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Assignment 2: Final Project

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Shall I Reduce Power?: A Look Within the Quenepón Restoration Project

Introduction

In 1912, Q-codes were created as a standardized collection of three-letter codes, which served operating signals for commercial radiotelegraph communication.[1] These codes, which were designed for radio communication when it exclusively used Morse Code, were later adopted by the amateur radio community as a shorthand method of communication. The code QRP was originally developed as a command or a question: "Reduce power," or, "Shall I reduce power?"

When ham radio adopted the code, it became a catch-all to describe the field of low-power operation.[2] The logic here is that anyone can set up a transceiver and an antenna and connect with others using 100 watts, but those imbued with the spirit of amateur radio find their artistry in being able to communicate using as low as 10 watts. This ability to operate at low power demonstrates the technician's skill, and is also an expression of neighborliness: with the availability of the radio spectrum to amateurs growing narrower and narrower, a technician (sometimes called a QRPer) who operates at a lower power than they're legally allotted is leaving more space for others to join the community.

While the Quenepón Restoration Project carries the QRP acronym only coincidentally, this framework of working at lower power to be an agile technician in service of the community is one that could guide the ethic of this preservation project. The goals of the Quenepón Restoration Project are modest, but for the archivists working on this initiative, they are still proving to be difficult to achieve within the timeline that was initially set by the team. This paper

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[1] Airwaysmuseum.com. "The 'Q' Code." accessed 11 December, 2019. http://www.airwaysmuseum.com/Q%20code.htm

[2] Hackaday. "How low can you go? The World of QRP Operation." accessed 11 December, 2019. https://hackaday.com/2016/03/08/how-low-can-you-go-the-world-of-qrp-operation/

aims to consider an alternative model that is less resource-intensive in the beginning in service of moving the project forward on an expedited timeline.

The Quenepón Restoration Project

The Quenepón Restoration Project is an effort to preserve an early Internet e-zine called *el Cuarto del Quenepón* , which was created by Maria de Mater O'Neill from 1995 and managed by her until 2005. El Quenepón is a distinctive online cultural document from a long-gone era of Internet history in a place far from Silicon Valley. It was one of the first – if not the first – electronic publication devoted to cultural production in Latin America and one of the first Spanish-language electronic publications in the world.

It is also, at present, a digital preservation puzzle. Although O'Neill diligently backed up her website as she created it, she never migrated her backups. The backups are on the technologies of their time: data tape cartridges, which face major obsolescence risks, and optical disks, which additionally face accelerating degradation concerns. That O'Neill had the foresight to back up what she was creating is a rare feat, and that she didn't migrate her formats is completely understandable. The challenge the Quenepón Research Project will be to craft an appropriate workflow and ethic to preserve the works contained on these formats that will enable them to find a long-term home, or at least a short-term step toward a long-term home.

The Quenepón Research Project is a collaborative research project between four archivists and O'Neill herself. The archivists are Caroline Gil, Media Conservation Fellow at the Museum of Modern Art; Amye McCarther, Archivist at the New Museum; and Danielle Calle, who is a recent graduate from the Moving Image Archiving and Preservation (MIAP) program at New York University; and Claire Fox, a current student in the MIAP program. The primary objectives for the projects are currently as follows:

1. Migrate digital assets from obsolete data tape cartridges and optical media to modern storage media.
2. Conduct artist interviews with O'Neill to document the linkages between image and text elements and their interaction on the live web during the life of the e-zine.
3. Apply for grants to support the hardware and software needs for imaging media.

Within the context of this paper, a smaller-scale assessment will be conducted: a file format appraisal of an ISO disk image created during an early meeting with O'Neill. This disk image, created on the fly with the intention of gaining a glimpse of the assets contained on the CD-ROM, provides a wealth of evidence that could help the Quenepón Research Project team strategize project next steps in a manner that may be more agile.

Getting Connected in the Global South

Just over 50 years ago, in 1969, ARPANET – the predecessor of the modern Internet – was founded at four node hosts: UCLA, Stanford, UC Santa Barbara, and the University of Utah, and by 1981 had expanded to 213 host computers across the U.S. Meanwhile, in 1985, the National Science Foundation Network, or NSFNet, was founded to link researchers to the NSF's supercomputing centers at five American universities. In 1988, the first round of countries outside the U.S. connected to NSFNet, including Canada, Denmark, Finland, France, Iceland, Norway, and Sweden. this point that the geography of the early Internet was highly concentrated in the Global North: U.S., Canada, and Western Europe. But in 1989, the network expanded to include ten more nodes, and one of them was Puerto Rico.[3] The network connection was established via the University of Puerto Rico, and O'Neill was there to take advantage.

In the early nineties, O'Neill was a recent graduate of Cooper Union in New York, and had returned to Puerto Rico to work in a community of close collaborators.[4] She worked primarily as a painter and graphic designer, and experimented with a range of digital imaging processes. She had her first experience connecting to NSFNet when she was employed by the University of Puerto Rico to design early web sites. She remembers the first time she opened a Mosaic web browser in her home and was greeted by a screen of Japanese newspapers, which blew her away: she could suddenly see the world from the weird office behind her kitchen. And furthermore, she could right click on the page and see the source code, and she knew that she was capable of building these sites, too.

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[3] National Science Foundation. "Support for the Participation of the University of Puerto Rico in the NSFnet." accessed 11 December 2019. https://www.nsf.gov/awardsearch/showAward?AWD_ID=8818283

[4] Maria de Mater O'Neill. Interview by Danielle Calle, Claire Fox, and Caroline Gil. San Juan, Puerto Rico. June 7, 2019.

At this point, the World Wide Web was still pre-Internet and pre dot-com. The web hadn't been commercialized yet, and content producers had to design scrappy platforms for themselves. As O'Neill puts it, the content online was representative of individuals who were just trying to figure things out. She saw an opportunity for her to do what she calls decolonizing history: giving a voice to her community in Puerto Rico, and allowing Puerto Ricans to talk about their experience and their history from their perspective. There would be no American or European curators shaping the voice of *el Quenepón*.

She decided to make an online publication with a distinctly contemporary voice, and she put out calls for people to submit art works and writing. When she registered for her domain, she called it *el Cuarto del Quenepón* after her office: a room painted the lime green color of a Puerto Rican citrus fruit called a Quenepa.

The publication took off quickly, and through relationships she'd built during her time publishing via the University of Puerto Rico's NSFnet connection, she became the second person to have a commercial Internet connection in Puerto Rico via Caribe.Net in 1995. With a sustainable Internet Service Provider and a reputation for getting things done, O'Neill solicited artists to submit works in a range of formats via floppy disks, and she would upload them every day to el Quenepón.

While the work was nearly all created by Puerto Rican artists, the visitors to the site were international: most Puerto Ricans weren't connected to the Internet yet. At this point, O'Neill wants to restore her backups of *el Quenepón* specifically to return it to Puerto Ricans as part of their artistic cultural heritage.

Yesterday's Internet Today

Today, if a user tries to visit the original site's URL – which is cuarto.quenepon.org – they'll find that the link is dead. Internet Archive's Wayback Machine made a 214 crawls of the site between February 1998 and September 2019 that provide a sense of what it once was, but those crawls aren't sufficient to give us a true picture of what the site used to hold. O'Neill knows that there was interactive content there. Early video livestreams. Flash animation. Things that still exist – or at least may still exist – on obsolete data tapes and optical disks.

When the Quenepón Research Project team first met Marimater O'Neill this past June during a community archiving workshop in San Juan, Puerto Rico, we had two exploratory meetings with her at her home to see how we might consult on the restoration of *el Cuarto del Quenepón*. During one meeting, a friend brought over a folder of CD-ROMs that carried backups of issues of el Cuarto del Quenepón. We selected one from 2004, and we used ddrescue to create an ISO disk image. We mounted the ISO disk image on a Windows95 virtual machine running on to see what kinds of materials we could find. After a few minutes of clicking around, we realized that not only did she back up the art objects that were on the website, but she also backed up all of the administrative files associated with the zine. That makes these cartridges and CDs representative of not only a series of art objects created by a generation of Puerto Rican artists, but additionally, they are an important cultural document that can tell us more about the way people used the early Internet in the Global South.

We also recorded an hour-long artist interview with O'Neill to learn about the history of *el Cuarto del Quenepón*. There are, of course, incredible stories caught up in those backup formats, as well as in the memories of the people who worked on the zine. O'Neill told us about the early days of receiving submissions on floppy disks and getting kicked around to different service providers, sometimes having to drive two hours away from her home to upload submissions a server. She told us about the day that one of her collaborators configured a live video stream, and we could still hear how exciting that event was in her voice. She also told us about trying to dodge proprietary formats and closed web browsers, which she had a knack for doing – and yet, she wasn't always successful.

The archivists hope to eventually find a permanent home for *el Cuarto del Quenepón*, whether in the form of its backup carriers, or in a file-based system. Ideally, this home would be in a museum in Puerto Rico, but we have concerns about digital preservation infrastructure and maintenance. Even some of the most well-resourced institutions in the United States don't have the capacity to steward complex digital media, with its dependencies and deprecations. And typically, digital objects are undervalued, or de-prioritized. In the case of this e-zine, time is working against us: the longer we wait to migrate formats, the harder it will be to find the appropriate decks for playing back or imaging the media, and services will only become more expensive.

An Alternative Approach

While the Quenepón Research Project team is experienced in the practice of creating disk images and writing grants, the process of locating drives, test tapes, test disks, and software has been time-consuming. Setting up an imaging work station and workflow will take time on its own – in particular with the data tapes and cartridges – and the process of imaging the disks themselves will also take additional time. While these tasks will be important in the process of preserving *el Cuarto del Quenepón*, they will not provide the archivists with any new information before imaging begins.

As an alternative, conducting a high-level file-format appraisal will provide the archivists with a new data to share with possible collaborators and funding sources, as well as with O'Neill. The archivists created one disk image of a randomly-selected CD-ROM in June of 2019. In conducting an appraisal of the disk image, the archivists might be able to answer questions that could be informative to potential future digital repositories, including:[5]

1. What files are present?
2. How were the files created and used?
3. How are the files arranged, both in terms of directory structure and naming convention?
4. How might we describe the relationship between the physical portion of this collection and the files?
5. Is there any duplication of digital materials within a single disk image?

Having answers to these questions, even if they're based on a small amount of data relative to the rest of the collection, would allow the archivists to gain more traction in their understanding of the needs of the e-zine, and how they might tailor specific questions and approaches related digital preservation standards including OAIS compliance and NDSR Levels of Preservation.

[5] Shira Peltzman, email to Claire Fox, December 10, 2019.

File Format Appraisal Approach

The file format appraisal was performed by Claire Fox, current student in the MIAP program. The approach included two primary actions:

Action 1: Explore the interactivity of the disk image by mounting it to a contemporary operating system and a virtual machine. Action 1 serves the purpose of determining whether virtualization or emulation might be necessary for rendering the files contained on this particular disk image.

Action 2: Determine the number of files contained within the disk image, and the specific number of files for each file format represented on the disk image. Action 2 moves toward answering the questions listed above that could be of use to a potential acquiring institution.

Action 1: Exploring Interactivity in a Modern and Virtualized Computing Environment

The first step in assessing the disk image was to determine whether it could be mounted in a modern operating system at all. An early concern for the Quenepón Research Project team was that many of the files might not be renderable on a modern operating system, and that any sort of assessment might have to be conducted via the use of a virtual machine or an emulator. However, the ISO was able to mount on a High Sierra operating system and render files without any issues.

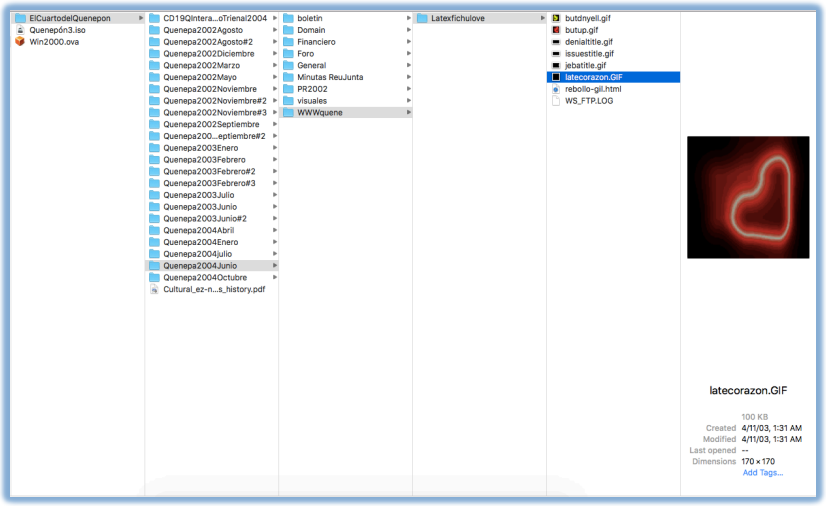

Figure 1: The directory structure in a High Sierra computing environment.

To determine whether any major discrepancies in look and feel might occur between the High Sierra environment and a legacy computing environment, the archivist also mounted the ISO within a Windows2000 virtual machine installed on VirtualBox.

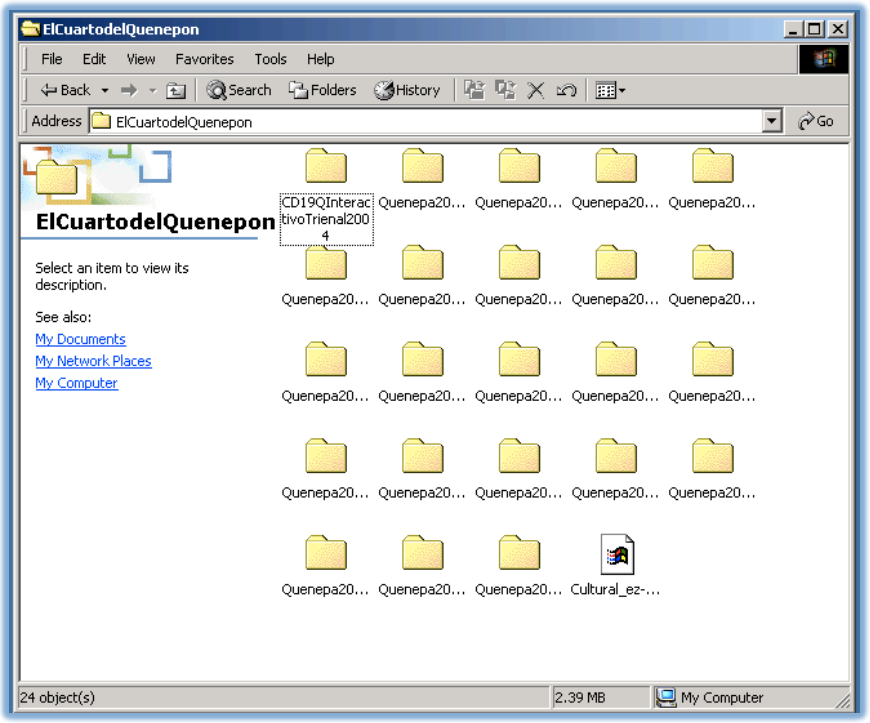

Figure 2: The directory structure in a virtualized Windows2000 computing environment.

While there was an aesthetic difference between mounting the ISO in the Windows2000 environment and the High Sierra environment, those differences did not hinder the archivist's ability to engage in a high-level file format appraisal. Working in both modern and legacy software environments was helpful in that they provided a basis for comparison against one another. Both provided a platform for thinking through questions 1, 3, 4, and 5 from those listed in "An Alternative Approach."

Action 2: Determine the number of files contained within the disk image

Once Action 1 had established that the ISO could be rendered in both legacy and modern computing environments, further actions could be performed to engage with Action 2. The aim

of Action 2 is to determine the number of files contained within the disk image, and the specific number of files for each file format represented on the disk image. The steps to conduct Action 2 were all performed in the High Sierra environment, and were as follows:

1. List the contents of directories by using tree.[6]
2. Count the number of files by extension using a script, and verify the total against the number determined by tree.
3. Use DROID to perform a batch identification of the file formats within the ISO, and verify the number of files against the numbers determined by tree and the script.[7]

Tree provided a clear view of the directory structure and file extensions, and returned a result of 273 directories and 3,092 files within the disk image.

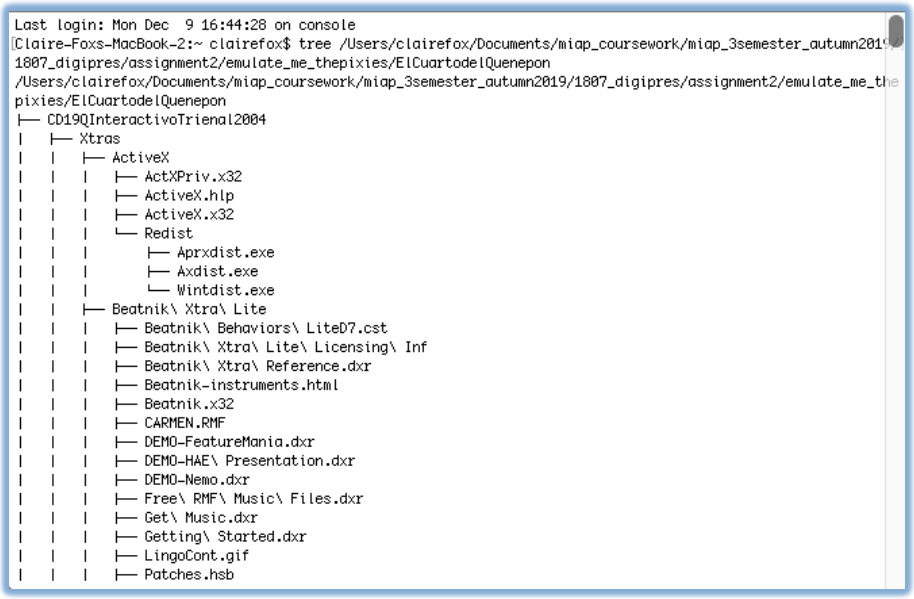

Figure 3: The directory structure in tree.

This information on its own is useful, and an additional method of verifying the number of files in the ISO and counting the number of each file format would provide further context for the

[6] Github. "MrRaindrop / tree-cli." accessed 11 December 2019. https://github.com/MrRaindrop/tree-cli

[7] Github. "DROID (Digital Record and Object Identification." accessed 11 December 2019. https://digital-preservation.github.io/droid/

files displayed in tree. A script from Pete Freitag written to list all file extensions and count the files in the directory proved useful here.[8] The script was written as follows:

```
find /some/dir | grep -c '\.js$'
```

In brief, the script outputs only files (no directories), outputs lines that have a dot followed by one or more characters that are not a dot, sorts them, and counts each unique file extension. By adding the number of files for each format together, the script matched the same number of files output as tree: 3,092.

DROID, on the other hand, provided a different output: it located 10,557 files. While this drastic difference in file counts is troubling, DROID did provide additional useful information that tree and Freitag's script could not provide. In particular, DROID was able to provide the name of the formats included in the ISO, not just the file extensions. It additionally provided the method by which it determined the file format (signature or extension), the MIME Type, and the date the files were last formatted, among other useful breadcrumbs of information.

Conclusion: Next Steps

Knowing that tree, DROID, and a basic script can provide format identification and counts on a disk image mounted on a modern computing environment are strong steps forward in gathering information about *el Cuarto del Quenepón* for the Quenepón Research Project. Further research should include designing a more specific methodology behind gathering the data beyond cursory file counts and identifications.

One particular task that will prove useful is researching more specifics on each of the file formats that appear within the ISO, in particular the top ten formats. PRONOM,[9] the online technical registry that powers DROID, can provide valuable information here, as can the Library

[8] Pete Freitag. "Recursively Counting files by Extension on Mac or Linux." accessed 11 December 2019. https://www.petefreitag.com/item/883.cfm

[9] The National Archives. "The technical registry PRONOM." accessed 11 December 2019. https://www.nationalarchives.gov.uk/PRONOM/Default.aspx

of Congress' Sustainability of Digital Formats website.[10] In addition, if there are instances where the ISO contains formats that PRONOM cannot identify, the archivists have the opportunity to register those file formats within PRONOM for the sake of providing the rest of the digital preservation community with context for file formats that are potentially rare.

This work in identifying file formats, along with their requirements, dependencies, and risks, will allow the Quenepón Research Project team to make informed decisions about where the e-zine may eventually call home. While the archivists have been considering museums and archives as the top choices for long-term stewardship, it is possible that a faster, more agile, non-archival initiative may be a better choice for providing access at the speed desired by O'Neill. If this is the case, a deep understanding and documentation of the materials, a backup storage plan, and an appropriate set of contracts will need to be researched and implemented.

For now, however, the guidelines of the QRP code – "Shall I reduce power?" – still ring true. Perhaps by reducing power (or in this case, scaling-down the scope of the assessment) will allow the Quenepón Research Project to make some important steps toward finding a long-term home with ambitious digital preservation goals.

[10] Library of Congress. "Sustainability of Digital Formats: Planning for Library of Congress Collections." accessed 11 December 2019. https://www.loc.gov/preservation/digital/formats/

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