William T. Street. Analyzing the Capacity of Library and Information Science to Preserve Non-Fungible Tokens. A Master's Paper for the M.S. in L.S degree. May, 2022. 35 Pages. Advisor: Denise Anthony.

Non-Fungible Tokens (NFTs) represent a new approach to ensuring authenticity of records, as well as being a medium that digital artists are flocking towards. Such a technology could prove to be incredibly useful in conducting work in the world of Library and Information Science. This research aimed to propose the beginnings of creating a set of best practices for the long-term preservation of NFTs, through interviewing LIS professionals who are experts in preservation. These interviews would attempt to garner insight on how NFTs could or couldn't fit into pre-existing frameworks of preservation practices, and if not, how to adapt current practices to accommodate them. Due to a lack of responses, the approach of this paper shifted from primary research to a review article, still with the aim of trying to understand what accommodations may need to be made to preserve NFTs in the long term.

Headings:

Archives Collection Management

Digital Preservation

Science and Technology Library Software

ANALYZING THE CAPACITY OF LIBRARY AND INFORMATION SCIENCE TO PRESERVE NON-FUNGIBLE TOKENS

by
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Approved by

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Introduction

Defining a Non-Fungible Token

A Non-Fungible Token (or NFT for short), is an emergent digital format that has been gaining increasing notoriety within the last several years (Bhatia et al, 2019). Despite the confusion that can sometimes surround the purpose of NFTs, the underlying concept of why they are created is relatively simple. An NFT is a collection of data (most commonly descriptive metadata) which is affixed to a digital ledger. (Bhatia et al, 2019). Within this ledger, the data cannot be changed or removed.

It is important to define in more clear terms both what a digital ledger is, and what purpose it serves. Blockchain , is the most commonly known and utilized digital ledger . (Nofer et al, 2017). Blockchain technology in its simplest terms is comprised of three components, which collectively constitute one block: its data, its hash, and the hash of the previous block in the chain. (Simply Explained, 2017).

A hash acts as a unique identifier to a block and only corresponds to the block for which it was created. The first block in the chain is unique, as it has no previous hash to point to, and is called the genesis block the hash of the previous block is encoded into a newly created block to create a timeline of authenticity, which can be used to more easily track what data is added, when, and what subsequent data gets added in response. (Simply Explained, 2017).

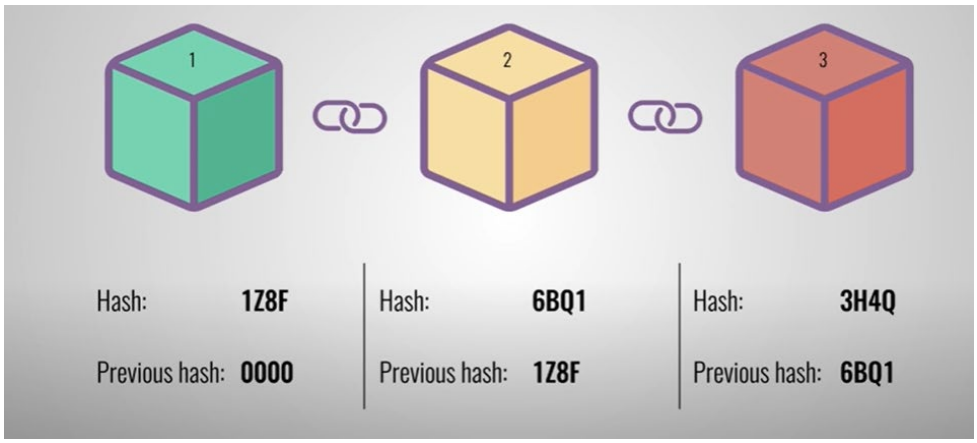

Figure 1: A 3 block example of the start of a blockchain. Block 1 acts as the genesis block, and so doesn't have a parent hash. Block 2's parent hash is the hash of block 1, and block 3's parent hash is the hash of block 2. (Simply Explained, 2017).

If one were to try and change an established block within a chain, the chain would create a new hash for the block in question. However, this wouldn't alter subsequent blocks , but the hash for the block immediately following the changed block would conflict with the new hash of the altered block. (Simply Explained, 2017).

An additional measure of ensuring data within a blockchain is through utilization of a peer to peer network. (Simply Explained, 2017). having multiple users who can verify whether a block is or isn't correctly aligned with the blocks that follow it creates another safeguard to ensure that once data is added to a blockchain, it will remain affixed in its original state. This is just one example of how digital ledgers utilize a decentralized approach to curate their data.

. It is Important to remember that at least within the context of blockchain, all NFTs are blocks, but not all blocks are NFTs. At its core, an NFT is metadata, meant to describe and represent other data within the context of the blockchain. The data that an NFT's metadata represents is not stored within the block. (Simply Explained, 2021).

Storing data separate from unchanging metadata is another way in which blockchain and ledger technologies utilize methods of decentralization.

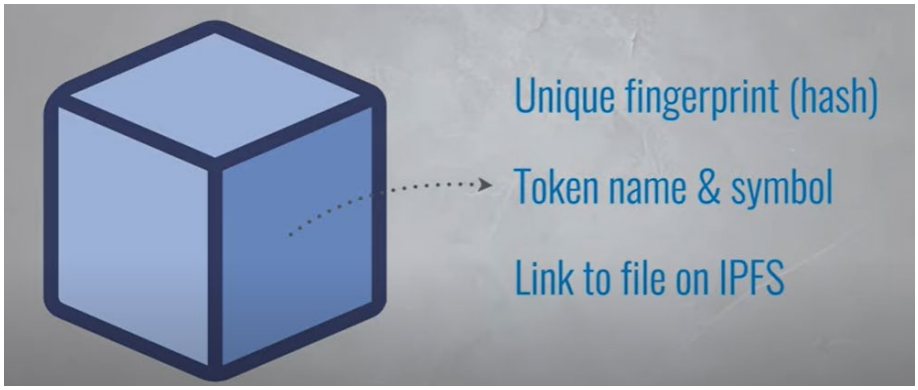

Figure 2: A representation of an NFT block, and compromises it. The unique fingerprint hash is similar to a hash within any other type of block, as is the parent hash of the previous block. The token name, symbol, and (optionally) link to the data the NFT represents on IPFS (Interplanetary File System) comprise the data component of the block. (Simply Explained, 2021).

While there are many who still feel confused by NFTs, both in terms of what they represent, and how to utilize them, others have flocked to them, particularly those in the visual arts. (Rae, 2021). NFTs don't exist just for data authenticity, however;, many see them as a means to create personal wealth. In the context of the art world, NFTs are integral to? to the newest development in art collection on a digital scale. An artist, auction house, or anyone looking to sell an NFT,can offer buyers a measure of authenticity and protection. (Bell et al, 2019). Because digital ledgers can be accessed by multiple users from devices on different networks, ownership of an NFT is simple to verify. (Permatasari, 2020). Multiple sources can certify that a party is irrefutably the current owner of the token.

This market for visual art NFTs is burgeoning in both size and value. In one instance, Christie's auction house sold an NFT known as "Beeple's Opus" for over 69 million

dollars. (Christie's, 2021). Such a sum speaks to how NFTs as a medium have captured the attention of the public. Yet, there are varying opinions of NFTs. Some laud them as the newest innovation that will change the world, others chide them as a joke, while many others know of them but are uncertain of how they work.

A. The Intersection of NFTs and LIS

Within the field of library and information science, one of the core drives of the field is to both determine which information is of enduring value to a community of patrons and make that information available to them. Whether LIS professionals serve a public, academic, or corporate community, , the goal remains the same. Part of the training of LIS professionals is focused on determining which records or other media have enough impact or importance to warrant dissemination and preservation. we must think not only of the current patrons, but those of the future as well.

This leads to a more subjective part of the profession. While a current patron can articulate what information they need, and as such it is easier to curate and disseminate that information, it is comparatively difficult to determine the needs of future users . LIS professionals ultimately must make subjective calls, utilizing their training and research to determine what would be best to preserve, as not everything can be preserved.

Commonly, a part of this approach to providing access to records for patrons is by bringing records into one centralized location (be that physically or digitally) within the repository. At many points within the process of care and preservation of records within a repository, great effort is made to ensure that all pertinent metadata associated with a record is kept either linked to or made a part of the record itself to

ensure that information is accessible and searchable to patrons as well as those charged with managing the digital records .

Library and Information Science professionals have a responsibility to stay at the forefront of new mediums, both hardware and software, to determine if and when something needs to be considered for long term preservation. In this sense, NFTs are no different. With an established interest among the public, there is an argument to be made that NFTs can and should be preserved long term., irrespective of whether or not the trend continues to grow or burns out. The case could be made that NFTs have already made an impact on the public that researchers in the future may wish to reference and learn from them directly.

B. How to Best Preserve NFTs

As an emerging digital medium, NFTs have inherit needs for their preservation. (Fernandez, 2021). These needs, which will be explored in depth later, may necessitate a critical review of the best practices for digital preservation utilized in LIS spaces if the field aspires to preserve NFTs.

The original intent of this study was to conduct interviews with LIS professionals and preservation specialists who felt qualified to speak on the subject of preservation and NFTs, to compare and contrast responses, and identify overlapping ideas in order to begin framing a set of standards for the long term preservation of NFTs (See Appendix A).

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In attempting to find study participants, three resources were used to elicit participants: :the member forums for both the Society of American Archivists and the

American Library Association, as well as the Digital Curators google group. Despite efforts to disseminate the call for participants to a wide audience, no one came forward to volunteer as a respondent.

why no one responded remains unclear. While it is possible that the investigator failed to generate a proper level of interest in the research, it is also possible that there weren't any who saw the call for participants who felt qualified to be a respondent for this study. What is clear, in contrast, is that within the larger literature, there are those who are thinking and writing about blockchain and NFTs, and how they relate to LIS and related disciplines. This inability to garner interest contrasted by a growing academic discussion through literature is what prompted the move from a primary study to a review article.

although the original methodologies could not be implemented, they pose questions and considerations that may be valuable to the larger discussion surrounding how to structure a standard of best practices for NFTs.

The aim of this review paper is to synthesize the current literature to answer this question. This will be done in 4 sections. I suggest removing the alphanumeric labels and use only the text. The first, , Defining Current Best Practices will look at current best practices in digital preservation, both recommendations and how those recommendations are utilized in practice, to develop a baseline understanding of where the field is. will then explore the specific preservation needs of NFTs, and analyze places in which LIS may need t change their practices to meet those needs. will then look at examples of institutions for which in-house preservation practices of NFTs have been established. The purpose of looking at these institutions is to see

both what is working well, and what needs improvement . Finally, s. will propose ways in which LIS might change to better suit the preservation needs of NFTs in the long term, drawing upon institutional examples, the specifics of the needs of NFTs, and commonly accepted practices already in LIS.

Defining Current Best Practices

Within the world of library and information science, while there can be deviation from the common practices, there do exist standards for preservation of records, typically known as the document life cycle (Antonacopoulos, 2004). While the document life cycle exists more as a concept, there do exist more tangible structures and suggestions at the industry level, such as Describing Archives, a Content Standard (The Society of American Archivists, 2004).

In terms of digital preservation, there are several methods utilized in order to ensure that records can be preserved for as long as possible. Such methods include techniques such as migration, emulation, and preservation of the technological hardware on which the data in question is housed. While these methods vary in their approach, there are several commonalities to them such as Having the records centralized in one location, and relying on the work of one institution to preserve the one record. This is not to say other copies of the record don't exist in other institutions, simply that normally, the one copy is overseen by one group or individual.

LIS standards have evolved and grown to meet the changes that we see in technology. Such change can even be seen in recent decades as the explosion of the internet and digital spaces as well as more niche tools such as blockchain have

prompted professionals to try to determine whether or not such advancements can be utilized for better preservation practices (Clifford, 1999). At the same time, there continues to exist a common core of practices, a generalized understanding of how preservation is done (Madison, 1998). This has led to a dichotomy within the field where new beneficial practices must be fit within the larger existing framework of the common understanding. Such attempts at integration aren't easy, nor are they always successful.

At a basic level, the document life cycle is comprised of multiple steps. (Wilkinson et al, 1998). The first of these steps is creation. Creation of a record can exist in two similar but different variations. The first is the more straightforward, wherein a document is made independently by a creator, and is later acquired by a repository. The variation to this is where a representative from a repository is in contact with a creator during the record creation. to advise and inform the creator on ways they could structure their document that could potentially make the process of accession and preservation easier.

Following creation, records are appraised, and if deemed appropriate for the scope of a repository, are accessed into the collection. When new records are accessed, they then need to be described in accordance with the description standards of the repository. Part of the process of description is creation of metadata. The purpose of metadata creation is multi-faceted. It is Not only for enabling long term preservation and authenticity of records, but also to increase the searchability of records for the user population. At the end of the life cycle is deaccession. Sometimes documents are removed from a repository, for a few reasons. On one hand, the scope and goals of a

repository may change, in order to better suit the changing needs of the user population. In addition to this, no one repository has limitless space. Determinations must be made about which records hold the most enduring historical value. In order to create space for newer more pertinent documents, older ones that have depreciated in relevance may need to be removed. (Wilkinson et al, 1998).

As it currently stands, the approach to the data life cycle and records management places the emphasis on adaptation on the part of the record to meet the capabilities of the repository. This is not necessarily a negative. Not all archives are equal in terms of collection scope, resources to allocate, and staff experience. Not every archive can collect every document, nor should they attempt to. A small local historical society won't have the same capabilities or interests as the Smithsonian.

However, there still exists questions in terms of where and when adaptation on the part of the repository is warranted. Typically, this will often be pushed forward by a change in hardware that would benefit the operations of the repository. (Given et al, 2010). In instances such as these, the concept of data migration needs to be considered. When new hardware is implemented, it is vital to ensure that the process of migrating old file formats into new ones, or at least into a form where the information is still accessible, needs to be forefront in the process.

Defining The Specific Preservation Needs of NFTs

Considerations of NFT Preservation

In order to properly assess how close or far LIS preservation practices align with the needs of NFT preservation, we must first better define what specifically NFTs require in order to be preserved in the long term.

While preservation of born digital materials in the modern day may seem simple on the surface, viewing it as such would be to ignore the nuances inherit to NFTs as a medium. Broadly speaking, there are two primary considerations that must be specifically accounted for when preserving NFTs : data migration, and how the data itself is stored in relation to the token. (Fernandez, 2021).

A. Data Migration

In terms of data migration, the time to consider how these data will be migrated in the future is when they are first accessioned. .,NFT's underlying ledgers aren't built to last forever. Hardware obsolescence is not only ever present, it moves at a rapid pace. When considering this, we also need to consider the core concept of the digital ledger, i.e., data which are affixed to the ledger cannot later be removed or otherwise changed. (Sherman, 2019). This is done at the level of the ledger, not the data itself. As such, care must be taken when data migration work is eventually done for digital ledgers. Consideration must be given to the hardware the data is being migrated to. Will this hardware similarly disallow the changing or removal of data? If not, will it be able to acknowledge to users that these data came from a ledger where this type of manipulation was prevented?

Where Data is Stored

Aside from data migration, care must be taken when considering how to preserve the data itself. An NFT contains descriptive metadata. (Kastrenakes, 2021). Only the

metadata is affixed to the ledger, and not the records that the metadata describe. NFTs utilize hyperlinks to point to the records themselves, which are hosted elsewhere on the internet. This is due in part to the file size limitations of blocks affixed to a ledger. It is more viable to store a collection of hyperlink data within a token than a collection of records themselves. (Kastrenakes, 2021).

The problem emerges when these webpages associated with the hyperlinks aren't properly maintained. While one may look after a digital ledger, if they aren't also curating the web pages, then the data within the ledger may. become invalid This can take multiple forms. Not only do webpages get removed, they can also have their content changed. Because the ledger cannot be changed, neither of these events can be reflected in the original NFT. This in turn, calls into question the long-term viability of the token, which loses relevancy when the record it is supposed to represent is altered . (Kastrenakes, 2021).

There are attempts to rectify this problem through use of other software, such a,s InterPlanetary File System (IPFS for short). IPFS is a sort of registration system for an NFT. If a creator registers their token with IPFS during the creation process, it can act as a level of safeguard from data obsolescence. It achieves this by taking a token's metadata, which normally can only point to one location on the web, and instead have it point to many. So long as the record the metadata represents is somewhere on the web, IPFS can link to it. (Kastrenakes, 2021).

IPFS is not without its faults, however. even with safeguarding one token by having it point to multiple locations, there have still been instances where a token's link fails to connect to the proper record. (Kastrenakes, 2021). While these records were

restored after it was brought to the attention of IPFS, these incidents still speak to a larger problem.

When we consider the preservation of an NFT, we cannot think of the token in isolation , but must include the records they represent. Under normal circumstances, this wouldn't be a difficulty. Metadata tend to be stored with the records they're associated with. However, this isn't the case with NFTs. Because the metadata is kept separate from the record by nature, preservation of the token is decentralized. This leads to a system where people in different locations have to preserve multiple parts of a whole, with or without strong communication. Even approaches like IPFS are trying to cure symptoms rather than the underlying disease. the problem of a lack of communication among preservation teams is not solved by introducing more isolated teams.

In order to move towards a better system of preservation for these tokens, it is important to consolidate preservation work, or at the very least establish more channels of communication. If a repository wishes to preserve a token, they need to be aware of who owns and operates the associated web pages which host the records. In most cases, this is two groups, an internet service provider (ISP) and a domain name business (DNB). The ISP ensures that the page has the means to run and continue to be hosted online, and the DNB owns the actual link. (Kastrenakes, 2021). It falls to someone else to rent the link, at which point they have the rights to curate the page itself. If there is a breakdown at either of these points, either an inability to continue hosting the page, or a change in ownership of the domain name, then the record will no longer be hosted on that link and the NFT will be invalid.

In an ideal situation, a repository would be able to both host the link as well as own the domain name outright, allowing for possible changes or alterations to both the ISP and DNB to be removed from the equation. The more parties that are required to operate to preserve one record, the more complicated the process will be.

I. Analysis of Repositories Utilizing NFTs

Several institutions and repositories, from those as large as the British Museum in London to smaller institutions such as the Seattle NFT museum , are starting to use NFTs for a financial and educational purposes. The goal of this section is to analyze how they go about preserving NFTs by utilizing publicly available publications,.

A. The British Museum

As previously mentioned, the British Museum is perhaps one of the most well-known entities in the LIS space to work with NFTs. they do so through a partnership program called LaCollection. an independent group, and that the British Museum is currently their first partner in this program. the museum brings resources to the partnership, i LaCollection is handling the care andpreservation of the NFTs themselves. (LaCollection, 2021).

LaColleciton makes clear that it utilizes Ethereum as its ledger of choice, and that the type of token utilized is ERC-721, the standard token for Ethereum ledger. Additionally, they make note that they utilize IPFS to safeguard the integrity and authenticity of their tokens. Of particular note, however, is that by their own admission, IPFS is run by “a network of willing participants, in a network of peer to peer nodes”. (LaCollection, 2021). This node network allows users to upload files to

IPFS. This, too, is decentralized. When a file later gets loaded through IPFS, it is not stored on a single server; rather, the file is located and hosted by multiple users throughout the network.

While on the surface this seems like a strong system for ensuring preservation, (one of the stated goals of LaCollection) and using the standard Ethereum token structure allows for easy resale of NFTs, many of the highlighted benefits of the system focus on how decentralized it is. The ledger, token structure, network, creator (the British Museum) and curator (LaCollection) are all decentralized from one another. While decentralization and multiple actors are not the enemies of preservation, each additional layer adds compounding challenges to the ability to preserve a record in the long term.

B. The State Hermitage

Similar to the British Museum, the State Hermitage in Russia is also making NFTs for financial benefit. Rather than Ethereum, they utilize a different ledger, Binance, as the hosting platform for their tokens. (The State Hermitage, 2021). Unlike Ethereum, Binance was designed as a marketplace. (Binance, 2021). Sale of NFTs is chief among their aims , whereas Ethereum has this as only one of a larger number of aspects within their scope.

Another noteworthy aspect of the Hermitage tokens is that they have to be made in accordance with Russian law. Russia strongly regulates the financial uses of cryptocurrencies and NFTs as a facet of that. While there were restrictions last year during the Hermitage sale of NFTs, the Russian legal system is moving towards a

ban of their sale in 2022. (Fabrichnaya et al, 2022). Understanding that not all tokens can be made with the same framework according to local laws means that there may be eventual differences in preservation needs as a result of these legal changes.

C. The Seattle NFT Museum

A third example the Seattle NFT Museum which opened in January of 2022 is more education focused. The museum's stated mission is "to provide an outlet for artists, creators, IP owners, and collectors to display their NFTs in a highly contextual, physical setting." (Seattle NFT Museum, 2022). This educational context provides a decidedly different scope from either the British Museum or the Hermitage. In both of those instances, the museums are creating NFTs for physical artworks in their collections and selling them; the museum doesn't hold ownership of the NFT, but acts as a place for private owners to display their records. (The Seattle NFT Museum, 2022).

This concept of loaning a piece to a museum is far from new, but including a file structure such as NFTs in the process does raise questions.. For one, which piece is being lent? Is it the metadata itself within the token, or the record itself, or possibly both? Beyond this, does care and custodianship change hands during the loan? Is the museum responsible for ensuring the links that keep the record online work during the loan, or does the responsibility remain with the owner?

II. How can LIS meet the preservation needs of NFTs?

A. A Decentralized Structure

When we consider both the theoretical needs of NFT preservation against both the current best practices in LIS as well as real world implementations of these standards,

several things become apparent. By nature, NFTs are designed to be decentralized. From the ledger technology they are built on, to the multi-user networks established to verify their authenticity, it is clear they weren't built to be overseen by a singular party. This somewhat exists at odds with classical LIS approaches to preservation, where normally, even if the metadata exists separate from the record, the two are typically able to be kept together. This is not as easily accomplished with an NFT. As such, we must consider what adaptations can and should be made, either on the part of repositories, or the structuring of NFTs, to allow for their long-term preservation. It seems clear that structurally, NFTs are going to remain decentralized, as this is part of the core of their concept. As a result, LIS preservation practices must adapt and grow..

There are a couple of different approaches that could be taken to this adaptation at a conceptual level. Either the discipline as a whole can rework the standards for digital preservation overall or create a set of sub-standards derived from the current practices but adapted to the needs of NFTs as best as possible.

B. The Need for Communication

Still the question remains, how does the field adapt to better accommodate this new medium? One early step is identifying all the parties involved and working to ensure channels of communication are either established or improved. When considering that a creator, an ISP, a DNB, a repository, and possibly a network such as IPFS all have to come together to ensure a record stays available online, it is clear strong communication and commitment from all parties will be needed to be successful.

Additionally, it could be beneficial to repositories to engage in outreach, both with those who create and maintain ledgers, as well as patrons. With regards to ledger creators, perhaps there could be a collaborative way to increase the file size limit of an entry within the ledger. If the record itself could be stored within the ledger alongside it's metadata, several middlemen would be cut out of the equation, and the potential for records to be lost or misdirected could be greatly reduced.

C. Considering the Needs of the Patron

Patrons have been largely left out of the discussion thus far. This is in part because, before performing outreach with patrons to determine how their needs can be met, it was first necessary to understand what is possible for repositories to provide. However, it is important to return them to the conversation here, and remember that at the heart of LIS, the work is catered towards the needs of the patron. Once it is established what is possible to provide, we must take care to work with our patrons and utilize programming to determine both the needs of patrons to access NFTs, as well as how they would best be able to utilize them.

The conversations around how best to preserve NFTs in the long term aren't going to be solved in a single paper. Rather, the goal of this paper was to further the conversation and try to engage more people to consider what potential solutions either exist or can be developed. In many regards, this conversation is still in its infancy. Such to the point that, while other publications do exist on this topic, this paper started first as a research study. The goal of the study was to first interview, and later survey LIS professionals about their thoughts on how best to create a standard of preservation for NFTs. Regardless of the form it took, this research topic was unable

to garner responses, which led to the shift to a review article. While there could be a plethora of reasons as to why the research failed to engage members of both the ALA and SAA, it is possible that one reason is potential respondents didn't feel equipped to have this conversation yet.

Whatever the reasoning for the lack of response in this instance, the need for having these conversations is apparent. It is also worth highlighting that developing a standard for preservation is an iterative process, and not something that needs to be perfect on the first try. Even standards that we consider to be ubiquitous today, such as DACS, went through versions and revisions, and is subject to change in the future.

Ultimately, whatever direction is taken with regards to preservation of NFTs, it is important that these conversations be had now in the relative early stages. With the fast pace at which hardware obsolescence happens, we cannot accurately predict when the digital ledgers of the current generation may become outdated, at which point the need to begin long term preservation will become more pressing. It is better to have these conversations now, and put a plan into place, then leave things alone, and scramble when the need arises.

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Appendix A. Initial Draft of Methods

Methods

Before exploring methods to help us achieve the stated goals of this thesis, we must first identify the stated goal. Primarily, the purpose of this thesis is begin to develop a standard of practice for the preservation of NFTs. This will be achieved by interviewing LIS professionals to gain a breadth of understanding of how new standards can be established within the existing general frameworks. For the purposes of this thesis, the definition of those who constitute the world of LIS will be broad. Everyone from archivists and records managers, to librarians and museum curators, and even those who work in auction houses.

The reasoning behind this is because in varying ways, all of these professions will have some level of interaction with the record lifecycle of the NFT. Archivists and records managers will most likely be invested in their preservation, in both the short and long term, librarians and museum curators will have a vested interest in disseminating and sharing the information within NFTs to their communities, and auction house workers have been shown to already be working with content creators for sale of their work,[1] and as such, have an impact on the creation of NFTs.

Through conducting these interviews of experts, the goal of this thesis is beginning the process of developing an industry standard of care for NFTs. In this

[1] Person. “Beeple's Masterwork: The First Purely Digital Artwork Offered at Christie's: Christie's.” Beeple: A Visionary Digital Artist at the Forefront of NFTs | Christie's, Christies, 11 Mar. 2021, https://www.christies.com/features/Monumental-collage-by-Beeple-is-first-purely-digital-artwork-NFT-to-come-to-auction-11510-7.aspx.

instance, care means the entirety of the document lifecycle, from working with content creators during the creation process, to acquisition in repositories, dissemination when patrons request information, long term preservation, and into deaccession. The process of creating such a standard is more than likely going to be an iterative process, and not one that will be solved within the scope of this thesis. However it may be possible to assess the relevant literature and data, and come to conclusions regarding some general ideas which may be worth implementing into an eventual standard.

To develop this understanding of industry knowledge, a survey will be utilized. This survey will be given in an online nature, distributed primarily through two channels. These channels will be the SAA (Society of American Archivist) Announcement List,[2] and the ALA (American Library Association) Connect message board.[3] Worth noting is the different structures of these two services. In the case of the SAA list, announcements are distributed to all members, and can thus have a much wider pull on visibility. In the case of ALA Connect, the survey will be posted as a discussion chain, and users must individually find it before they can participate.

There are inherit limiting factors in terms of the expected respondents to the survey. Most notably, the areas in which I am looking for participants is constituted only by Americans. This in turn, means that the perspectives I will be getting will be wholly

[2] "SAA Email Discussion Lists." SAA Email Discussion Lists | Society of American Archivists, https://www2.archivists.org/listservs.
[3] "Home." ALA, https://connect.ala.org/home.

Western, and not offer international insights. While such perspectives would be beneficial, limitations such as an inability to access equivalent organizations in other countries and potential language barriers means that it would be simplest and most effective to limit my scope to one country.

Additionally, these surveys are only being sent out to members of professional organizations. This further leaves out potential insights, such as those from accredited professionals who cannot or are unwilling to pay membership dues to be part of these organizations, as well as non-accredited professionals (such as those who work in community archive settings but lack traditional training) who may not even be aware of such organizations.

Content wise, the survey will attempt to use a variety of questions to gauge both understanding of and level of interaction with NFTs. These questions will take varying forms, such as matrices of rating scales, demographic collection questions, and open-ended short answers.

The purpose of rating scales is to give respondents a measure by which they can describe their level of comfort with NFTs, how often they work with them, and other questions of this nature. Demographic questions would be anonymized, but request information that would allow respondents to identify which concentration they work in, which US state they work in, and work sort of institution they work in (academic, government funded, private sector, etc.).

Additionally, the survey will be structured in broad enough terms to apply to a variety of LIS concentrations. Overly focusing questions on one concentration may limit the ability of others to properly convey their experience level. Ideally, the structure of the open-ended questions would allow for respondents to more closely express how NFTs are or aren't being utilized in their concentration.

To develop the framework for a standard of acquisition, description, and preservation, several strategies can possibly be employed. One such strategy is the use of selective snowball sampling based interviews and literature review. There are multiple places wherein interviewees could be found for a discussion about developing a framework. One possible place for recruitment is through the use of professional organization websites, such as the American Library Association, and the Society of American Archivists. Another could be through use of google groups, such as the digital curation group,[4] a self identified group of digital curators, who may be willing to speak about the process. Additionally, there may be potential in reaching out directly to some institutions that are already engaging with NFTs (such as auction houses[5]) to see if they have or are developing a standard of practice.

There are inherit limiting factors in terms of the expected respondents to the request for interviews. Most notably, the areas in which I am looking for participants is constituted

[4] "Digital Curation." Google Groups, Google, https://groups.google.com/g/digital-curation?pli=1.
[5] Person. "Beeple's Masterwork: The First Purely Digital Artwork Offered at Christie's: Christie's." Beeple: A Visionary Digital Artist at the Forefront of NFTs | Christie's, Christies, 11 Mar. 2021, https://www.christies.com/features/Monumental-collage-by-Beeple-is-first-purely-digital-artwork-NFT-to-come-to-auction-11510-7.aspx.

only by Americans. This in turn, means that the perspectives I will be getting will be wholly Western, and not offer international insights. While such perspectives would be beneficial, limitations such as an inability to access equivalent organizations in other countries and potential language barriers means that it would be simplest and most effective to limit my scope to one country.

Through these interviews and hopeful literature reviews of existing internal best practices, trends of how to best care for NFTs will begin to emerge. Utilizing these trends, as well as existing literature of best practices for other types of records, the ultimate goal is to suggest some thoughts regarding what special needs NFTs may need in terms of care relative to other record types.

To conduct these interviews, human subjects will be interacted with for information. As such, there will need to be a review process submitted to the IRB (Institutional Review Board) before the study can commence. However, due to the nature of the content of the questions, it is unlikely that this will be a long process. The nature of the study with exception to unforeseen outliers, will not have a negative mental, physical, or emotional impact on participants. For examples of sample survey and interview questions, see appendix A.

Overall, the methods utilized in this study are guided by the questions that are hoped to be answered. By utilizing interviews, qualitative data will be generated. This makes more sense within the scope of the question being asked, as there isn't a binary

right or wrong approach to preserving NFTs. By utilizing open ended questions to get a variety of information from respondents, a more rich analysis of the data can lead to stronger insights.

Appendix B. Sample Interview Questions

1. How would you describe your role within the world of Library and Information Science?
2. How would you define a non-fungible token?
3. To what extent have you worked with NFTs in a professional capacity? What sorts of interactions were you making with them?
4. If you've worked with NFTs previously, what sorts of challenges have they presented?
5. Do you think NFTs will have an impact on the work you do moving forward? How so?
6. What sort of practices do you consider and utilize when you're preserving materials in your work?
7. Do the practices you utilize for preservation undergo revision? If so, how often, and what is the process like? Is it done for a clearly defined reason, or is it a more routine procedure?
8. How does usage of materials by patrons factor into how you preserve and store materials?
9. If you were going to develop a standard of preservation for NFTs, how would you go about it? What aspects of them as a medium would you consider?

10. If your repository were to start or expand their work in preserving NFTs, would your standard practices have to change? What would need to be adapted to fit them into the standard? Would they need their own categorization outside of the standard currently utilized?

Appendix C: Email Listserv Recruitment

Subject Line: Participants being sought for a library and information science research study

William Street, a graduate student at the University of North Carolina at Chapel Hill's School of Library and Information Science, is looking for participants for a research study. This focus of this study is gaining an understanding of how professionals in the library, archive, and museum worlds are interacting with and preserving Non-Fungible Tokens (NFTs). To achieve the goal of this study, a survey conducted through the online survey tool Qualtrics will be utilized. This message was sent to you through an email listserv through the American Alliance of Museums, Society of American Archivists, or American Library Association.

If you take part in this study, you would be asked to complete a short, 10-15 minute online survey. To be able to take part in this study, individuals must be at least 18 years old and a non-student member of their organization. If you are interested in participating or have any questions about the study, please email ws15@ad.unc.edu or call (203)505-2405.

Appendix D: Sample Survey Question Layout

Survey on Non-Fungible Token (NFTs) Standards of Preservation

1. What is your current role in your institution?
    - This question will have an answer box for participants to submit a short answer.
2. Have your patrons shown an interest in learning about or seeing NFTs at your institution?
    - This will be a yes/no question, where participants will be able to select only one response.
3. Does your institution participate in the creation, buying, or selling of NFTs?
    - This question will have multiple selections, for creation of NFTs, purchase of NFTs, sale of NFTs, or none of the above. Participants will be able to select multiple responses to this question.
    - If they answer yes with one or more of the first three responses, they will be directed to subsequent questions in the survey.

- If they answer no, they will be thanked for their time and informed that while their responses have been recorded, the subsequent questions do not pertain to them.

4. Is preservation of the NFTs (token) done in-house at your institution?
    - This will be a yes/no question, where respondents are able to select only one choice.
    - If a respondent answers yes to this question, they will be directed to question 5a.
    - If a respondent answers no to this question, they will be directed to question 5b.

5a. Do you consider yourself qualified to speak to the preservation of digital media in your institution?

- This question will be a yes/no question.
- If participants answer yes, they will be directed to question 6.
- If participants answer no, they will be thanked for their time, and note that while their responses have been recorded, that further questions do not pertain to them.

5b. Do you utilize a 3rd party to preserve NFTs in your institution?

- This will be a yes/no question where respondents can only select one response.
- Whether participants select yes or no, they will be thanked for their time, told their responses have been recorded, and that they have reached the end of the survey.

6. Do you believe there are unique challenges to preserving NFTs that other forms of digital media don't have? Examples of challenges that may pertain to the preservation of NFTs may include (but are not limited to): bit rot, an inability to change metadata once created, software obsolescence, and legal ownership of records.
    - This will be a yes/no question, the response of which will inform question 7. Participants will only be able to select one response.
7. If you answered yes to the previous question, what specific preservation challenges do you think NFTs face? If you answered no to the previous question, please enter "n/a".
    - This is an open-ended short answer question, where participants will be able to write in an answer to the question.
8. Do you feel that your institution can currently properly care for NFTs and make them available to patrons?
    - This will be a yes/no question, where respondents can only selection one option.
    - Whether participants select yes or no, they will be thanked for their time, told their responses have been recorded, and that they have reached the end of the survey.