) which wet cleans and then removes remaining surface liquid by vacuum, is recommended. Ultrasonic machines should be avoided on cracked or broken vinyl, but for structurally sound media it can be especially useful. Always be aware of static charging and dissipate any static held by the record before playback or storage [1].

Fig. 2 Dirt removed from a Dubplate.

4. METHODS AND RESULTS

4.1. Collection

The materials used in this work were collected from Sound System members personally known by the first author, ensuring as much information could be collected about the records, such as year of cutting, storage methods, and often the name of the engineer who cut them. The two specific records discussed here were chosen according to criteria, as suggested by McCoy-Torres [12]:

- Records the owners wanted digitised
- Records of artists now deceased
- Records having either no digital version or a low-quality one

4.2. Digital Ingestion and Cleaning

Each chosen record was, once photographed, immediately digitally ingested. The equipment used for this was an Audio Technica LP120 turntable with an Audio Technica VM95E (bonded eliptical) stylus. The turntable platter was deadened using an NAO Acoustic Isolation Mat. A Focusrite Scarlett 2i2 audio card was used to convert the signal from the turntable's internal preamp which was set at the standard RIAA position. The digital file was captured using Audacity (audacityteam.org). The turntable levels and balance were tested using a HiFi News Calibration record (hifinews.com), providing a thorough check of the frequency response, input levels and input balance before digital transfers occurred. The turntable tonearm was also balanced to ensure accurate tracking forces would be applied.

4.3. Playbwoy Sound Dubplate (Elephant Child Specials)

This record was chosen because the artist was murdered in 2013, leaving the dubplates as part of his legacy. The record was in a relatively good condition when received having been stored in relatively well. It was dry cleaned using a dry cloth normally used for cleaning glass, removing most of the loose surface contamination. Each side of the record was then played from lead in to lead out groove at its correct RPM of 45 RPM. The digital file was captured at 96 kHz and 32-bit in Audacity. The resulting audio file was then exported as a .WAV file. A log sheet was then created with all relevant details of the record and audio file. The record was then wet cleaned using generic paper towels, boiled water and three drops of dish washing detergent, resulting in more surface contaminants being removed. Once wet cleaned, the record was ingested a second time using the same methods and settings as previous. A second log sheet was created for this audio file. The digital files were then subjectively compared audibly to decide which version had fewer audible defects. It was decided that the second pass was audibly cleaner.

4.3.1. Track 1: '*Hail*'

The first track to be processed in lzotope RX8 was '*Hail'*. The spectrographs pictured shows the unprocessed initial version of the track's first and second passes. The noise on the track is especially visible at the beginning of the file (left side of Fig. 3). This view confirms that the second pass (after cleaning) has less surface noise present and should be used as the basis for any further processing. Once the file

was imported, the first process applied was the De-click function to remove as many audible clicks and pops as possible without affecting the true audio signal. The next process used Spectral De-noise which works by learning the profile of the background noise and subtracting it from the signal. Overuse of this process had a negative effect on the true audio signal as it attempts to remove a wide band of frequencies that are interpreted as noise. This process was undone and repeated several times to get to a, subjectively, reasonable outcome. Fig. 4 shows the intensity of the noise at the beginning of the track being greatly reduced. The next function employed used was Center Extract which is designed for stereo files that have been derived from a mono file. Generally, it suppresses the 'outsides' of the track which is generally where extraneous sound resides in mono tracks transferred using stereo styli. Interestingly, using this function sparingly on '*Hail*' produced an audibly cleaner version of the file. Arguably, use of this tool on a stereo file can remove too much of the ambiance of the track, however very light use produced a more useable version of the audio file. It was at this point it was noted that the track was lacking much of the higher end of the frequency spectrum. The owner of the dubplate was contacted to find out more details about the record, who stated that it was a popular track and thus played often. This led to degradation of the groove and hence the 'muddy' playback. It is also possible that some of the processing may have removed some of these higher frequencies. It was decided that processing would stop at this point since the majority of the background noise was removed and, although not perfect, the vocal could be heard clearly.

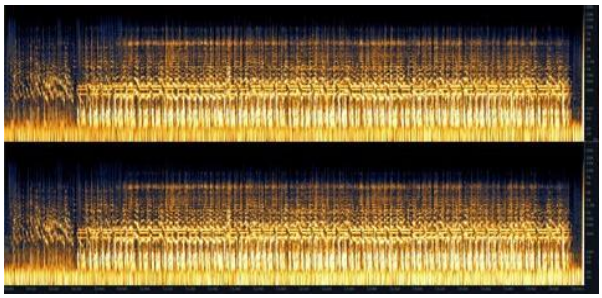

Fig. 3 Second pass spectrogram of 'Hail'.

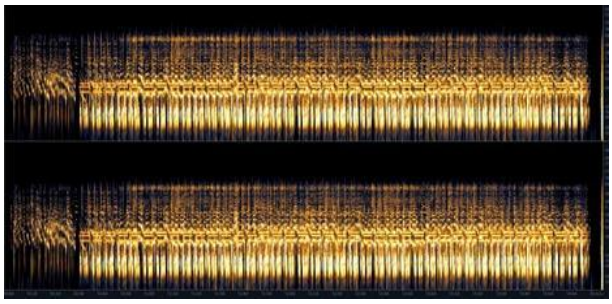

Fig. 4 Spectrogram of 'Hail' post center extract (final track version).

4.3.2. Track 2: '*Pray Everyday*'

The next track to be processed was '*Pray Everyday*'. Again, it was noted after comparing both the audio files and spectrograms of each pass, that the second pass had less surface noise in its unprocessed state, thus this was chosen for further processing. As with '*Hail*', the first process used was the De-click function, removing the majority of the audible clicks and pops. It was noted that the audio file contained a hum between 97 Hz and 101 Hz. Since the ingestion equipment had been calibrated before digital transfers occurred, and did not show any extraneous frequencies, the source of the noise was unknown. It was not part of the track itself since no other noise is present. In order to remove it, the spectral de-noise function

was trained around that frequency and lower and performed on the track. This process succeeded in removing the most of this extraneous noise. A second spectral de-noise was used to remove as much general surface noise from the audio file. Again, this was a trial-and-error process to balance removing noise and adversely affecting the true audio signal.

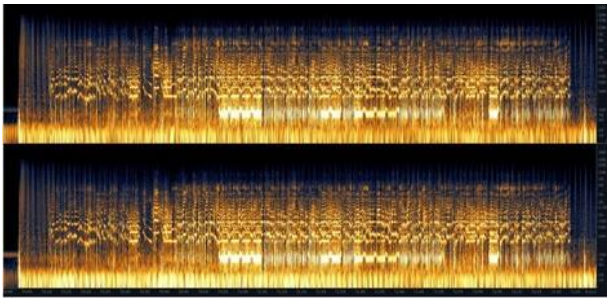

Fig. 5 Second pass spectrogram of 'Pray Everyday'.

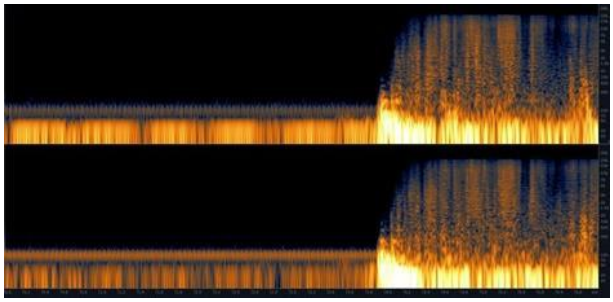

Fig. 6 Enlarged screenshot of low frequency hum on 'Pray Everyday'.

4.4. Deathmark Sound Dubplates

The track selected was performed by Monty Gallis and Kojah Mon. A duo from Bermuda who no longer perform together. It was recorded over 20 years ago in a home studio in Bermuda and cut in Florida from DAT tape. The cutting process remains unknown. This record was in far worse condition than the Elephant Child Dubplate, with severe damage on the leading edges which appeared to be missing pieces of the lacquer coating that makes up the playing surface of the record (Fig. 7). The record had been stored badly initially as well as played many times, so it was expected that the audio held would be poor condition. However, it was unknown how well the initial recording sounded as the DAT has disappeared. Because of this, it was important to digitally capture the track as they exist nowhere else. The dubplate was digitally ingested in the same fashion as the Elephant Child dubplate. However, as the grooves on this record was in worse condition, the transfer speed was dropped from 45RPM (the intended playback speed) to 33⅓RPM to increase groove adherence by the stylus. Audacity has a function in its effects menu (Change Speed) that will adjust the speed of the audio file transferring it up from 33⅓RPM to 45RPM, thus returning the audio file to its intended playback speed.

Fig. 7 Damage to the 'Kiss From A Rose' dubplate, with magnified section.

4.4.1. Track 1: '*Kiss From A Rose*'

This track brought up the question of whether to remove the RIAA curve put onto the audio by the preamp in the Audio Technica turntable before processing in lzotope RX8 would begin and replace it after processing. It was found by comparison (audibly) that removing this curve would not only boost the high frequency defects on the track, but also hid any rumble or other low frequency defects [13]. It was thus decided that the RIAA curve would stay in place as it sounded, subjectively, better. The track was ingested at the lower speed of 33⅓RPM and processed in Audacity to correct the playback speed. The RIAA curve was removed before this and replaced after it was completed to avoid incorrect frequencies being processed. As with the 'Elephant Child' dubplates, it was found that the digital file created after wet cleaning was less contaminated and thus was used for further processing in RX8 (Fig. 8). The first process undertaken was de-clip, processing any clipping in the track and interpolating the relevant wave forms to be less square. De-click was then used to remove many unwanted pops and clicks. Spectral de-noise was applied to remove unwanted surface noise that had been ingested with the audio. This process left a few unwanted noises on the audio file. The centre extract tool was used at this point to attempt to remove these artefacts (Fig. 9). Interestingly, this seemed to make the noise levels, subjectively, acceptable although it was a compromise as there was also a loss of atmosphere in the track. The track was then normalized, which increases the gain on a track so that its peak level reaches a target peak level.

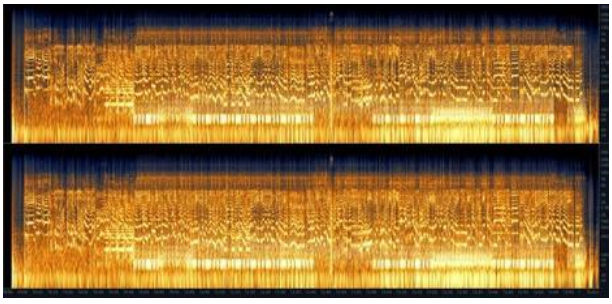

Fig. 8 Second pass spectrogram of 'Kiss From A Rose'

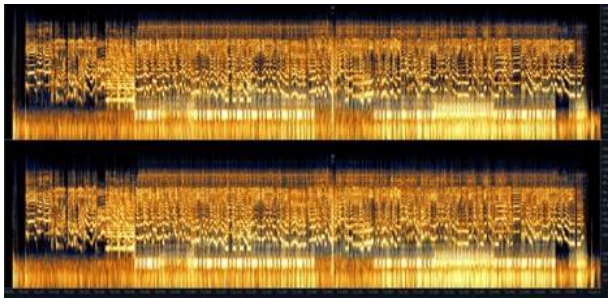

Fig. 9 Final version spectrogram for 'Kiss From A Rose'.

5. DISCUSSION

5.1. Cleaning methods

This work used simple household solutions to the problems of cleaning, since this will be useful to Sounds that do not have access to cleaning machines or commercially available cleaning solutions. Although the results from the cleaning methods for this project were somewhat successful, there are many ways to improve this process and its outcomes, such as discussing options with chemical scientists to analyse the contaminates found on the lacquer surface.

5.2. Turntable and Stylus

The turntable used for this project was an excellent, home use turntable. It is designed for home applications and as such it is on the lower end of professional restoration applications. Although the platter was deadened on the turntable, higher end turntables would have better noise related specifications. This project lacked, at very least, stylus options which made it difficult to gauge if a different stylus might have produced a better output. To avoid over processing, future experiments must use this comparative method of stylus choice.

5.3. Preamplifier

Leading on from the turntable and stylus discussion, a flat preamp may have been useful for this work. One of the issues with grooved recordings is that low frequency signals create larger grooves which can cause the stylus to leave the groove [13]. In many situations, Dubplates were recorded in situations that were not conducive to audio recording. This meant that microphones, mixing desks and other recording equipment may have been less than optimal for the intended purpose. When attempting to digitally restore a dubplate, it is unlikely that it will have had the RIAA curve applied to it. In essence, by applying the playback RIAA curve as undertaken here, there may be the addition of extraneous frequencies or an untrue representation of what is actually on the record.

5.4. Software Processing

Once the dubplates were committed to the digital domain, processing to remove unwanted noise began. This processing was hampered by the issues raised in the previous section. It is important when processing to know how far to push and when to stop. Over processing leads to distortion in the audio signal as well as loss of frequencies fundamental to the audio file. Audacity has powerful effects within it and an especially useful filter curve effect, including the RIAA curve and many other pre-1950 EQ curves. This program was used, in this work, as the capture program for digital ingestion. It was also used to change the playback speed of tracks that were ingested using a slower than intended RPM.

The interface for RX8 Advanced can display either the waveform of a track or the corresponding spectrogram. This is useful since it provides a visual representation of the energy at each frequency level. This is displayed by colours ranging from orange to white. RX8 is intuitive, however one must beware of over processing while using any of the many functions within the program. In this work, extensive use was made of the spectral de-noise function, to remove any unwanted broadband and or tonal defects from the audio signal. This function requires a large amount of finesse as it is possible to remove or suppress frequencies from the true audio signal. Another tool used in this project was the center extract plug-in. Although not designed for use with stereo tracks, this plug-in was used to remove extraneous noise from tracks with relative ease. However, there was a compromise when using this tool. It was very easy to remove atmosphere and depth from a stereo track with this tool. As it was designed primarily for use with mono tracks imported using stereo equipment, the algorithm seeks similarities between the left and right channels and endeavours to remove any noise that is not similar. When overused while processing the dub plates for this project, it was noticed that some reverb was removed along with the noise that was being targeted. These issues aside, the program is extremely useful in the right circumstances and with the right supporting equipment.

5.5. Subjectivity versus Objectivity

One of the biggest obstacles faced was the question of when to stop audio processing. Regardless of software being used, it is quite easy to overdo the processing of a file. This is not the over processing previously mentioned, but instead the search for perfection in the processing. When digitally restoring an audio file, regardless of medium or genre, it is important to know when the file is 'good enough'. However, the definition of this varies depending on if one looks from a subjective or objective point of view. Something perceived as a flaw in an objective observation may be pleasant to the listener and thus should not be removed. The question with restoring dubplates could be as simple as '*how much of surface noise should be left in the mix*'. Many people enjoy the sound of the crackle associated with grooved recordings. Just as the cutter and their client may discuss how much bass to add to the dubplate they are producing, it is important to keep in mind who the end product is aimed at. Grooved media is enjoyed by many because of the warm

harmonic distortion that accompanies it. Fundamentally, it has to be understood what the purpose of the restoration is.

6. CONCLUSIONS

The novelty in this work has been the bringing together of a number of aspects, such as signal processing, cleaning, audio signal processing processes and so on, to formulate a proposed methodology for restoring dubplates from the Reggae/Dancehall culture of the West Indies.

At the end of this work, several lessons have been learned. The limitations of certain methods of cleaning dub plates were discovered however it was also found that very basic household items can be used effectively when attempting to remove surface contaminants. Given that over-the-counter vinyl cleaner is detrimental to the lacquer layer of the dub plate showed that non-solvent-based solutions must be used. The process of restoring a dubplate is not one that can really be automated since a fundamental element of the process is for the operator to undertake the cleaning process by hand to ensure that damage is not caused to the dubplate, and for the operator to continuously listen to the track and make a professional (and partially personal) judgement on whether an action undertaken in the audio processes stage had improved the listener's experience or not – something that an automated process cannot achieve at the moment owing to its very subjective nature.

When digitally ingesting materials it is paramount that the best equipment available should be sought. It is also important to ensure that all maintenance has taken place on both the equipment and on the records before ingestion takes place, making it easier to remove any remaining surface noise in software. Software is a powerful tool in the world of restoration. In the past, much of the processes we now have access to by the click of a button, was only available in hardware and was relatively expensive. Now, with the technology available, it is possible for Sound men to perform these digital transfers in the comfort of their own homes if they have the minimum equipment available. This is a useful idea when it comes to dub plates as many of the smaller Sounds may not have access to full professional restoration equipment. However, as the Technics SL-1200 and its derivatives are one of the most robust and prevalent turntables in the world, it is possible a layman could perform basic digital ingestion and basic processing on a dubplate that may have been in storage for many years.

As with all audio restoration and archiving, it is important not to waste either time or space in the digital realm on unnecessary transfers. One should endeavour to transfer those artefacts that are in the most danger of fatally deteriorating. It is always important to evaluate the media you intend to transfer and ensure it is the best choice for digital transfer.

Dubplates (in their lacquer form) will eventually become impossible to play as their design was not meant to last very long or even be played very often. Many of these records have already disappeared owing to storage issues and accidents. They

are more fragile than vinyl records and as such should be treated with the utmost care and attention. They are also representative of a culture that has expanded around the world and has been deemed worthy of protection by the United Nations.

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