Developing an approach for archiving Digital Audio Workstation projects:
A pilot study

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**Abstract – This paper concerns a current pilot study relating to contemporary popular music created on digital audio workstation (DAW) software, being undertaken at the Alexander Turnbull Library (part of the National Library of New Zealand Te Puna Mātauranga o Aotearoa). For the pilot we have collaborated with New Zealand music artist Luke Rowell to archive the production components for two albums. The study addresses the reality that, where music production once involved physical media such as magnetic tape, for the last 25 years it has largely shifted to the digital domain. While preserving the final musical product released to the public remains technically straight-forward, documenting the processes which artists now employ in digital production is far more challenging.**

**This paper will begin with some background about Luke Rowell’s music, then consider DAW software and the archival challenges it presents. We will then cover the approaches taken by the Library and our progress to date.**

**Keywords – digital audio workstation, music archiving**

**Conference Topics – Innovation; Exchange**

# Introduction

Born in 1983, Luke Rowell is one of New Zealand’s foremost synthpop and vaporwave musicians [1]. Over the last 22 years, he has released 15 albums and performed hundreds of gigs around the world. His track ‘Gravy Rainbow’, released under the alias Disasteradio, was a YouTube hit in 2010, with over one million views [2], while his albums as Eyeliner are

considered among the essential works of the global vaporwave movement. Much of his music is available for free download and reuse under Creative Commons licenses [3].

Music writer Martyn Pepperell notes that Rowell “grew up in a family with interests that met at the intersection of art and technology” [4]. He adopted computer-based music technology at an early age, exemplifying recent generations of artists whose practice is wholly born-digital. His initial albums were composed using the freeware tracker-sequencer program Jeskola Buzz. Around 2010 Buzz ceased being actively supported and Rowell adopted the Steinberg DAW Nuendo as his main creative tool.

# Digital Audio Workstations

 Since the development of non-linear audio editing in the late-1980s, digital audio workstations such as Pro Tools, Logic Pro, Audacity and Nuendo have become central to music production. Garageband, which comes bundled with Apple devices, is a consumer-level example that many people will be familiar with. These applications replicate, streamline, and extend techniques first developed in recording studios, such as multi-track recording, tape editing, sound mixing, and signal processing (manipulation of audio signals). They also offer new creative tools relating to digital sampling (reuse of sections of audio), sequencing (programming of note or sample sequences), and sound synthesis. DAWs are now utilized in most music production contexts, from home-recording to being embedded in professional studios.

 Why is it desirable to preserve the information represented by a DAW production? Research libraries such as the Turnbull Library have traditionally sought to collect analogue items which contribute to the study of music as a creative process. Such sources might include manuscript scores and sketches, live recordings, and studio tapes, through which one can trace the genesis and refinement of musical works, including how recordings have been constructed in recording studios. The project materials generated by DAWs are the digital equivalent of what music archives have previously collected in analogue form. If these files are not preserved, we inadvertently create a born-digital void for future understanding of how most music is now created.

 The complexity of DAW applications and general risks pertaining to digital material, however, present a daunting challenge for digital preservation. The objective of our pilot study, which we have come refer to as the Disasteradio Project, has been to develop sustainable workarounds for archiving the information contained in Rowell’s DAW productions. We aim to complete the study in late 2022 and hope our findings might prove useful to music archivists, as well as artists wanting to secure long-term access to the digital componentry of their music.

# Digital Preservation

As Riccardo Ferrante writes, a key challenge for the preservation of digital content is technical obsolescence:

“Born-digital objects require particular hardware and operating systems in order to be accessed and rendered with integrity. As technology evolves, parts of these technical environments are replaced with newer, faster, smaller components. The hardware and software necessary for a 10-year old object to operate as designed is often no longer readily available; neither is the skill set required to maintain that environment. Innovation in the marketplace is itself a risk to the cultural heritage it produces” [5].

Standard audio files such as WAV or MP3 are currently deemed as having a low risk of obsolescence. DAWs are another story entirely. When audio is loaded into, generated, and manipulated in a DAW, each decision is stored in a project file. This aggregate of editing, mixing and effects metadata refers to audio assets and/or coded audio sequences being used for the production. The production’s integrity is thus dependent on both project file and source files. Adding further complexity is the almost ubiquitous use of plugins: third-party software components that extend a DAW’s functionality with virtual instruments and various forms of signal processing. Signal paths, the flow of audio signals from source to output, may also be routed through an external hardware environment including sound modules. Another challenge is that most DAWs are proprietary applications, each using its own project file format that cannot be opened on other platforms. Many lack open-source code that would offer greater interoperability. This poses real challenges to ensure that a DAW session can still be accessed into the future.

There are four basic digital preservation strategies that the Library considered in archiving DAW files:

1. *Maintain the original technical environment (hardware, software, plugins, etc.)*
2. *Replace the original software with a backwards-compatible application*
3. *Emulate by creating a virtual version of a suitable environment*
4. *Migrate the digital content into a new format that can be accessed* [6]

The first two of these were deemed impractical by the Library, especially given the varied permutations of DAWs, plugins, OS and hardware which would need to be maintained or replaced. Since the establishment of the National Digital Heritage Archive (NDHA) in 2008, the Library’s digital preservation strategy has been based on migration [7] as the methodology for long term preservation of and access to digital collections. There are increasing numbers of tools available for virtualization of digital content, and the Library did consider emulation as a possibility. However, for the purposes of the pilot project, there seemed to be far less risk in expanding our current migration strategies to include DAWs, rather than attempting to build a new virtual environment for the collection. Given the complexity of the DAW files, even migration itself was no simple task.

 At this point, we should note that issues with obsolete DAW projects have been recognized in the music industry. Artists have reported slowly but surely losing access to older DAW sessions, thus being unable to remix or rearrange their past work [8]. Losing the ability to carry out such iterative creative processes highlights another reason why strategies to allow ongoing access to DAW productions are needed. As it happens, the music and video industries have developed several file formats to enable better operability across platforms, most notably the OMF (Open Media Framework) file or the newer AAF (Advanced Authoring Format) file [9]. With these container formats, source assets are preserved alongside editing metadata. Although primarily designed to enable projects to be operated across different DAW (and video editing) platforms, AAF files could allow for ongoing migration of projects from DAW to DAW to ensure future access. However, from a digital preservation perspective, such complex formats pose daunting challenges similar to those presented by native DAW project files. Nor does their use overcome issues arising from incorporation of multiple third-party plugins, each with its own OS and hardware dependencies [10]. While AAF files were not used in this pilot project, as they do not have the ability to adequately record plugin data that is paramount to Rowell’s music, preserving AAF files may be considered for other digital music collections.

# The Disasteradio Project

The Library’s collaboration with Luke Rowell began following the 2018 announcement that the cult music label Flying Nun Records was donating its master tape archive to the Turnbull Library [11]. Rowell contacted the Library to asked whether we were also preserving DAW project files. We didn’t have any DAW files in our digital music collections at the time but flagged this as an area for further research. The Library proceeded to develop a proposal with Rowell to archive two albums as a pilot study. The Disasteradio Project was approved in 2020 and work on the pilot study began. The two albums chosen for archiving were the Disasteradio album *Visions* (2007), created on Jeskola Buzz, and the Eyeliner album *Buy Now* (2015), created on Steinberg's Nuendo. Our first discovery was that the Buzz projects for the tracks on *Visions* could no longer be opened correctly, a mere 13 years after being created. So, another Nuendo album, *Charisma* (2010), was substituted.

 The Library’s basic approach to digitally preserving Rowell’s DAW projects has been a special form of migration. For each album track, Rowell has himself created a package of production components to give to the Library. If the Nuendo project file (.npr) represents the native digital object, then we have found a range of alternative ways for the information it contains to be expressed and preserved. The Library considered the significant properties of Rowell’s electronic music files, and created a standardized file manifest for each track across the entire collection (see Table 1). Using the UK National Archives PRONOM registry as a guide, only low-risk formats are represented in the packages [12].

TABLE I

Types of material within the Luke Rowell Digital Music Collection and file formats for each type of material.

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| Materials | File format |
| Track stems (dry) without effects and automation | WAV |
| Track stems (wet) with effects and automation | WAV |
| MIDI (Musical Instrument Digital Interface) types 0, 1 and General |  MID |
| Audio samples (if used) | WAV |
| Working mixes | WAV, MP3 |
| Final mixes, mastered and unmastered versions | WAV |
| Spreadsheet of technical information | XML |
| Screenshots of session settings | JPEG |
| Screencast with commentary | MPEG-4 |
| Music videos and promos | MPEG-4 |

Certain components of these packages are relatively straight-forward. Musicians will be familiar, for instance, with exporting sets of individual tracks (for example, vocals, bass, drums) from a multitrack production as separate audio files, or stems. Such stems are readily preserved as digital objects and can be imported into any DAW for remixing. Mixdowns, created from mixes of individual tracks, are another standard output from a DAW project.

More novel approaches have also been taken for providing researchers with other avenues for investigating the fine details of Rowell’s music. He has compiled spreadsheets, for instance, that document the settings, plugins and signal paths for individual stems within each project, cross-referenced to other assets in the collection packages. Screenshots show the settings for every plugin used for every stem. For *Buy Now*, over 700 such images have been created and preserved. Rowell has also created screencasts of the Nuendo projects for all 11 tracks on this album. In these videos he gives a guided tour of the relevant session, disclosing his creative decisions and documenting the user experience of a digital audio workstation for future researchers.

As a form of migration for digital preservation, the approach taken for the Disasteradio Project is new for the Library. Normally, digital archivists would manage the migration process following receipt of the original files, converting material into stable formats for preservation and access. The Disasteradio Project deviates from archival orthodoxy, migration being undertaken prior to transfer and by the donor themselves. In this case, Rowell is clearly the person who best understands his technical environment and creative process. He can therefore accomplish the migration task most effectively. In recognition of the work required by the donor to ensure future access and understanding of his work, the Library paid him for time spent preparing the collection.

# Discovery, Research and Re-use

 In 2021, Rowell and the Library completed work on archiving *Buy Now*, which was primarily composed using Musical Instrument Digital Interface (MIDI) sequences. MIDI files aren’t audio files themselves, but rather are performance instructions containing notes, tempo, instruments, volume, and other information to explain how the music should be played by a software program, electronic instrument, or other device. While the Library hasn’t preserved the original DAW project files, we hope that by preserving the MIDI, stems, and mixes, and the ways in which we have preserved and documented the packages retains the significant properties of the collection and expresses the underlying abstract form of the files [13]. Through these packages, the collection affords the ability to remix and understand Rowell’s technical process. The resulting collection material was released in May 2021 and is now available through the National Library of New Zealand website [14]. The Luke Rowell Collection is open access and available worldwide. Rowell has generously made the material available for online download under a Creative Commons BY-NC-SA license, which means the music can be remixed, resampled, mashed-up, and rearranged. We see the collection as having potential interest for researchers in the music studies and education sectors, in the music community, and for the wider public. As a promotional adjunct we invited other artists to contribute to a remix album based on the collection. This album, *Free Buy Now Remixes*, was released on Bandcamp as a free download, alongside a blog providing further examples of potential reuse [15].

# Conclusion

Luke has since deposited materials relating to the Disasteradio album *Charisma,* with description and ingest almost completed by the Library. Following completion of the pilot study, we anticipate presenting a fuller analysis of the Disasteradio Project. *Charisma*, which includes a range of hybrid audio-MIDI compositions, has presented a more complex archival proposition than *Buy Now*. This recent experience has highlighted the variety of challenges that may still be faced using the method outlined in this paper, even within a single artist’s oeuvre. We acknowledge that one of the main drivers of success of the project so far has been the close collaboration between the artist and the Library. Our interim conclusion, though, is that the approach holds considerable potential for digital preservation of DAW projects and may have some applicability for work in adjacent fields such as digital video and architecture.

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