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Contemporary Single-Artist Digital Archives: Development of the Relational Database for the artist Morgan O'Hara with a Focus on the Preservation and Accessibility of Digital Content

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STRUCTURE

ABSTRACT

This study describes the process of a relational database development for the contemporary artist Morgan O'Hara, with the objective of laying the groundwork for the subsequent digitization of her artworks and related materials, and creation of digital archive. It discusses the emergence of contemporary single-artist digital archives and collects data about the structure and technologies implemented for their creation through the interviews with the representatives and developers. It then analyzes data based on the extant best practices regarding preservation and accessibility of digital content with a focus on data models, database technology, metadata standards and controlled vocabularies. The data analysis results, and the review of archival materials related to the artistic practice of Morgan O'Hara were used to recommend the most fitting data model, database technology, metadata and controlled vocabularies. The thesis then outlines the process of relational data modelling and presents the results in FileMaker Pro layouts.

Keywords: *Digitization, Contemporary Art, Digital Archive, Relational Database, Metadata, Controlled Vocabulary, File Maker Pro, Preservation, Accessibility, Data*

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LIST OF ABBREVIATIONS

AAT - Getty Art and Architecture Thesaurus

ARLIS - Art Libraries Society of North America

CDWA - Categories for the Description of Works of Art

CIDOC-CRM - ICOM International Committee for Documentation Conceptual Reference Model

CMS - Content Management System

CSV - Comma Separated Values

DBMS - Database Management System

ERM - Electronic Resource Management

HTML - Hypertext Markup Language

HTTPS - Hypertext Transfer Protocol Secure

JSON - JavaScript Object Notation

MoMA - Museum of Modern Art

PDF - Portable Document Format

PREMIS - Preservation Metadata: Implementation Strategies

RDF - Resource Description Framework

SPECTRUM - Standards for Electronic Records and Archives

SQL - Structured Query Language

TGN - Getty Thesaurus of Geographic Names

ULAN - Getty Union List of Artist Names

XML - Extensible Markup Language

INTRODUCTION

In recent decades, appreciation for single-artist archives in the context of contemporary art has grown significantly. This has resulted in the emergence of digital collections, consisting of interrelated objects, providing a comprehensive overview of the artist's career and personal life. The motivations behind these archives may vary, but the main focus remains on preserving works of art and providing access to them. Database technology and content management systems enable artists and art organizations to store, manage, and share their archive content efficiently. To ensure the sustainability of digital content, it is essential to keep up with the rapid changes in technology. This can be accomplished, among several other methods, by using consistent and interoperable metadata, controlled vocabularies and data models that would allow data migration.

This thesis is dedicated to the creation of a relational database for the contemporary artist Morgan O'Hara with the objective of laying the groundwork for the subsequent digitization of her artworks and related materials, and the development of a digital archive. It discusses the emergence of contemporary single-artist digital archives, examines examples of these, and evaluates the structural technologies employed for archive-creation based on extant best practices regarding data models, database technology, metadata standards, and controlled vocabularies. Data for the analysis were acquired through expert interviews with archive managers and representatives of companies that provide content management technologies for archives. A literature review with a particular focus on the ‘Digitising Contemporary Art’ project reports carried out by the Europeana platform further supplemented this data collection method. Following evaluations of extant archival practices and a review of Morgan O'Hara's materials on her website as well as personal conversations, the most suitable solution for data model, metadata, and controlled vocabularies were identified. The thesis then illustrates the process of relational data modelling and presents the result in a form of a FileMaker Pro layouts consisting of fields representing the way in which archival information is organized.

The thesis consists of three core chapters. Chapter one gives an overview of archival practice in visual art with a focus on contemporary art. Chapter two provides the review of digital contemporary single artist archives and the technology behind them, describes the artistic

practice of Morgan O'Hara and materials to be archived, and discusses the choice of a data model, metadata standard and controlled vocabularies for the archive. Chapter three presents conceptual and logical data models, discusses its implementation in File Maker Pro and presents the example of the end-user layout.

JUSTIFICATION FOR THE STUDY AND OBJECTIVES

Morgan O'Hara is an American born artist who has created an large collection of artworks throughout her more than five decade-long career. Her works have been exhibited across the world, and are in the permanent collections of high-end institutions such as the British Museum in London and the Metropolitan Museum of Modern Art in New York. O'Hara has been awarded numerous international residencies, has taught master classes, and has won the Pollock-Krasner Foundation's Lee Krasner Lifetime Achievement Award. She has also published seven multilingual works and organized two transnational social art projects/performances.

To preserve her work, O'Hara has begun to gather and classify information related to her artistic practice and career, which can now be accessed on her website. The website contains an artist statement, a list of exhibitions, a description of work series and some photos of the artworks as well as digitized editions of artist's books and press reviews. This content provides an overview of the artist's career history, yet the website does not act as a comprehensive storage of digital materials.

Morgan O'Hara's works play an important role in the development of post-war conceptual and performative art. They are transnational in nature often representing moments that combine events, well-known individuals and geographic locations. This makes them a valuable historical source, and it is, therefore, necessary to protect and ensure access to them.

This could be achieved through the creation of a digital archive to preserve and promote artworks and other materials related to the artist's life and career, while providing greater access to them for researchers, curators, and the public. At the most fundamental level, to achieve these ends the digital archive must include a comprehensive collection of the works, with high-quality images and detailed metadata. Additionally, the archive should enable the artist to effectively manage her works, including artwork consignments, exhibitions and the press, as well as

increasing the visibility of her works by making them more accessible to a wider audience and providing new opportunities for interpretation and discussion.

The objective of this study is to choose metadata standards, controlled vocabularies, data model as well as database software to develop an initial database based on existent best practices in the field of contemporary art digitization and the comparative analysis of the technology used by extant single-artist archives. The database system will join the different elements associated with artist's career together and enable effective cataloguing and administration of data. This efficient data management system will save time, money and energy as it increases precision, speed, capacity, and usability in terms of data input, storage, processing and output. Moreover, a database system can be utilized to stimulate virtual communication between the archive and its viewers and provide a way to connect within and between organizations.

METHODOLOGY

The conception of this research project was a conversation with Morgan O'Hara to establish a clear purpose for digital archive creation, develop a representation of how different aspects of the artist's career relate to each other, and classify the artworks and other materials that would make up the archive.

The next step was a comprehensive literature review to analyse and assess the history of contemporary art archiving practice through a multidisciplinary approach. This was followed by an in-depth study of past and current contemporary art digitization projects and manuals describing best practices ranging from the choice of photographic technology and metadata standards to data sustainability solutions and digital storage infrastructure. Based on the data information and consideration of the case study's particularities, the scope of the project was established: to choose a data model that is the most applicable based on the amount and type of archival data; to choose a database software for efficient data management; to choose metadata standards that ensures effective data description and its potential exchange with other institutions/aggregators; to choose data value standards (controlled vocabularies) to ensure accuracy and searchability of the terms.

The next step included the search for and review of extant single-artist digital contemporary art archives and identification of the content management technology they use as well as providers of these technology, such as Sigmar Polke archive that was built using FileMaker Pro. The software providers/archive developers and representatives of some of the archives (Appendix A) were contacted to organize online consultation and ask questions related to the project's scope (Appendix B). Some of the information from archive representatives was obtained via email correspondence. The conversations were audio recorded to improve the subsequent information summary, which was then complemented with the data available on CMS Softwares' websites.

After the evaluation of technology and practices regarding metadata and controlled vocabularies implemented by the archives as well as prior literature review, the following choices were made: CDWA metadata standard in combination with a customized metadata; Getty thesauri AAT, TGN and ULAN in combination with customized controlled lists; relational data model and File Maker Pro software for database creation.

This was followed by practical implementation, which included the conceptual and logical data model creation, it's implementation in File Maker Pro and development of the end-user layout to present the initial stage of how data can be inserted and represented.

1 ARCHIVES IN VISUAL ART

The connection between archives and visual art can be traced by examining the frequency of words associated with archival practice in art related literature. In her book 'Art+Archive' Sara Callahan describes the frequency analysis of words 'archive' and 'archival' that appeared in the art magazines Artforum and Art Journal in the period from the 1960s to the late 2010s. According to her findings, the use increased slightly in the 1990s following a sharp boost from around 2005 onwards.[1]

A similar pattern can be seen from the Google Ngram Viewer – an online search engine that visualises the frequencies of strings 'using a yearly count of n-grams found in printed sources published between 1500 and 2019 in Google's text corpora'.[2] The string's n-grams[3] are matched with the text corpora and if found in 40 or more books, are visualised as a graph.

From the period from 1900 to 2019, the use of the word 'archive' increased slightly from 1910-1920, and then grew steadily from the 1930s onwards. There was a decrease from 2006 to 2012 and then a sharp increase up to the year 2019. The trend indicates a wider use of the term in publishing overall, including art-related literature.

[1] Callahan, S., Meskimmon, M., & Jones, A. (2022). *Art + Archive: Understanding the archival turn in contemporary art.* Amsterdam University Press, 49.
[2] Wikipedia contributors. (2022, September 28). *Google Ngram Viewer*. Wikipedia.
[3] N-gram is a continuous sequence of n elements from a given sample of text or speech in the fields of computational linguistics.

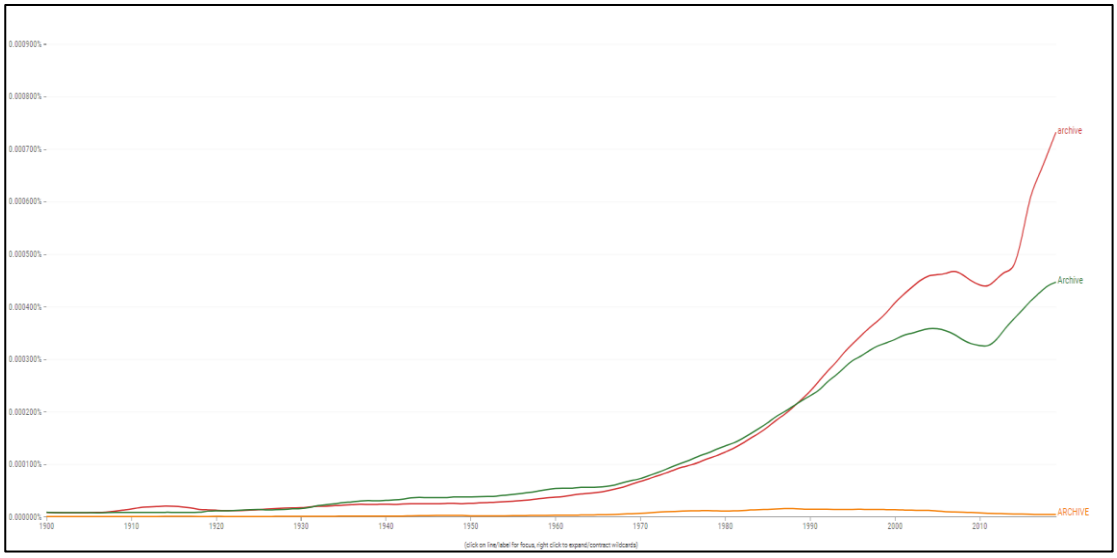

Figure 1. The use of the word 'archive'(red), 'Archive'(green), and 'ARCHIVE' (yellow) in the literature from 1900 to 2019.

In the essay 'Introduction: Following the Archival Turn', Cheryl Simon looked at how modernist and post-modernist thinkers like Walter Benjamin, Michel Foucault and later Jacque Derrida saw the archive in terms of its transformative cultural and social power. In his book 'Archive Fever: A Freudian Impression', Derrida argued that archival practices are not neutral, and archives do not merely store documents. Instead, the archival practices are fundamentally affected by controlling powers of the past and archives act as places of debates between the past, present and future.[4] Simon defined this view as an 'archival turn' in the linguistic orientation of the period from 1970s to 1990s. The more recent archival turn according to Simon, turned from linguistic to material aspects of the archive, with increased interest in photographic materials, and the blending of archival forms with art practice.[5]

From the 1960s onwards the archives in visual art field keep acquiring new meanings in the process of conceptual and practical deconstructions, and the emergence of more interconnected and inclusive approaches that characterize the self-consciousness and technological

[4] Derrida, J., Prenowitz, E. (1998). *Archive Fever: A Freudian Impression (Religion and Postmodernism) (1st ed.).* University of Chicago Press.
[5] Simon, C. (2002). Introduction: Following the Archival Turn. *Visual Resources*, 18(2), 102.

transformations of our age.[6] Practices and roles in the visual arts, archiving and curation have blurred and often generate fusions of the three.

1.1 THE EMERGENCE OF CONTEMPORARY ART ARCHIVES

In the context of contemporary art, the concept of the archive recently became an object of fixation for many curators, art historians and artists themselves, who have shown an increased appreciation for protecting and transmitting art. In her book 'Impossible Archives. An Obsession of Contemporary Art', Cristina Baldacci identifies practical and theoretical problems that come with contemporary art archiving. The practical ones include the ephemeral nature of contemporary art which makes it hard to come up with exact guidelines for what constitutes a piece of such art, and it can be difficult to decide which pieces should be kept and documented for future reference. Moreover, the multimedia nature of contemporary art makes it challenging to preserve. The theoretical problems include the debate about significance of archiving and what should constitute a contemporary art archive. The author points out that the ways in which artworks are currently recorded, stored, and protected are often characterized by unequal power relations, which may lead to certain artforms being given preferential treatment over others.[7]

1.1.1 Typologies of the contemporary art archives

The extant contemporary art archives can be divided into three categories based on the physicality of works they store – physical, digitized, and born-digital art. Nowadays, contemporary art institutions often have both physical and digital archives.

Physical contemporary art archives are collections of physical artworks and their related documentation including a range of media such as paintings, sculptures, photographs, and installations. The collections are often held in public archives, museums, and galleries, and can be accessed for research and study. Examples of physical archives include The Museum of

[6] Breakell, S. (2015). Archival practices and the practice of archives in the visual arts. *Archives and Records*, 36(1), 2.
[7] Baldacci, C. (2017). *Archivi impossibili. Un'ossessione dell'arte contemporanea*. Parole E Immagini.

Modern Art[8] and the Walker Art Center [9]. Both archives are invaluable resources for learning about modern and contemporary art, and includes collection of art books, periodicals, catalogues, curatorial files, artist interviews, academic papers, research projects and other ephemera. All these resources are available to the public, and both institutions offer programs and workshops to facilitate visitors' exploration of the archives.

Digital archives have emerged to preserve, document and share contemporary art in more efficient and accessible ways. They are normally hosted on websites as databases and contain digitized versions of the artworks (typically photographs/video) and their related digitized documents. A good example of a comprehensive online archive is The Art Institute of Chicago[10], which holds materials from different time periods. It provides access to digital images, information, and context about the artwork, as well as historical photographs, publications, and educational materials. These components can be utilized by students, educators, and researchers to gain further understanding of the museum's collections. The online archives are available to anyone with an internet connection, they provide a range of materials that can be cross-referenced and engage the viewer in an interactive and educational manner. The problem with online archives of contemporary art is that certain pieces may not be available due to copyright and intellectual property issues. Furthermore, while these archives may provide some facts about the artwork and artist, they often lack detailed, contextual information that would be necessary for further study.

Digital Art archives are devoted to preservation of the history and progression of digital art, such as videos, computer games, and digital installations. Charlie Gere argued that the significance of modern art galleries/museums is contingent on their potential to modify their regular display and sale functions and become providers of immersive experiences to the viewer by being able to accommodate digital art and its different roles of production and consumption.[11]

The Victoria and Albert Museum has embraced digital art as an important part of its mission to collect, protect, display and make available the international artistic legacy. It has created a system for gathering and recording digital art, taking a digital-oriented strategy that involves

[8] https://www.moma.org/research-and-learning/archives/. Accessed on January 3, 2023.
[9] https://walkerart.org/library-research. Accessed on January 3, 2023.
[10] https://www.artic.edu/collection?style_ids=21st%20Century. Accessed on January 3, 2023.
[11] Gere, C. (2004). *New Media Art and the Gallery in the Digital Age*. Tate Papers, London.

seeking out digital creations from both established and emerging artists. The V&A has various digital technologies for gathering, protecting, and accessing its digital art, including the V&A Digital Collections Platform[12], which provides visitors the opportunity to search for and explore digital artwork, and the V&A Digital Archive, which preserves digital art in a safe online portal. The museum also works with providers of digital platforms, such as Google Arts & Culture, to develop creative methods of displaying and enjoying digital art and employs digital technology like virtual reality and 3D printing to make its digital art shows more immersive. There are many challenges in the preservation and contextualization of digital artworks, yet it is essential for future interpretation of digital art history.[13]

The Tate Modern also collects and preserves digital art by having a Digital Art department that interacts with artists and organizations to acquire, document and maintain new works, exhibitions, and projects. The Department not only selects extant digital artworks for its collection, but also commissions those. The first Tate digital art project commission went live with the work of Harwood@ Mongrel on 26 June 2000, curated by Matthew Gansallo.[14] To ensure sustainability of artworks, the Tate works closely with their creators, uses appropriate storage and archiving methods, and creates high quality reproductions to be shared.[15]

1.1.2 Merge of archiving and contemporary art practice

From the visual arts community perspective today, archives are seen not only in terms of their preservation and accessibility aspects but also in terms of creative sites that generate innovative approaches to visual art production.[16] Artists have been analyzing archival practice from different angles, posing challenges to its original purpose, extending it further and adapting to contemporary reality.

[12] https://www.vam.ac.uk/collections/digital-art-design . Accessed on January 3, 2023.
[13] Dodds, D. (2019). Collecting, Documenting and Exhibiting the Histories of Digital Art. A V&A Perspective. *Museums and Digital Culture*. Springer, Cham. 217-230.
[14] https://www.tate.org.uk/intermediaart/entry15267.shtm. Accessed on January 3, 2023.
[15] Gere, C. (2004). *New Media Art and the Gallery in the Digital Age*. Tate Papers, London.
[16] Breakell, S. (2015). Archival practices and the practice of archives in the visual arts. *Archives and Records*, 36(1), 2.

For artists such as Karen Kilimnik, who realizes her collages based on information about the works of various artists, archives play a valuable role as primary references for her art practice.[17] They do so as well for the artist and curator Douglas Blau. In his pictures shows he uses accumulated postcards, magazine clippings, photographs and film stills.[18]

The tendency of museums to come up with more elaborated methods of fine art storage, sometimes even more than the artworks themselves, was described by the curator Ingrid Schaffner in the article "Digging back into 'Deep Storage' and Deep Storage". [19] This idea and the question of the future of the artworks as they enter the physical storage of the museum was explored and visualized by the artist Martin Kippenberg's in the installation, where he blurred exhibition space and a storage room.[20] The sculptures standing alongside the crates, cardboard boxes stuck to the walls and a series of works wrapped in packing tape appeared suffocated and stripped from the original artistic intent.

The merging of artwork and archive was realized by the German artist Franz Erhard Walther. Worrying about his work's future, he inserted preventive measures against the mistreatment of the *First Work Set* within the work itself making it an archive. Apart from the fabric sculptures, it contained prior drawings, photographs of the sculptures' performative use and even shelves to store the entire assemblage.[21]

This merging concept can also be seen in Andy Warhol's practice of collecting casual everyday objects, ranging from letters to cookie jars, and storing them in cardboard boxes. The so-called 'Time Capsules' were catalogued after his death and now amount to over six hundred boxes. They act as important documentation providing an invaluable insight into Warhol's private and professional life on the one hand and are also art objects in themselves on the other.[22]

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[17] Wetzler, R. (2019, December). Pastel Chateaux, Glittery Goddesses, and Stickers: Karen Kilimnik's Latest Exhibition. *Art News*. Retrieved November 16, 2022 from https://www.artnews.com/art-in-america/aia-reviews/karen-kilimnik-303-gallery-review-1202672474/

[18] *Douglas Blau - ICA Philadelphia*. (2008, April 3). Institute of Contemporary Art - Philadelphia, PA. Retrieved November 16, 2022 from https://icaphila.org/exhibitions/douglas-blau-2/

[19] Schaffner, I. (1998). Digging back into 'Deep Storage' and Deep Storage. *Deep Storage: Collecting, Storing, and Archiving in Art*. Munich and New York: Prestel-Verlag and Siemens Kulturprogramm. 10–21.

[20] *Martin Kippenberger.* (2006, April 22). MAP Magazine. Retrieved November 16, 2022 from https://mapmagazine.co.uk/martin-kippenberger

[21] Schaffner, I. *(1998).* Digging back into 'Deep Storage' and Deep Storage. *Deep Storage: Collecting, Storing, and Archiving in Art*. Munich and New York: Prestel-Verlag and Siemens Kulturprogramm. 10–21.

[22] Ibid

Marysia Lewandowska emphasized inclusivity in her artwork+archive work called 'Women's Audio Archive', where she documented voices of female artists who would otherwise likely be excluded from being archived.[23] Her installation 'It's About Time', shown at the Venice Biennale 2019, explored the methods by which historical narratives can be recognized, dissected, and reconstructed using the archival trace. It imagined an alternate history of the founding of La Biennale with women at its center and consisted of an audio play and a short film edited from archival material.[24]

Another example of inclusivity in visual art archives was done by a digital museum MoRe, founded in 2012 by the Others Association and researchers from the University of Parma in Italy. The project focused on gathering, administering and disseminating unrealized artistic projects from the 1950s onwards, that for some reason had not been completed. The conundrum of unfinished stories opened up vast research possibilities while adopting curatorial, art-historical and archival activities often in parallel.[25]

Raphael Lozano-Hemmer merged the concepts of collective memory and art in his recent interactive installation 'A Crack in the Hourglass' at the Brooklyn Museum, which is the archive of digitally stored portraits of Covid-19 virus victims acting as a memorial. People were encouraged to take part in the project by uploading images of their family and friends who have been lost to the virus on the project's website, along with a personal message. They could then watch either in person or through a livestream as a robotic arm places grains of sand to replicate the image. Once the portrait was finished, it was digitally stored, and then gradually erased by the force of gravity. The sand was then reused in the next picture.[26]

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[23] *Marysia Lewandowska: Women's Audio Archive*. (2019, July 31). Whitechapel Gallery. Retrieved November 5, 2022 from https://www.whitechapelgallery.org/events/marysia-lewandowska-womens-audio-archive/

[24] *It's About Time. 58 La Biennale di Venezia 2019 – Marysia Lewandowska.* (n.d.). Retrieved November 5, 2022 from https://marysialewandowska.com/its-about-time-58th-venice-biennale/

[25] Zanella, F., Bignotti, I., Modena, E., & Scotti, M. (2015). MoRE, an archive of signs and traces of artistic practices: creating a tool for research in contemporary art and curatorial practices. *Archives and Records*, 36 (1). 56-70.

[26] Lloyd-Smith, H., Dorado, J. (2022, July 31). *Rafael Lozano-Hemmer's robotic sand installation honours lives lost to Covid-19.* Wallpaper. Retrieved January 10, 2023 from https://www.wallpaper.com/art/rafael-lozano-hemmer-a-crack-in-the-hourglass-an-ongoing-covid-19-memorial-the-brooklyn-museum

1.2 DIGITAL CONTEMPORARY ART ARCHIVES

For the academic community, apart from being a rich source of research material, archives now pose philosophical questions about their nature and meaning for people. Archives not only tell stories about the materials they contain but facilitate new stories through their users' interpretations, re-use of archival materials and further re-interpretation.[27]

Sue Breakell, Archive Director at the University of Brighton Design Archives in the UK, highlights the importance of voices outside of academic and artistic fields, that despite not being professional in archiving, are adapting practices to preserve the information about their communities. The unprofessionalism reveals new unpredictable approaches to archiving and contributes to the field's development.[28]

Archivist at the Glasgow School of Art Susannah Waters puts an accent on the visual art archive as a living organism which should be approached with a balance between professionalism, sustainability and inclusivity, and that communal access ensures its vitality.[29]

The vitality of the visual art archive, thanks to technological development, can be improved through digitization. Traditional physical archives are focused on a collection of items and are subjected to strict rules of access – appointment schedules, often the necessity of justified research purpose, material retrieval executed by the professional archivist/librarian, restricted use of physical materials to avoid damage, frequent inability to make a digital copy, etc. While having the same purpose as a physical archive, a digital archive consists of digitized (scanned, photographed, transcribed) copies of primary and secondary materials, which are interlinked allowing multifaceted inquiries into the areas of interest. This operational method of building digital archives as a leading principle for open database development in the humanities. [30]

[27] Breakell, S. (2015). Archival practices and the practice of archives in the visual arts. *Archives and Records,* 36(1), 1.
[28] Ibid, 3.
[29] Ibid
[30] Palmer, C. L. (2004). Thematic Research Collections. *A Companion to Digital Humanities*. Hoboken: Blackwell Publishing. 353.

As outlined in the documentation of 'Digitising Contemporary Art', a project carried out by Europeana in the period from 2011 to 2015, digitization aids the essential purposes of the archive - preservation and access.[31] This topic is further developed in the following chapters.

1.2.1 Preservation

The preservation aspect of digitization has two layers, the first focuses on the material object and how the creation of a digital surrogate (copy) protects it from frequent physical manipulation that could cause damage. Should the damage occur, the digital surrogate acts as a substitute. The second level is concerned with the digital surrogate by focusing on the consistent metadata[32], reliable file type, and the copy's relationship with digital surrogates of other objects.

Contemporary artworks, which are characterised primarily by the variety of mediums from which they are created, including rapidly developing and changing digital technology, are context-dependent, interactive, and multimedia-based, and their transitory nature requires a different approach to documentation and archiving.[33] Digital cultural heritage be it a born-digital art or digitized one, is disappearing rapidly -objects quickly become inaccessible, file types become obsolete and unreadable.[34]

Long-term preservation of information in digital form faces the problem of multiple and often incompatible standards, lack of concentration of forces on preservation, and most importantly lack of adaptation strategy to constantly improving technology.[35] It requires building a new culture that takes a user-cantered approach and focuses on the survival of bits over time. This can be achieved with constant collaboration between artists, archivists, computer scientists, art historians, lawyers and politicians to establish digital preservations policies as well as a secure

[31] Dierickx, B. et all. (2013). D4.2 Guidelines for an A-Z digitisation workflow for contemporary artworks. *Digitizing Contemporary Art.* 11.
[32] Metadata is data about data. In other words, information about the values of the database.
[33] Grau, O. (2016). The Complex and Multifarious Expressions of Digital Art and Its Impact on Archives and Humanities. *A Companion to Digital Art*. John Wiley & Sons, Inc. 33.
[34] Lyman, P., Besser,H. (2009). 'Defining the Problem of Our Vanishing Memory: background, current status, models for resolution'. *Museums in the Digital Age*. Routledge. 340.
[35] Grau, O. (2016). The Complex and Multifarious Expressions of Digital Art and Its Impact on Archives and Humanities. *A Companion to Digital Art*. John Wiley & Sons, Inc. 36.

long-term system for storing digital records.[36] Otherwise, there is a risk of loss of contemporary art materials for future generations, which will result in a major art historical gap.[37]

Documentation is crucial for contemporary art objects that are often context-dependent and are ephemeral in nature. It can range from preparatory sketches and exhibition photographs to installation instructions and descriptions of conservation measures. Every little material piece of an artist's life like notes, receipts or sketches on a napkin, one day can become extremely significant for insights into their career and the creation story of her/his works.

In the report 'Digital Solutions: Initiating Digital Projects to Document Arists' Work, Records, and Processes', the authors note that throughout the history of contemporary art, artists have not dedicated enough attention to the importance of archiving their practices and activities, in this way limiting sources for scholars, curators and art dealers in their attempts to reconstruct the stories.[38]

Artists' records not only help to provide a more complete understanding of their career history and the development of their practices on the macro level, but also give immeasurable insight into the micro level of relationships they had with exhibiting institutions, curators, fellow artists, the public, etc. Through documents such as exhibition posters, correspondence with galleries/museums, photographs from artist residencies, etc., we learn a great deal about the lives of artists and how their lives influence their artwork. Use of these records generates unexpected interpretations of artist's practices by scholars and curators and contributes new facts to the previously known artist's biography.[39] Indeed, for the past fifty years, artists and curators have been conceptualizing documentation as potential works of art. Records have become an extension of the works of art, and their cultural and academic importance has grown immensely.

The digital archive is a balance between a catalogue in the traditional sense and the interrelations between the objects. Therefore, just like in the case of artworks, it is important to digitize documentation and create a web of interlinked and cross-referenced archival materials.

[36] Lyman, P., Besser, H. (2009). 'Defining the Problem of Our Vanishing Memory: background, current status, models for resolution'. *Museums in the Digital Age*. Routledge. 341
[37] Grau, O. (2016). The Complex and Multifarious Expressions of Digital Art and Its Impact on Archives and Humanities. *A Companion to Digital Art*. John Wiley & Sons, Inc. 36.
[38] Swadosh, J. et all. (2013). Digital Solutions: Initiating Digital Projects to Document Arists' Work, Records, and Processes. *Artists' Records in the Archives: Symposium Proceedings.* Archivists Round Table of Metropolitan New York, Inc. 22.
[39] Ibid, 24.

The role of the images, be they digitized artworks or documentation, change when they are part of a digital archive – they can be related to each other and other resources within the database and with outside resources in new ways, contributing to the rise of new discussions. The process of inventory, digitization and creation of links between artworks, documentation, people, etc., increases the chances of new forms of knowledge production.[40]

The embrace of new technology in the archival field is similar to that in the field of art history. In both cases, technology contributes to continuous innovations in the field and the birth of new methodologies. The term Digital Art History, for example, comprises the methods involving digital tools for data collection, analysis and interpretation, and is not distinct from traditional Art History.[41] Same goes for Digital Archiving, which combines traditional archiving principles and new means provided by technology.

This synthesis is necessary to stay aligned with rapid technological development and to avoid a loss of interest in these fields from the academic community, especially young students, and the general public due to outdated approaches.

The interconnected databases in both Digital Art History and Archiving will generate new research questions and help to find answers to the earlier ones.[42]

1.2.2 Accessibility

With her famous phrase 'Anxiety and dust provoke the archiving impulse' Ingrid Schaffner highlights the common urge of artists to preserve their legacy by entering museum storage through their works. She notes, however, that museums offer access to their records and at the same time prevent it, by choosing what to put on display and granting admission to resources only to a limited number of persons.[43]

[40] Beaulieu, A., De Rijcke, S. (2016). 'Networked Knowledge and Epistemic Authority in the Development of Virtual Museums'. *Museums in a Digital Culture*. Amsterdam University Press. 88.
[41] Bentkowska-Kafel, A. (2015). Debating Digital Art History. *International Journal for Digital Art History*, (1). 6.
[42] Bishop, C. (2018). Against Digital Art History. *International Journal for Digital Art History*, (3). 2.
[43] Schaffner, I. (1998). Digging back into 'Deep Storage' and Deep Storage. *Deep Storage: Collecting, Storing, and Archiving in Art*. Munich and New York: Prestel-Verlag and Siemens Kulturprogramm. 10–21.

Many museums in recent years - The Metropolitan Museum in New York, The Art Institute of Chicago, Le Louvre and Rijksmuseum to name just a few - have made their collections accessible online, sharing information about the works that are both on view and in reserves. Yet, for a user who does not look for any object, author or artistic movement in particular, and is just casually exploring the digital collection of the museum, it would not be easy to come across a contemporary artist, who donated the work to the museum with a desire to preserve one's legacy. In other words, the content of the digital collection is in every case curated by the museum, and what the user sees on the front page of the website is what is likely to be the most frequently clicked on and read about. The situation is better for a user who knows what s/he is looking for. In this case, the museum provides a description of the object of interest, its high-quality image (sometimes downloadable) and metadata like title, medium, size, etc.

This pushes artists to alternative platforms to care for their artistic career story and practice. The alternatives include personal digital archives created with the use of database technology and Content Management Systems. These give more control and freedom in decision-making regarding the technology involved, metadata used, accessibility choices, etc. Another alternative is the donation of works to foundations/archives that specialise in a particular artistic movement/period/location/medium/etc. and accept digitized materials and/or carry out the digitization themselves. In this case, the works are less likely to get lost in the vast amounts of archival materials.

As previously mentioned, the liveability of archives does not depend exclusively on preservation. Accessibility is crucial as cultural objects are not merely representations of something. They consist of multiple stories that arise from diverse interpretations and narratives formed around them, constituting their substance and representing their employment in various social, cultural and political contexts as the result of their existence. In order to enrich these stories and ensure objects' social life, it is necessary to extend the display of objects into various settings for their use and participation in social engagements.[44]

Human immersion in the processes of non-verbal communication using large volumes of various images is due to the transformations made possible by developments in technology and means of

[44] Srinivasan, R.; M. Becvar, K.; Boast, R.; Enote, J. (2010). 'Diverse Knowledges and Contact Zones within the Digital Museum'. *Science, Technology, & Human Values* 35 (5), Sage Publications, New York, US. 760.

communication. Technical inventions, from photography and cinematography to web-based search engines and social networks, have meant that in modern times visual images are not only translators of information, but the information itself. In other words, the perception of the world today is much influenced by the visual content on the web, which is why making digitized images available can increase the popularity of the works and prevent them from fading into oblivion.

Making digital archives available to the academic community and the public has many benefits. First, it serves as a primary source of high-quality images and information about artworks and protects them from copyright infringements. Secondly, studies have shown that embedding artwork images in platforms that aren't directly linked to art may result in unexpected and more associative ways of user access and interaction.[45] This phenomenon is called Accidental Cultural Consumption and happens when an individual interacts with an art object outside its usual cultural context, for example, when s/he sees an artwork in the newspaper or a Wikipedia article. This is directly linked to the popularisation of the works - users can reach the archive without even looking for it if materials are used in various places across the web. The archive therefore will expand its share of the market and include consumers different from the usual socioeconomic background. Statistics show that digital consumption of art increases when it is seen as information – on Wikipedia users are more likely to learn about artwork through artist's biographies (29.6%), historical figures (5.9%), political figures (1.2%), and mythological figures (3.5%).[46] Lastly, the availability of images on the web increases their sharing and gives birth to diverse interpretations and narratives about the objects.[47]

The concept of a digital collection has evolved from simply being a catalogue of objects to a more complex network of interconnected stories and images about the objects. This is why it is important to ensure accessibility of digital archives and make sure that materials are optimally used in various platforms across the web, from news platforms to social media. As digital archives become increasingly important in our society, it is essential to understand the

[45] Beaulieu, A., De Rijcke, S. (2016). 'Networked Knowledge and Epistemic Authority in the Development of Virtual Museums'. *Museums in a Digital Culture.* Amsterdam University Press. 87.
[46] Navarrete, T., & Villaespesa, E. (2020). Digital Heritage Consumption: The Case of the Metropolitan Museum of Art. *Magazén,* 2. 239.
[47] Srinivasan, R.; M. Becvar, K.; Boast, R.; Enote, J. (2010). 'Diverse Knowledges and Contact Zones within the Digital Museum'. *Science, Technology, & Human Values* 35 (5), Sage Publications, New York, US. 760.

implications of their use and to explore the potential for innovation in their presentation and engagement with users to enable the most effective utilization of the materials.

2 DIGITIZATION OF CONTEMPORARY ART

For the past thirty years, the number of digital single-artist archives has been growing. Some are available online in part or fully, others give access to materials through requests. The Tate dedicated two events to archiving in visual arts, 'The Archival Impulse' in 2007 and 'Archiving the Artist' 2009, with the aim of combining the voices of artists, academics and archivists and start the debate. These events laid the path for processes such as provision of training for artists in archive creation and management carried out by ARLIS (Art Libraries Society).[48]

The accessibility of technology has allowed individual artists and foundations to digitize artworks and documents and then register, maintain and manage these materials together with other related data such as events, people, etc. in Content Management Systems (CMS)[49]. In his paper about digitization practices and archive development, Diego Mantoan, professor at the University of Palermo in Italy highlights that in the context of private art collections the scholarly distinction between a digital repository (database) and an archive is irrelevant, since the underlying idea for the digitization lies in the formation of organized form of information similar to a catalogue raisonné, which is what professionals in the field on contemporary art are accustomed to.[50]

2.1 EXAMPLES OF DIGITAL SINGLE-ARTIST ARCHIVES AND THE DATABASE SOFTWARE INVOLVED

This chapter will outline some of the examples of DBMS and CMS technologies used by single-artist digital archives, who agreed to share information, and look into how these technologies were implemented. The aim is to understand the reason for the digital archive creation in the first place, which in turn would explain the choice of technology. This chapter will also outline the level of accessibility of digitized materials for researchers and the public.

[48] Breakell, S. (2015). Archival practices and the practice of archives in the visual arts. Archives and Records, 36(1), 1–5.

[49] The CMS is a tool used to enable users to update, retrieve and share materials stored without needing any technical expertise quickly and easily.

[50] Mantoan, D. (2021). Recent Challenges to Contemporary Art Databases. Digitisation Practices and Archive Development in Artist Estates and Private Collections. *Art, Museums & Digital Cultures. Rethinking Change.* Institute of Art History, School of Social Sciences and Humanities, Universidade NOVA de Lisboa. 162.

2.1.1 File Maker Pro: Joan Michell and Sigmar Polke archives

FileMaker Pro is an easy-to-use relational database creation tool based on the SQL standard. The tool makes it simple for users to customize their databases to fit their needs by adding, editing, and deleting fields, setting up relationships between tables, and creating custom reports. The customizability of the tool is one of the main benefits for art archive creators as it allows autonomy decisions regarding metadata and controlled lists of values of the database, and also the choice of a layout for the end-user – a cataloguer/archivist who will populate the database. The layout is a visual design tool that allows to easily add and organize objects such as fields, buttons, text, and images to represent the database in the user-friendly manner.

FileMaker Pro offers various export options including HTML, XML, PDF, Microsoft Word and Excel documents. These options are useful for the data exchange between the institutions as it allows to easily perform metadata mapping and transformation of relational data model to the semantic data model if necessary.

It also offers enhanced security with encryption and password protection, as well as cloud storage so users can access their data from anywhere with an internet connection. The modifications made by users are registered in the system, so it is possible to track changes. The free technical support is available 24/7 in the first year of use, and data modification are saved every 20 minutes and backups are stored for 30 days with a possibility to retrieve deleted data.[51]

Finally, the File Maker Pro database can be integrated into a website and made available fully or partly to the public.

Joan Mitchell

The Joan Mitchell Foundation uses File Maker Pro to manage photographic materials related to the artist's life and career, ranging from photographic prints and negatives to slides, transparencies, and born-digital images. These images are available for scholars and students

[51] https://www.claris.com/filemaker/pro/. Accessed on December 28, 2022.

through the outward-facing database which allows a filtered search by date, subject heading, etc. At the moment, this option is only available on-site in New York, US.[52]

Joan Mitchell (1925-1992) was an American abstract artist, whose mediums included but were not limited to oil on canvas, lithographic printing and pastel on paper. Her career lasted more than 40 years, and she is seen as one of the important artists of the post-war period, also an active participant in the New York School of artists in the 1950s.[53]

In her will, Mitchell bequeathed the creation of a foundation that would support American artists, and in 1993 the foundation was established in New York as a non-profit organization.

The Foundation focuses primarily on the collection and preservation of materials about Mitchell's artistic and personal life, which include photographs, studio materials, archival art (sketchbooks, artworks gifted by friends), personal and professional communication records, and other primary source materials. It also manages the collection of Mitchell's original works, working with art institutions and curators around the world and ensuring public access to the works.[54]

While the foundation does not have a database solution for the management of its archive as a whole, some of the archival materials such as selected photographs, documents, groups of books, articles, oral histories and documentaries are available on the foundation's website.

Further, the foundation provides artists with free guides on career documentation, inventory management and legacy planning, as well as Digital Media Guidelines and Resources.[55]

Sigmar Polke

Similar to the Joan Michell Foundation, the Sigmar Polke's archive database was modelled using the File Maker Pro application. It consists of interrelated tables describing the artist's works, literature, documentation, exhibitions, works of other artists relevant to the archive and addresses

[52] This information was received through email correspondence with Director of Archive & Research at Joan Mitchell Foundation Laura Morris on November 4, 2022.
[53] Joan Mitchell Foundation. (n.d.). *Joan Mitchell: Biography*. Retrieved August 10, 2022 from https://www.joanmitchellfoundation.org/joan-mitchell/biography
[54] Joan Mitchell Foundation. (n.d.-a). *Archives & Research*. Retrieved August 15, 2022 from https://www.joanmitchellfoundation.org/joan-mitchell/archives-research
[55] Joan Mitchell Foundation. (2022, September 15). *Professional Development*. Retrieved August 10, 2022 from https://www.joanmitchellfoundation.org/professional-development

of institutions. The database front end was developed with a layout tool, allowing insertion of information, its presentation and search in a user-friendly manner. The archive database was instrumental in the production of a stable central archive and catalogue raisonné, used as reference points for both scholars and collectors. Moreover, the use of File Maker Pro tools allowed the automatic creation of authentication certificates to verify the artworks' provenance.[56]

Sigmar Polke (1941-2010) was a German Pop Art artist who had a significant influence on the development of contemporary art since the 1960s. He worked in a variety of mediums such as paintings, drawings, films, installations, fine art prints and photographs.[57] Over the 62 years of his career, Polke participated in at least 209 solo shows and 1268 group shows and was awarded various art prizes such as the Golden Lion in Venice in 1986 and Carnegie Prize in 1995. His works are held in several private collections and museums around the world. Sigmar Polke is ranked among the top hundred artists globally and the top ten in Germany based on the exhibition history (number of exhibitions, type of hosting galleries and museums).[58] After his death in 2010, Polke's big estate was left with little information about a large number of artworks produced during the artist's lifetime, making it hard to establish their authenticity. It caused a market disruption due to forgery which damaged artist's reputation.

Since then, the Estate began the development of a 'comprehensive archive and a critical Catalogue Raisonné'.[59] Soon after the database was finished, the organization split due to disagreements between the heirs, and the Anna Polke Foundation was established by the artist's daughter, with an aim of encouraging engagement with his works. With the similar goals as the Estate, the Foundation grants scholarships for research projects and invites academics and collectors to assist in the archive creation, which once completed will serve as a primary research

[56] Mantoan, D. (2021). Recent Challenges to Contemporary Art Databases. Digitisation Practices and Archive Development in Artist Estates and Private Collections. *Art, Museums & Digital Cultures. Rethinking Change.* Institute of Art History, School of Social Sciences and Humanities, Universidade NOVA de Lisboa. 167.
[57] *The Estate of Sigmar Polke*: Sigmar Polke. (n.d.). sigmar-polke.de. Retrieved November 18, 2022 from http://www.sigmar-polke.de/index.php?id=2
[58] *Sigmar Polke | Artist.* (n.d.). ArtFacts. Retrieved November 18, 2022 from https://artfacts.net/artist/sigmar-polke/524
[59] *The Estate of Sigmar Polke*: *The Estate*. (n.d.). sigmar-polke.de. Retrieved November 18, 2022 from http://www.sigmar-polke.de/index.php?id=2

source and facilitate the creation of a Catalogue Raisonné.[60] Therefore, there are likely to be two digital archives of Polke's works. As of today, neither of the archives is available to the public.

2.1.2 LightSignalMediaGroup: TOMIKO Archive by Patrizia Bach

The TOMIKO Archive was created by the artist Patrizia Bach, who in 2001 began collecting amateur and family photographs mainly from 20th-century Germany. In the process of archiving, Bach explores questions of preservation of alternative, private, not handed down history and in which ways it can remain alive in contemporary times. Guided by the intent of saving stories of life that heedlessly lie on the stalls of flea markets, she came up to the realization that the photographs in their entirety rather than individuality make the legacy.
The archive comprises over 500 thousand photos, which the artist digitized and tagged, out of which 7 thousand were fully inventoried and over 1600 are available online.[61]

The relational database for the archive was custom-made by the LightSignalMediaGroup[62] following the needs of the artist, therefore, the metadata and controlled vocabularies were decided upon by Bach. The database was based on SQL standard and provides an end-user (artist) with a graphic interface to update, manage, share and retrieve data. It is possible to export data in CSV, JSON and SQL formats. Data backup occurs with every modification and stored on two servers simultaneously. Data can be retrieved during the next 7 days after modification. Technical support is available for a monthly fee.[63]

Patrizia Bach

Patrizia Bach (1983) is a German artist, working mainly in the medium of drawing. Her other artworks are formed from collecting, archiving and reorganizing objects through which she

[60] *Foundation – Anna Polke Stiftung.* (n.d.). anna-polke-stiftung.com. Retrieved November 18, 2022 from https://www.anna-polke-stiftung.com/en/foundation/
[61] TOMIKO Archiv - *home*. (n.d.). tomikoarchiv.de. Retrieved November 17, 2022 from https://tomikoarchiv.de/
[62] *Services / Full Service Media Agentur in Köln, Rotterdam, Frankfurt, Madrid wir erstellen hochqualitative Projekte für unsere Kunden Europa und Weltweit! | Lightsignalmedia.group*. (n.d.). lightsignalmedia.group. Retrieved November 17, 2022 from https://lightsignalmedia.group/page/Services
[63] This information was received during a video call with LighSignalMediaGroup developer Max Schafgans on October 12, 2022.

explores concepts of history.[64] Her works are located in the collection of Berlinische Galerie and at Paperfile.

2.1.3 Art Butler: Franz Erhard Walther archive

Art Butler[65] is a Content Management System designed specifically for the management of art collections. It is essentially a relational database presented to the end-user (gallery, artist, private collection) in a user-friendly graphical layout. In comparison with two previously discussed softwares, Art Butler database tables are pre-designed and include 'Contacts', 'Works', 'Artists', 'Exhibitions', 'Consignments', 'Offers', 'Literature', etc. Each of these tables contain corresponding metadata fields, with the ability to add four customized fields, that are populated by the user. The system allows the use of controlled vocabularies that can be modified.

Art Butler provides many day-to-day administrative solutions such as the generation of invoices, offers, invitations, provenance information and artwork lists, and their automatic emailing to the addressee. It allows the user to keep a calendar of upcoming events and be notified about them in advance. Overall, the software seems to be more suitable for commercial galleries or private collections, where financial transactions and information exchange between the parties involved are regularly performed.

Technical support is available for a monthly fee.[66]

Franz Erhard Walther

A few years ago, the Franz Erhard Walther Foundation began a digital archive initiative with the purpose of creating a Catalogues Raisonné. The inventory of materials, database design and data insertion are being performed with the use of Art Butler. The archive is in the process of being created and is not available online.

[64] Bach, P. (n.d.). *About*. patriziabach.de. Retrieved November 6, 2022 from https://patriziabach.de/Info/Person
[65] https://www.artbutler.com/en/software/. Accessed on November 1, 2022
[66] This information was received during a video call with Art Butler representative Clara Gutmann on October 25, 2022.

Franz Erhard Walther (1939) is a German artist, a winner of the Golden Lion of the 2017 Venice Biennale and a participant in at least eighty-seven solo shows and four hundred twenty-eight group shows over the last 53 years. He is mostly known for formulating a concept of 'activation objects', which includes a viewer as an actor.[67]

In the period of 1963 to1969, Walther created the first Werksatz (First Work Set) which he presented during the 'Spaces' Exhibition at MoMA in New York in 1969. It consisted of textile sculptures of bright colors, influenced by Pop Art, which could be animated by a viewer, individually or collectively, in the process of physical interaction of a body and sculpture material. They were designed with straps, openings and clasps allowing various ways of tactile two-way interactions – a person with the material, and the material with a person. Rather than exploring what material is, Walther looked for what it can do by inviting the public to explore it with him.[68]

He identified the cyclic lifestyle of his works – they could be static or dormant, which does not equate to incomplete or unfinished, and active when they are interacted with. While in a dormant state, the sculptures were wrapped and stored, to then be revealed again and enter an active state.[69]

Walther provides documentation for the treatment and installation of his First Work Set within the work itself by making it an archive. Apart from the sculptures, the set contained prior drawings, photographs of sculptures' performative uses and even shelves to store the entire assemblage. The medium he works with, as well as the multiple states of his artworks, makes them an interesting case for documentation and archiving.

[67] *Franz Erhard Walther | Artist.* (n.d.). ArtFacts. Retrieved November 10, 2022 from https://artfacts.net/artist/franz-erhard-walther/1237
[68] Finbow, A. (2016, July). *Franz Erhard Walther born 1939 Werksatz (Workset) 2008*. Tate. Retrieved November 10, 2022 from https://www.tate.org.uk/research/publications/performance-at-tate/case-studies/franz-erhard-walther
[69] Ibid

2.1.4 ArtSystems: Andy Warhol archive

ArtSystems[70] is a cloud-based, secure database software that automates data organization. The provider puts its focus on data security – the software is encrypted according to the HTTPS protocol and access to the account requires a multifactor authentication and servers are located in multiple places, so depending on the user's location the data is stored on the closest server.

Similar to Art Butler, the relational database of ArtSystems has seven pre-designed tables (called modules) – 'Contacts', 'Works', 'Artists', 'Editions', 'Exhibitions', 'Transactions' and 'Work References and Library'. The fields in tables are also pre-defined with a number of customizable ones. The controlled vocabularies to populate the fields can be introduced by the user. The system allows to perform efficient querying and save them for later use.

On top of the automatic generation and emailing of invoices, newsletters and other documents, ArtSystems offers integration with Articheck software for condition reporting and QuickBooks for accounting reporting.

Other special features include automatic currency conversion based on the market rates, conversion of measurement units and automatic transformation of inserted bibliography to Chicago Reference Style useful for Catalogues Raisonné.

ArtSystems offers a variety of efficient tools for those who need to manage big collections fast, however, it is not possible to integrate the database to the website other than the ones created by ArtSystems for additional fee. Moreover, the data export in a mappable CSV or any other file format cannot be performed by the user and should be requested for additional fee (around 700$). The system backs up everyday and the backup files can be restored during the next 30 days, again for additional fees.[71]

Andy Warhol

According to Andy Warhol's will, in 1987 his estate became the home of the Andy Warhol Foundation, the primary mission of which was the advancement of visual art. Apart from

[70] https://www.artsystems.com. Accessed on November 7, 2022.
[71] This information was received during a video call with Art Systems representative Deven Golden on November 8, 2022.

organizing grant programs for artists, the foundation promotes academic research and public knowledge of Warhol's artistic and cultural impact through access to his works, mainly through the Andy Warhol Museum in Pittsburgh (established in 1994), to which it donated more than 3 thousand works (the current number of objects is around half a million).[72]

The Warhol archive, held both by the Foundation and the museum, contains perhaps the most comprehensive collection of works and documentation of any American artist, and the cataloguing of primary research materials is still an ongoing process. The diverse range of mediums Warhol used to work with included painting, sculpture, films, drawings, graphic art and photography.[73]

To manage the digitized collection of records, the Foundation used the services of database solution provider ArtSystems. In fact, the Warhol Foundation was one of the first clients of the company, and the broad range of materials made it create a complex relational database taking into consideration all the particularities of the ephemeral and multiplex nature of Warhol's work. Now, this database model is a standard provided by the company.

The Foundation gives an insight into Warhol's works through the Catalogues Raisonnés' summary[74] (image slideshow), but doesn't have a comprehensive database with images and metadata available online.

Warhol is unique among artists in terms of his efforts to document his artistic and personal life. He was also a collector himself, acquiring fine art, decorative objects and furniture of diverse value. But his collection extended further than these objects. From the 1950s until the end of his life he put everything that passed through his hands into boxes daily, which then have been sealed and put in storage. The boxes contained a variety of objects ranging from invoices to cookie jars to drawings of his mother. The so-called Time Capsules today make a core of the Foundation and Museum and provide invaluable assistance toward the reconstruction of

[72] *About – The Andy Warhol Foundation for the Visual Arts.* (n.d.). warholfoundation.org. Retrieved November 9, 2022 from https://warholfoundation.org/about/
[73] Smith, J.W. (n.d.). *Saving Time: The Archives of The Andy Warhol Museum*. carnegiemuseums.org. Retrieved November 9, 2022 from https://carnegiemuseums.org/magazine-archive/1996/janfeb/warhol.html
[74] *Paintings, Sculptures, and Drawings – The Andy Warhol Foundation for the Visual Arts*. (n.d.). warholfoundation.org. Retrieved November 9, 2022 https://warholfoundation.org/warhol/catalogue-raisonne/paintings-sculptures-drawings/

Warhol's personal and business relationships, the process of his artworks' creation and public reactions to them.[75] The Time Capsules are available to visitors both offline and online on the museum website and have been completely incorporated into the art collections to offer a wide-ranging social and historical context for comprehending Warhol's work.[76]

2.1.5 Discussion

The examples of single-artist digital archives mentioned above provide insight into the motivations for their creation. In most of the examples, the development of digital archive creation began after the death of an artist by the foundation that was established often according to the artist's will. The primary reason for the establishment of the archive is first and foremost preservation of the legacy: gathering, inventory and digitization of as many materials as possible for the purposes of Catalogue Raisonné creation, acting as a primary source for scholarly research, preventing forgery and partly controlling the art market value. In most cases, the archives are still in the process of development, indicating the importance for artists to begin documentation of their careers and inventory of the works as early as possible. Most of the archives are not available to the public and have limited online availability even for research purposes (often due to incomplete processes). Patrizia Bach makes an unusual case by being a developer of her own archive, which is less personality based and more focused on her artistic practice and the legacy of her projects.

None of the archives discussed have been using internationally recognized metadata standards for the works of art such as CDWA, SPECTRUM, etc., that are used to ensure searchability, interoperability and preservation of metadata. The same goes for controlled vocabularies that were not based on the established thesauri such as AAT, ULAN, etc. However, it is important to note that art related metadata standards and vocabularies act as guidelines for the institutions whose data is likely to be public and exchanged with other institutions. Therefore, if the

[75] Smith, J.W. (n.d.). *Saving Time: The Archives of The Andy Warhol Museum*. carnegiemuseums.org. Retrieved November 9, 2022 https://carnegiemuseums.org/magazine-archive/1996/janfeb/warhol.html
[76] *Time Capsules.* (n.d.). The Andy Warhol Museum. warhol.org. Retrieved November 17, 2022 from https://www.warhol.org/timecapsule/time-capsules/

archive's public availability is not the priority, the use of standards might not be as crucial, yet is still highly recommended for metadata preservation.

The CMS and DBMS discussed are based on the relational database model, consisting of a network of autonomous tables joined together by bridge-tables that could be accessed through queries. This structure was most likely used because it provides greater flexibility and enables the discovery of unexpected associations. The relational databases can be divided into custom-made ones such as File Maker Pro and Lightsignalmediagroup, and others made specifically for art collections like Art Butler and ArtSystems.

The benefits of custom-made ones are the autonomy and flexibility in decisions regarding database design, choice of metadata, easy data extraction, and its integration on the web. However, they require knowledgeable personnel for database modelling and insurance of digital sustainability. Databases with pre-made structure for art collections are designed to be as comprehensive as possible to serve the user's needs, but their pre-defined nature can be limiting if the user wants to expand the existing database. Additionally, there may be limits to data extraction possibilities and a risk of data loss in case the software is updated, with potential additional fees that could be incurred for data transfer.

Choosing the right CMS software depends on the institution's needs. ArtButler and ArtSystems are the appropriate solution for tracking administrative aspects such as loans and sales. For creating a digital catalogue of materials for preservation, and subsequent publishing and potential exchange with other cultural institutions, custom-made databases may be a better choice.

2.2 Case study: Creation of a Digital Archive for the artist Morgan O'Hara

This part of the chapter will describe the case study of the thesis – the artist Morgan O'Hara, her work, the intention and reasons for her digital archive development.

2.2.1 Biography and practice

O'Hara's life has been defined by movement and adventure. Born in Los Angeles in 1941, she grew up in an international community in Japan but later moved back to California, where she completed a master's degree in Art from the State University at Los Angeles. Since the 1990s she has primarily worked in Europe and Asia, maintaining studios in Paris, Milan, Bergamo, Berlin, Corneliano Bertario and most recently Venice. Despite calling Italy her home for the past 21 years, O'Hara's works continue to be exhibited and held across the world. Her first solo exhibition was held in 1978 at the Musée Cantonal des Beaux Arts in Lausanne, Switzerland, and she started to do performative drawing at performance art festivals at the invitation of German artist Boris Nieslony in 1989. Her work was honoured with a solo show in the newly opened Drawing Room at the Drawing Center in New York in 1997. Her works are in the permanent collections of well-known institutions, among which include the British Museum in London, the National Gallery of Art in Washington D.C., the Metropolitan Museum of Modern Art in New York and the Kupferstichkabinett Museum in Berlin, to name just a few.[77]

Morgan O'Hara has been awarded numerous international residencies including at the MacDowell Colony in Peterborough, New Hampshire, Emily Harvey Foundation in Venice and New Space Arts Foundation in Vietnam. She has taught master classes in drawing and the psychology of creativity in art academies in the United States, Europe and Asia. In 2017 she won Pollock-Krasner Foundation's Lee Krasner Lifetime Achievement Award.[78]

From the years 2000 to 2021, seven multilingual volumes of *Encyclopedia of Live Transmission* have been published in Italy, New York, Macau and Chile, always in conjunction with solo exhibitions. They consist of short reflections on O'Hara's series *Live Transmissions* by curators, writers and academics, whom the artist has encountered throughout her career.[79]

Morgan O'Hara has created and implemented two transnational social art projects/performances. Tell Us A Story project emerged in 1972 out of the idea of confronting negative media news.

[77] *BIO | MORGAN O'HARA*. (n.d.). Morgan O'Hara. Retrieved July 2, 2022 from https://www.morganohara.art/bio
[78] Ibid
[79] *PRESS| MORGAN O'HARA*. (n.d.). Morgan O'Hara. Retrieved July 2, 2022 from https://www.morganohara.art/press

Participants were invited to handwrite their personal experiences of peace. The performances were held in Japan, Chile and Italy, resulting in a collection of handwritten multilingual stories and drawings, that now make part of the artist's collection.

In 2017 due to frustration with US political events, O'Hara began the Handwriting the Constitution project when she went to the New York public library and began handwriting the constitution of the United States of America.[80] Since then, this practice has been realized in more than 152 sessions around the world with more than two thousand people participating. The goal of the project was to create a physical and psychological space that explores 'concentrated writing as an art form, and a process designed to bring people together in a quiet and calming way, all by focusing on the citizen and human rights.' It has been identified as a powerful and transformative form of activism for introverts. The artist has a collection of handwritings from the participants who wished to donate them. [81]

The methodology of her work consists of the formulation of a conceptual framework, followed by a development of a system of observation and work with particular details of the everyday, to then collect visual data and make the concept appear in the artwork. In her own words - 'an aspect of living catches my interest and I begin to work, approaching life as a problem solver whose job it is to pay attention and to render ideas visible.'[82]

The distinguishing characteristic of O'Hara's artistic practice is the thematic series of works that are often interlinked. Some of the series have been ongoing for fifty years, while others were more concentrated in terms of the creation period.

During her over half-century-long career, Morgan O'Hara has created more than five thousand artworks, held over two hundred performances, published thirteen books and seven letterpress editions, and participated in seventy-nine solo and a hundred eighty-one group exhibitions has done thirty-three international residencies. Her works are held in twenty-four collecting institutions and forty-five private collections.

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[80] O'Hara, M. (2017, January 30). *The Constitution, By Hand.* The New York Times. Retrieved February 9, 2023 from https://www.nytimes.com/interactive/2017/06/30/opinion/sunday/the-constitution-by-hand.html

[81] *SOCIAL ART PRACTICE | MORGAN O'HARA*. (n.d.). Morgan O'Hara. Morgan O'Hara. Retrieved July 2, 2022 from https://www.morganohara.art/social-art-practice

[82] *WORK | MORGAN O'HARA*. (n.d.). Morgan O'Hara. Retrieved July 2, 2022 from https://www.morganohara.art

The grand collection of materials, most of which is stored in New York, has never been properly inventoried, and feeling the risk of deterioration and loss due to physical damage and lack of connections between documentation and artworks, O'Hara began to gather and classify information related to her artistic practice and career. The information and some of the digitized works can now be accessed on her website, and based on the artist's description, here comes the outline of the artwork series.

2.2.2 Artwork and Documentation description

Live Transmissions (1981-ongoing)

Live Transmission series is what Morgan O'Hara is mostly known for. Twenty such works are currently held in the British Museum's drawing collection. Drawing together aspects of life drawing, portraiture, landscape and calligraphy into a single unified practice, this type of live performance art is defined by real-time drawing that records the hand movement and energy transmission of its subject or subjects. O'Hara uses up to 20 razor-sharp graphite pencils with both her hands, a practice she derived from her engagement with the Japanese martial art Aikido and its focus on balance, both physical and psychological. She reconciles the left and right hemispheres of the brain, the result becomes a reconciliation of, in her own words, the 'controlled refinement of classical drawing with the sensuality of spontaneous gesture' that 'transcends arbitrary "oppositions" between abstract and figurative art'.[83] Their real-time creation brings to life a dialogue between the observer (Morgan in this case) and the participant (the subject) as the 'drawings themselves become a third actor or mediator in the experience'.[84]

There are over four thousand *Live Transmission* works drawn over five continents. They focus on human communication and document ordinary actions and movements that make up daily life, transforming normal, fleeting moments into eternal ones. They feature hand movements of people of various ages and professions, from fishermen to political leaders, from academics to famous dancers.

[83] *Morgan O'Hara.* (n.d.). EFA Studio Program. Retrieved July 5, 2022 from https://www.studios-efanyc.org/morgan-ohara
[84] Ibid

This ‘documentary intent’ is ‘narrative work which results in a final product that is not figurative.’[85] The titles have this effect too: they are time-space coordinates indicating where the transmission took place, giving specific meaning and status to random moments in time and space.

The series immerses a viewer into cultural traditions, fleeting historical moments, the daily life of cities, and most importantly into the individual people whose movements animate them.[86]

Figure 2. LIVE TRANSMISSION: movement of the hands of choreographer BILL FORSYTHE while correcting and demonstrating FRANKFURT BALLETT during rehearsal of "TABLE" / Frankfurt Opera House/ 8 May 2000/ O'Hara

Form and Content (1996-ongoing)

This series consists of ink drawings that are based on the silhouette of specific individual *Live Transmissions*. It comprises nine thematic sets with thirty-six drawings in each - *The Shape of Discourse* (1996), *Keyboard Studies* (1996), *Modus Operandi* (1997), *Formal Arrangements*

[85] Ibid
[86] Kastner, J. (2017). Morgan O’Hara. Artforum. Retrieved February 5, 2023 from https://www.artforum.com/print/reviews/201705/morgan-o-hara-67953

(1999), *Macau* (2005) and *Different Drummers* (2019-ongoing). [87] The series is ongoing. Each series is done on a different kind of paper making the process of sorting them into specific series easy.

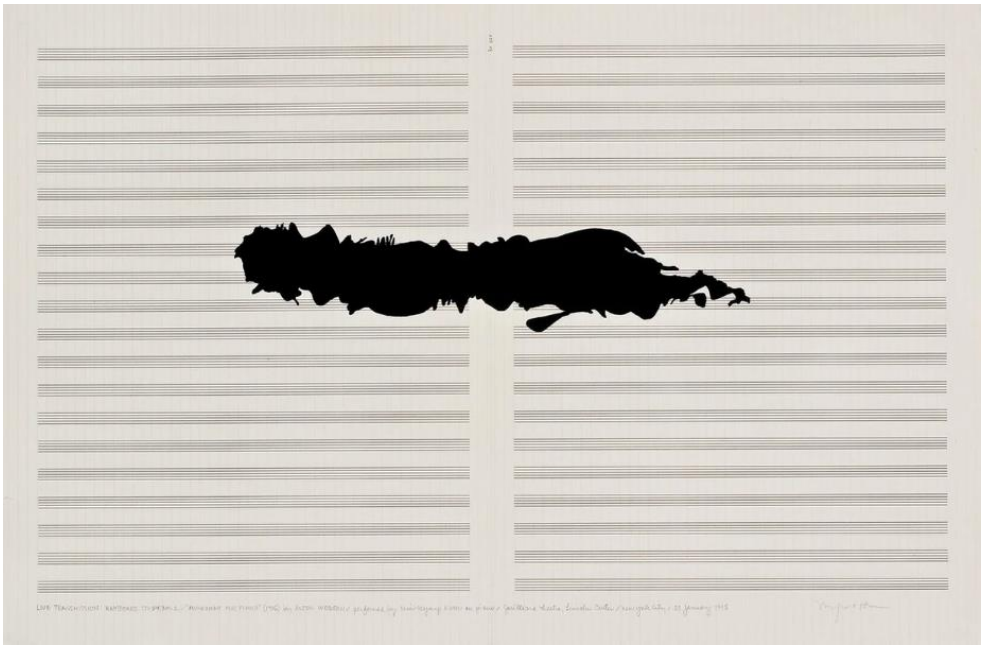

Figure 3. 1995 KEYBOARD STUDY WEBERN

Time Studies (1972-ongoing)

The series is made up of ink and graphite drawings with colour coded records of how the artist's time was spent, with each colour corresponding to a specific activity. The concept was driven by the attempt to understand the meaning of life as a process, and O'Hara made a lifetime commitment to it.[88] The artworks are often closely linked to the specific location (country, city) during the artist's travels and provide a comprehensive insight into periods of her personal and professional life. O'Hara continues to make records of activity distribution over time in

[87] *FORM AND CONTENT | MORGAN O'HARA.* (n.d.). Morgan O'Hara. Retrieved November 19, 2022 from https://www.morganohara.art/form-and-content

[88] McKibben, B. (1986). New Museum. New Yorker.

notebooks even without colour-coded drawing production.[89] All of the notebooks with the original handwritten data are in boxes in her storage space in New York city.

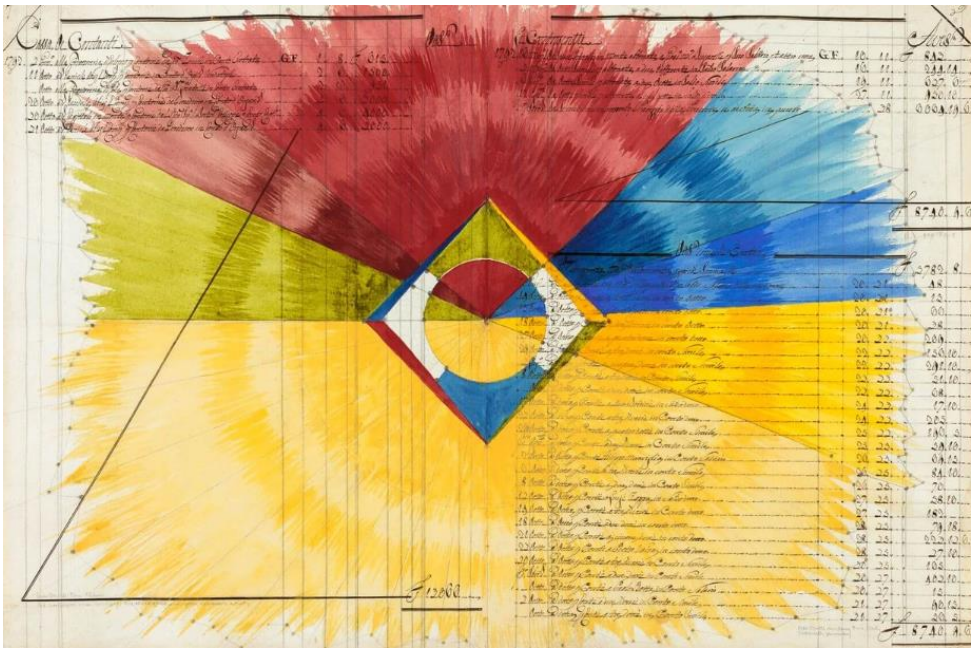

Figure 4. 2009 MACDOWELL SUMMARY

Portraits for the twenty-first century (1984-2007)

The series consists of a hundred fifty-three 'portraits' of people based on the stories of their geographic dislocation patterns. The process involved the questions asked by the artist followed by an interviewee's story and recording of the geographic locations on the map. Then, using the key city in the life of a person as an axis, the linear patterns connecting the locations were traced onto on heavy drawing paper using graphite, ink and sometimes coloured pencils. The process is completed when a person identifies and acknowledges their story in the drawing. The interviewees included persons of various backgrounds - artists, composers, farmers, art collectors, pianists, physicians, architects, writers, artists, economists, parents, a nazi resistance worker, etc.

[89] *TIME STUDIES | MORGAN O'HARA*. (n.d.). Morgan O'Hara. Retrieved November 19, 2022 from https://www.morganohara.art/time-studies

In some cases, participants requested the addition of colours and details to the drawings, and one – Sociologist Alain Touraine - completed the drawing with colour himself.[90]

Figure 5. Ad Petersen museum curator

Site-Specific Wall Drawings

The site-specific wall drawings were created by projecting photographs of *Live Transmission* drawings on a wall and painted over with acrylic/ink by O'Hara and local volunteers. After each exhibition, the works are painted away and afterwards exist only as photographs. The largest work done measuring 4.5 x 22 meters was produced in the Museo Nacional de Bellas Artes, Santiago, Chile, and involved 150 volunteers. The few permanent works can be found in OZW Building of the Freije Universiteit in Amsterdam (2006), the Canadian Academy in Kobe, Japan (2008) and the Macau Art Museum, China (2005).[91]

[90] *PORTRAITS FOR THE 21ST CENTURY | MORGAN O'HARA.* (n.d.). Morgan O'Hara. Retrieved November 19, 2022 from https://www.morganohara.art/portraits-for-the-21st-century

[91] *WALL DRAWINGS | MORGAN O'HARA.* (n.d.). Morgan O'Hara. Retrieved November 19, 2022 from https://www.morganohara.art/wall-drawings

Figure 6. 2006 OZW left.side forward

Letterpress Editions

In these editions, O'Hara uses century-old hand-carved wooden letters found and collected by printers in Venice to produce prints of quotations from poetry from various sources. By choosing to assemble the words by stacking block against block instead of equally spacing the text following graphic design practice, the artist lets the spacing occur naturally without manipulation to highlight the individual physical existence of each letter.[92]

[92] *LETTERPRESS EDITIONS | MORGAN O'HARA.* (n.d.). Morgan O'Hara. Retrieved November 19, 2022 from https://www.morganohara.art/letterpress-editions

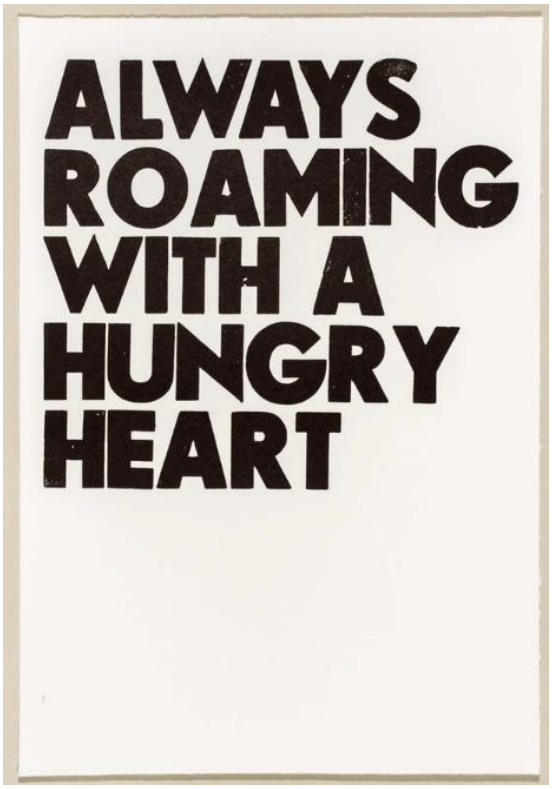

Figure 7. 01_ALWAYS ROAMING WITH A HUNGRY HEART

Honoring John Cage

John Cage (1912-1982) was an American composer whom O'Hara met in Los Angeles in 1961 and who had a significant influence on her work. In honor of the centennial of his birth, she produced two series:

The Ears series consists of a hundred ink and graphite drawings of ears with hand-copied text extracts from Cage's book 'Silence' (1961). Three works were produced using gold leaf.

The second series called *Discs* is made on laser-cut wooden discs hand painted with orange Japanese calligrapher's ink with handwritten questions from the 'Silence'.[93]

[93] *HONORING JOHN CAGE | MORGAN O'HARA*. (n.d.). Morgan O'Hara. Retrieved November 19, 2022 from https://www.morganohara.art/honoring-john-cage

Figure 8. EARS 02 GIVE UP MUSHROOMS

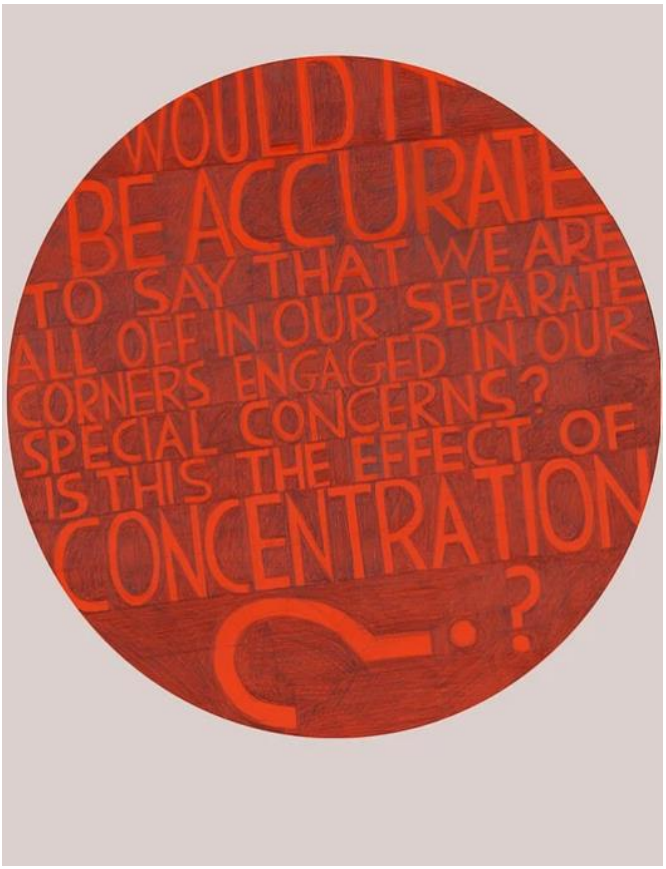

Figure 9. DISCS 07 WOULD IT BE ACCURATE

Covid

Consisting of fifty-seven works, the *Covid* series is the most recent and is made up of collages and ink drawings, produced during the global pandemic in 2020 in an attempt to understand it and its consequences. The series has three subseries, nineteen works each:

Series 1 was done in Tübingen University Guest House for visiting professors in March 2020 when O'Hara was in quarantine and includes ink drawings titled with headlines from The New York Times during March-May 2020.

Series 2 was created in Venice and consists of diptychs- an ink drawing plus a collage with newspaper clippings with the Covid-related texts. Titles have been chosen from headlines in The New York Times from June-August 2020.

Series 3 was made in Venice and comprises ink drawings with international newspaper clippings glued on. The titles were taken from headlines of Le Monde, El Pais, La Corriere della Sera, Frankfurter Allgemeine, and The New York Times during September-November 2020. [94]

Figure 10. LA BATTAGLIA_La battaglia contro COVID_19 continua

[94] *COVID | MORGAN O'HARA*. (n.d.). Morgan O'Hara. Retrieved November 19, 2022 from https://www.morganohara.art/covid

Documentation

As previously discussed, in the last fifty years, artists' records and documentation of artistic practice began to be seen as an extension of artwork, holding immense cultural and academic value. The documentation of Morgan O'Hara's practice can be divided to visual and textual one.

The visual documentation consists of photographs, video materials, maps, artworks' preliminary drawings and sketches. They include the captures of the artist in the process of realizing the works e.g. *Live Transmissions* drawings while observing the movements of people. It also includes photographs from the events like exhibitions, studio, artistic residencies, etc.

The textual documents include the artist's own publications and publications by others about her works. It also consists of O'Hara's journals she kept throughout her career with thoughts and observation, all of which provide the most personal and valuable evidence. Other documentation includes press reviews of artist's works, exhibition press releases, artistic statements, tax receipts, and O'Hara's mail correspondence with gallerists, artists, curators, etc.

2.2.3 Purposes of digital archive creation

The works of Morgan O'Hara play an important role in the development of post-war conceptual and performative art. The protection of artworks and documents, as well as ensured access to those, is a priority for the artist.

The transnational nature of O'Hara's works makes them a valuable historical source as they are often related to geographic locations where the artist lived and to people she encountered there. She honors the crafts of the people, be it gold hammering in Venice, choreography in New York, academic lecturing in Germany or baking in Tokyo, through the movements of their hands in the *Live Transmissions* series. In the *Portraits for the 21st Century*, she documents and interprets people's biographies based on their geographical movements. She invites people to tell their stories, be heard and to in the end see them as artworks.

These series can be seen as historical documents of places, people, and events. For example, the US presidential transition of 2021 was documented in the *Live Transmission* of Joe Biden and Donald Trump. The famous choreographers Bill Irwin and William Forsythe were documented

while rehearsing their shows. Other examples are portraits of conservator and curator Ad Petersen and artists Alison Knowles. As mentioned previously in this chapter, when works are part of the database and are published online, they can be linked to other materials on the web related to persons' biographies, geographical locations and events. In this way, the links contribute to the mutual enhancement of information about the materials and drive new interpretations and associative knowledge production. This would enormously benefit scholars of various fields, curators as well as the public, and of course the artist, whose works would be encountered outside of the art field bringing more users to the archive page and enhancing the artworks' market value and recognition.

The creation of the digital archive would allow O'Hara to have all the materials inventoried, digitized, stored and managed. From the preservation perspective, digital copies will act as substitutes for analogue originals and help to prevent their decay and quality loss. Digitized materials can also aid in the future restoration of the originals. Because of the established relationships between digital objects of the archives, it will be hard to lose them and easy to track ownership and exhibition history of artworks, prevent forgery by being a primary source of reference, and by using consistent metadata, share and integrate the archival materials in other digital archives/aggregators (e.g. Europeana). Adherence to the best practices for digitization projects will provide better opportunities for improving digital archive's position in the art sector[95], while control over reliability of archival records will constitute a consistent narrative contributing to enhancement of the artist's reputation and assurance of her legacy.[96]

Apart from the aforementioned improvements in accessibility for outside users, the access to digital materials by the artist will also improve administrative tasks by allowing effective material collection for artwork loans, sales, exhibitions and press.

[95] Cocciolo, A. (2014). 'Challenges to Born-Digital Institutional Archiving: The Case of a New York Art Museum', *Records Management Journal*, 24(3). 240.
[96] Reed, M. (2017) 'From the Archive to Art History', *Art Journal*, 76(1). 125.

2.3 CONTEMPORARY ART DIGITIZATION PROCESS

In the context of preservation and access as two main purposes for contemporary art digital archive creation, digitization is not merely a conversion of physical object into a digital format, but rather a multi-stage process entailing digitization plan preparation, selection of materials, choice of preservation parameters (metadata, file types, file naming, etc.) and technology (e.g. photo camera, scanners, storage and management system, etc.), performance of digitization, quality control and finally making the files accessible. The core objective is to perform the digitization process only once, therefore a preparation of a careful plan based on the extant best practices is necessary.[97]

The digitization plan should begin with establishing the goals of the digitization project based on a summary of the requirements of the party for whom the digitization will be performed. Second step is the general review of the collection, documentation, places and people involved and establishment of the relationships between them.

Based on the results of the first two steps, the priorities and stages of the projects are identified, a part of which is the choice of metamodel and data management technology, metadata and controlled vocabularies.

2.3.1 Metamodels: Relational and Semantic

A model is a representation of how things are in the real world, while a metamodel is a representation of how the model works. For most practical applications in the field of digitization of visual art, there are two primary metamodels: the relational and semantic models. When it comes to successfully choosing and using a metamodel, the practical requirements are very important: the metamodel must be a standard to provide a reliable foundation for modelling and, in today's information environment, it must be an international and open standard to be accepted by many.

[97] Dierickx, B. et all. (2013). D4.2 Guidelines for an A-Z digitisation workflow for contemporary artworks. *Digitizing Contemporary Art.* 8.

Relational metamodels define the structure of data in relational databases. The process of relational modelling typically involves development of an entity-relationship model (ERM) as the first step. ERM is based on the idea that the real world consists of entities and relationships. An entity type is a category of entities (e.g. "artwork") and can have various attributes (e.g. "year of creation", "title" and "medium"). Relationships describe the connection between entities (e.g. works of art and artists).[98]A conceptual model is then converted into a logical model by transforming it into a tabular representation. Each entity type in the diagram becomes a separate table, and its attributes become columns. Each table has a unique key value, which is necessary to establish relationships between tables and ensure access to information from various tables by queries. The use of tables reduces the size of stored files and eliminates redundancy, leading to more memory and quicker access to data. Since the tables are linked, unique data is only stored once. Moreover, a relational database increases cross-referencing capacity, thus providing more research opportunities for archives, museums and other institutions. In addition, if a set of records needs to be modified, the alteration can be made in the first table, and records will be updated in every display (layout) of data.

From the previously discussed examples of digital single-artist archives the preference for relational database model is apparent. This can be explained by the fact that relational model and database technology, that allow its implementation, have been around for decades, and therefore are more established, better understood, widely supported and reliable.[99] Another reason, as outlined by Mantoan, is the popularity of such method in the field of contemporary art. He cites Alfred Chandler's phenomenon of 'development by trend' when explaining why private art collections follow the practices of others, regardless of the benefits, conforming to the implicit standards.[100] Moreover, dozens of cost-effective CMS solutions with aesthetically sophisticated interface and a variety of administrative tools, make the use of relational databases intuitive and pleasant.

[98] Flanders, J., Jannidis, F. (2019). *The Shape of Data in Digital Humanities: Modeling Texts and Text-Based Resources*. Routledge, Abingdon, United Kingdom. 57-62.
[99] Ibid
[100] Mantoan, D. (2021). Recent Challenges to Contemporary Art Databases. Digitisation Practices and Archive Development in Artist Estates and Private Collections. *Art, Museums & Digital Cultures. Rethinking Change.* Institute of Art History, School of Social Sciences and Humanities, Universidade NOVA de Lisboa. 165.

The alternative to a relational metamodel is the semantic one. It uses concepts, terms, and language that are easily understood by humans, rather than the technical details of the database implementation. It is a layer of abstraction above a database schema which allows for a semantic understanding of the meaning of the data stored in the database.[101] RDF, which stands for Resource Description Framework, is a type of semantic data model used to represent information on the web. It is based on a graph structure, consisting of nodes (also called resources) and edges (also called triples). Each node represents an entity, such as a person, place, or thing, and each edge represents a relationship between the two nodes. For example, a triple might look like (artwork, was created, year), representing the fact that an artwork was created in a particular year. The edges in an RDF graph can also have additional information, such as the type of relationship, or a description of the relationship and act as metadata. The nodes can be expressed as URI or literals, while edges can only be expressed as URIs.[102]

The transformation of abstract RDF model to the machine-readable model is done through the serialization, usually in XML, JSON or Turtle formats. This helps to ensure that information is consistently represented and understood by other applications that use the same formats.

The examples of institutions that use RDF include but are not limited to The Museum of Modern Art, The Getty Museum, The British Museum, The Metropolitan Museum of Art and Europeana. It is popular in the cultural field for its consistency, flexibility, ease of use, and open standard. It provides a way to describe and share data between systems, which is essential in the cultural field due to its diverse range of data types. Additionally, RDF is an open standard, meaning anyone can create and use it without requiring permission from a vendor or institution. The implications of such model, however, requires a considerable financial and intellectual investment, which explains why it is mostly adopted by major public institutions who can afford such expenses. The private collections, on the other hand, simply do not need functionalities of the semantic model because, in most cases, the primary objective of single-artist digital archives is collection of digitized materials and their internal management rather than ensuring accessibility of these materials to the public and sharing them with other institutions.

[101] Flanders, J., Jannidis, F. (2019). *The Shape of Data in Digital Humanities: Modeling Texts and Text-Based Resources*. Routledge, Abingdon, United Kingdom. 80.
[102] https://www.w3.org/TR/rdf-concepts/. Accessed on December 20, 2022.

Considering the above and keeping in mind the purposes of archive creation for Morgan O'Hara as well as the number of materials and their nature, the relational metamodel is the most feasible solution. Even though, the public accessibility of digitized materials and their potential exchange with other institutions is an important factor for the artist, the initial digitization process would be simpler with the use of more widely adopted technology in the field. The ERM would act as a reference point in case it is necessary to transform relational data into semantic one.

The database model will be implemented using File Maker Pro. The choice is explained by software's customizability, easy use and robust set of features for creating and presenting relational databases. Moreover, basic familiarity with the software was acquired during my course of university studies.

2.3.2 Metadata: CDWA

Metadata can be used for multiple purposes in digital art collecting or archiving. It can help to find a resource such as an artwork, describe what the resource is, show where it came from and who owns it, explain how it was created, how it is managed, and how it can be kept safe. It can also help connect this resource to other resources.[103]

When dealing with a digital collection it is important that both the artworks and their digital versions, as well as contextual documents and their digital versions, are adequately described and registered together with all related information (events, people, institutions, etc.) as metadata into a database according to a chosen metadata standard. Although personnel may be limited, the task of comprising metadata standard should not be delayed until later but should instead be done concurrently with the digitisation process.

At present, there are many different metadata standards, making it difficult to select one. Metadata standards can vary in their aims, the level of detail they describe, and the encoding they employ.

The museum industry largely relies on metadata standards for cataloguing purposes one of which is Categories for the Description of Works of Art (CDWA). It was developed in 1998 by Getty

[103] Dierickx, B. et all. (2013). D31. Metadata Implementation Guidelines. *Digitizing Contemporary Art.* 8.

Research Institute and J. Paul Getty Trust as a result of collaboration between art historians, museum curators, librarians, information managers and technical professionals. CDWA consists of 512 categories and subcategories, with a core of a small subset of these categories being necessary for a work to be described and identified. The core categories that an art information system should contain can and should be determined by the needs of the user, the goal of the institution, and other various considerations. This core is implemented as an XML schema known as CDWA Lite and is consistent with the OAI-PMH standard, a protocol for exchanging metadata between a content provider and content aggregator.[104]

It means that metadata based on the CDWA standard can be easily mapped to data exchange standards such as LIDO[105]. Metadata mapping for exchange is the process of mapping metadata elements from one system to another, for example, when digital content from one institution is transferred to another, e.g. contemporary art collection transfers its digital content to Europeana portal. Usually, the reason for metadata exchange is to increase visibility and accessibility of information. To ensure this, it is necessary that the digital content is interoperable with other digital material on the platform where it is transferred to and the process of metadata mapping can be performed smoothly. MINERVA has identified two ways to ensure this interoperability: by making sure that resources and content are managed and created using consistent standards and rules, and by making the content accessible via internet protocols and APIs.[106]

The CDWA categories and subcategories in combination with personalized system of metadata seem the most appropriate solution for the description of Morgan O'Hara's works for the following reasons:

- In this way, it is possible to customize the standard to meet the needs of the artist, while also taking advantage of the domain knowledge of the original standard.
- The artist expressed interest in potential transfer of archival content to an aggregator (e.g. a foundation with a digital archive), which would be easy with metadata mapped to exchange standard.

[104] Ibid
[105] Ibid, 39.
[106] MINERVA. (2008). *Technical Guidelines for Digital Cultural Content Creation Programmes*. (Version 2.0). 9-10.

- The use of the CDWA guidelines is beneficial to data integrity and sustainability and will allow data to be migrated to new systems as technology advances.[107]
- The CDWA standard is the more widely adopted in the field of cultural heritage than, for example, SPECTRUM[108] and CIDOC-CRM[109]. While SPECTRUM is more suitable for big collection management and CIDOC-CRM for large-scale research projects, the use of CDWA requires less technical expertise, is well-documented and easy to use, making it an appropriate choice to accurately describe artworks and their related visual and textual documentation, persons, places and events.
- The CDWA can be extended with PREMIS[110], used for technical information description, to describe digital images of artworks and visual documentation.

2.3.3 Data value standards: AAT, TGN, ULAN

Data value standards, such as controlled vocabularies and thesauri, are terms, names, and other values used to populate data structure standards or metadata element sets. Thesauri are dictionaries with "agreed" terms that help computers recognize the similarities between various words that describe the same thing. This makes searches more accurate, since synonyms will be included in the search. Furthermore, the use of thesauri and vocabularies also has other benefits, such as the ability to avoid spelling mistakes, support multilingual searches, aid in categorization, add a possibility of concordances and data exchange.[111]

The AAT, TGN and ULAN are well-structured, standardized, comprehensive thesauri developed by Getty Research Institute. They provide terminology to catalogue, document, categorize, retrieve, and discover art information, to capture the richness of variant terms and context, to promote consistency in assignment of terms, to aid retrieval and discovery and look-up resources of information. The Getty thesauri are open-source making them accessible to anyone who wishes to improve their knowledge and application of terms related to art and architecture.

[107] Dierickx, B. et all. (2013). D31. Metadata Implementation Guidelines. *Digitizing Contemporary Art.* 28.
[108] Ibid, 29.
[109] Ibid, 17.
[110] Ibid, 26.
[111] Ibid, 20.

The Art and Architecture Thesaurus (AAT)[112] is a hierarchical database that contains over 34,000 concepts related to art and architecture, spanning from antiquity to the present. Concepts are classified according to the facets within the AAT form: Associated Concepts (contains abstract concepts and phenomena related to art and architecture); Physical Attributes (work shape), Styles and Periods, Agents (identified by their occupation or activity, social role), Activities (e.g. archaeology, design), Materials (e.g. wood, canvas), Objects (produced by humans). Each concept has an assigned numerical ID and is associated with terms, related concepts, a parent concept, sources of data, and notes. The thesaurus includes terms used to describe art and architecture, each of which has various forms, such as a singular form, a plural form, natural order, spelling variants, possible pronunciations, and synonyms. The main disadvantage is that it might lack some specific terms related to contemporary art.[113]

The Getty Thesaurus of Geographic Names (TGN)[114] is similar to the AAT structure in that it has 912,000 records on places from prehistory to the present day. Each record is related to a unique numerical ID, names, a parent, geographical coordinates, notes, sources data, a place type, and other relationships. The place type describes its role, such as the capital of a state. The thesaurus contains names, which are expressed in English, the local language, and sometimes other languages. It is categorised hierarchically, with two main aspects: World and Extra-terrestrial Places. Places are divided into categories of their current physical and political world, such as World - Europe - Italy. This vocabulary is beneficial in its inclusion of geographical coordinates and categorisation to differentiate between places with the same name, as well as its multilingual support. An issue is that it may not always include places associated with contemporary art.[115]

The ULAN thesaurus[116] is a database of 120,000 artists from all eras, with 293,000 different names and spelling variations, pseudonyms, and names in multiple languages. Each record is connected to a unique ID, related artists, sources, and notes. It is mostly composed of two sections - Person and Corporate Body - and it can be beneficial in that it includes multiple

[112] https://www.getty.edu/research/tools/vocabularies/aat/. Accessed on January 20, 2023.
[113] Dierickx, B. et all. (2013). D31. Metadata Implementation Guidelines. *Digitizing Contemporary Art.* 41.
[114] https://www.getty.edu/research/tools/vocabularies/tgn. Accessed on January 20, 2023.
[115] Dierickx, B. et all. (2013). D31. Metadata Implementation Guidelines. *Digitizing Contemporary Art.* 42.
[116] https://www.getty.edu/research/tools/vocabularies/ulan. Accessed on January 20, 2023.

versions of the artist's name, allowing for more accurate retrieval of data. However, it may not always contain the names of less known, modern-day artists.[117]

The use of Getty thesauri combined with local controlled lists for the description of the archival entities seems to be an appropriate solution to maintain consistency in data entry and the underlying relationships between entities. Moreover, the use of normalized thesauri terms to populate art-related metadata makes the information retrievable and helps to increase findability of the digital archive (if made publicly available) by linking it to other digital archives and offering a search among multiple repositories.[118]

AAT is an appropriate choice to describe artwork and visual documentation properties like style, genre, material, etc. Since people, including well-known artists, are often subjects of Morgan O'Hara's works, the ULAN can be implemented to reference their names. Similarly, TGN is suitable for description of geographic locations where the artworks were created, not only to show their provenance, but also because for some artwork series the location acts as part of the subject.

[117] Dierickx, B. et all. (2013). D31. Metadata Implementation Guidelines. *Digitizing Contemporary Art.* 42.
[118] Bellan, M. (2022). "Modern Art from the Arab Region – Digitisation as a Chance? The Research and Database Project LAWHA as a Case Study". *magazén*, 3(2). 255.

3 DATABASE DESIGN AND IMPLEMENTATION

The steps for relational database implementation of the design of a conceptual model, its transformation into the tabular logical model, establishment of rules of constraints to ensure data accuracy and integrity, and finally its implementation in the chosen database management system.

The process of database design began with analysis of information and functionality needs of the artists. Conversations with Morgan O'Hara and review of materials available online lead to the creation of abstract visualisation of her career's aspects, with a primary focus on artwork series.

The series were divided according to their subject, e.g. *Live Transmissions* and its derivative series *Form and Content* and *Site-Specific Wall Drawings* concern persons and their movement during an action, which is almost in every case related to their profession. Therefore, the main subjects of these series is People, Profession and Event. *Portraits for the 21st Century* and *Honoring John Cage* series are about specific people, while *Time Studies, Letterpress Works* and *Covid* series are shaped around concepts like time, language, history and society as a whole. *Tell Us A Story* and *Handwriting The Constitution* series are performative social practices and their subjects are individual interpretations of peace and civil and human rights.

The constitutes of Visual and Textual Documentation (e.g. photographs, notes, press reviews), Events (e.g. exhibitions, loans/consignments, residencies) as well as persons and corporate bodies such as individual collectors, galleries, museums, etc., were identified.

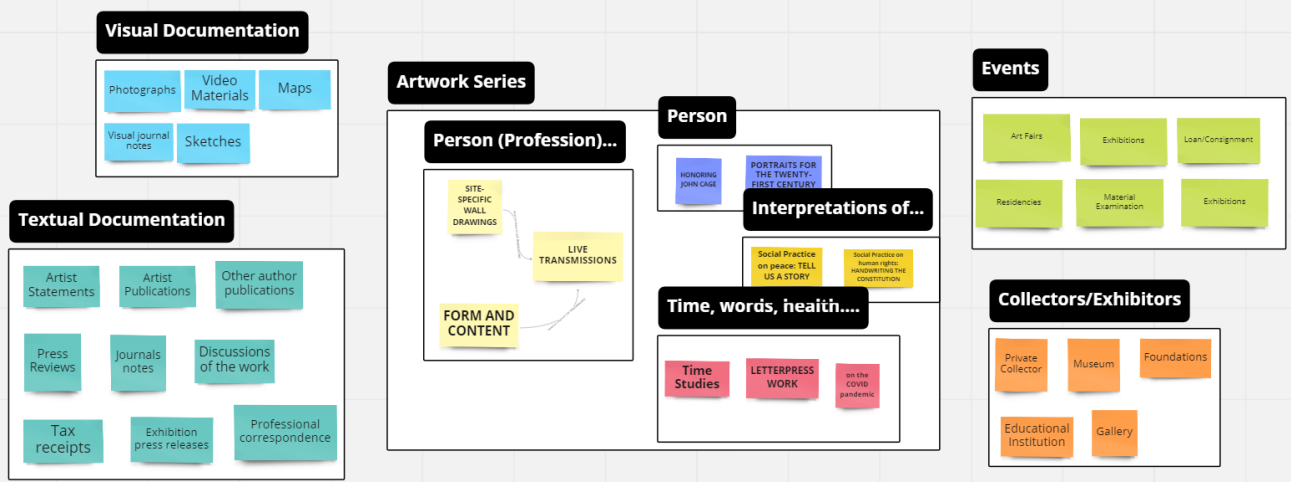

Figure 11 Abstract representation of Morgan O'Hara's artistic career. Available at: https://miro.com/app/board/uXjVPPQh2c8=/

The functionalities of the database need to support the purpose of the project – provide a reliable, secure and user-friendly way for inputting, storing, analyzing and presenting data related to Morgan O'Hara's artistic practice. The system should ensure efficient access to physical and intellectual materials to the artist and cataloguers in the first place, and subsequently to the public.

3.1 CONCEPTUAL DATA MODEL

An Entity-Relationship model was used to identify, describe, and visualize entities and their relationships in the context of the O'Hara's artistic career. This model captures the semantic information and offers an integrated, comprehensive view of the data, arranging the information in a way that makes it possible to automatically generate the logical model. Abstraction is a crucial part of this process.[119]

Fig. represents twelve main entities that relate among themselves through four types of relationships – one-to-one (1→1), one-to-many (1→N), many-to-one (N→1) and many-to-many (N→M).

[119] Flanders, J., Jannidis, F. (2019). *The Shape of Data in Digital Humanities: Modeling Texts and Text-Based Resources*. Routledge, Abingdon, United Kingdom. 83.

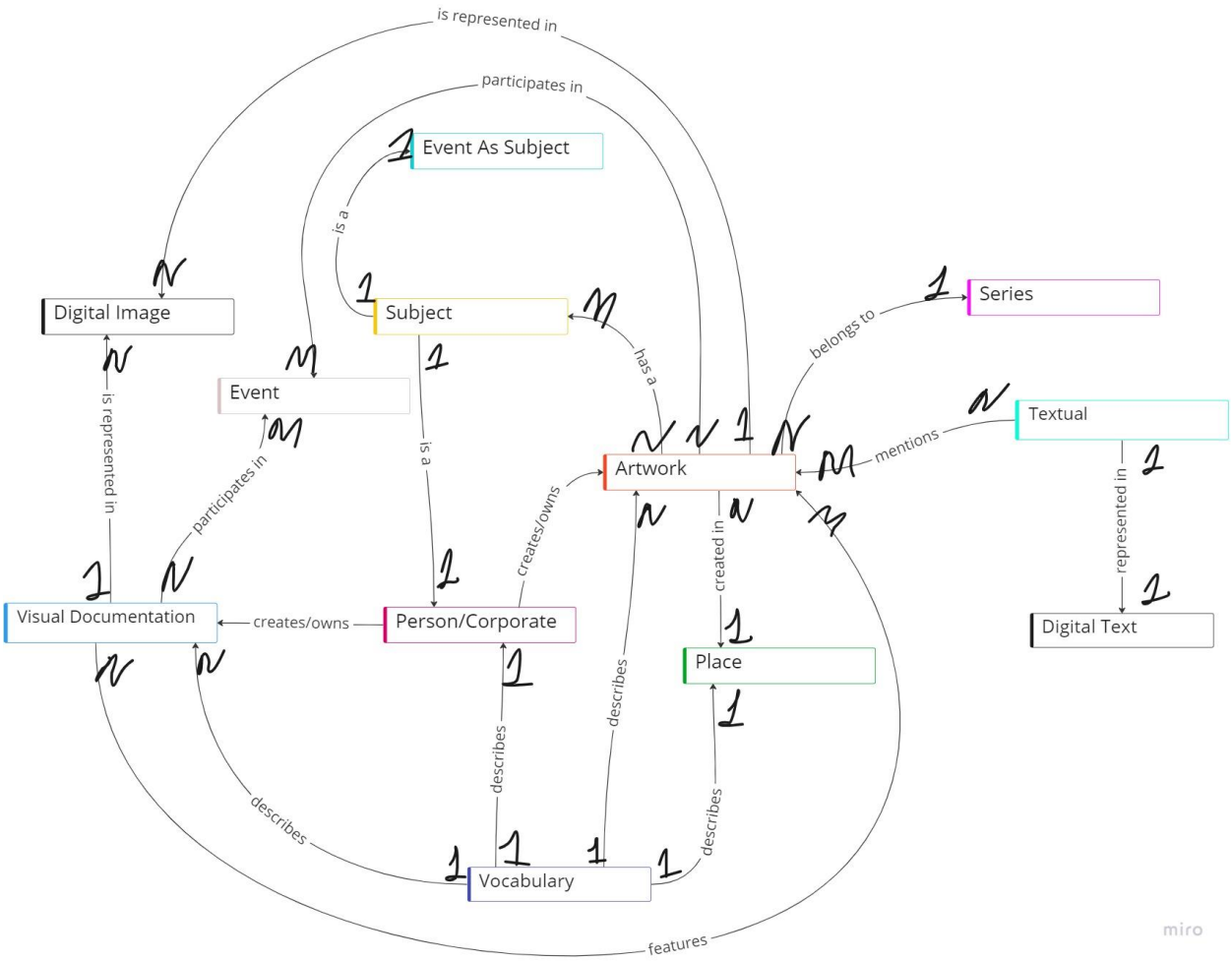

Figure 12. Conceptual data model. Available at: https://miro.com/app/board/uXjVPtOeGqw=/

Since artworks are the primary constitute of the archive, *Artwork* entity relates to most of other entities. For example, *Artwork* relates to *Series*, and this relationship can be semantically described as 'an artwork belongs to a series'. Each artwork belongs to one series, while a series can contain multiple artworks, their relationship is therefore many-to-one.

The attributes (metadata) for *Artwork* description, as well as for other entities, were based on CDWA standard in combination with personalizes metadata. Table 1 shows part of the metadata used with a corresponding CDWA field.

Artwork	Corresponding CDWA field
InvNum	Object/Work Record ID
Catalog Level	Catalog Level
Arwork Type	Classification Term
Title	Title Text
Title Language	Title Language
Title Date	Title Date

Table 1. Partial table of Artwork attributes with corresponding CDWA field

Artwork is related to *Visual Documentation* through a many-to-many relationship since the latter 'features' the former. In the archive, visual documents act not only as 'support' materials for artworks (e.g. photograph or sketch), but also as independent visual records (e.g. a picture from the artist's journal), that are not related to artworks but are important to provide insight into the artist's thought and creation process and can be conceptualized as potential works of art. The metadata for *Visual Documentation* is very similar to the *Artwork* one (see Appendix C). Both entities are represented in digital versions, and therefore are related to the *Digital Image* entity with one-to-many relationships (each artwork/visual document has many digital images, while a digital image is related to one artwork/visual document). *Textual Documentation* is also represented in a digital version and is related to the *Digital Text* entity. Since technical metadata is outside the scope of this thesis, both *Digital Image* and *Digital Text* will not contain description, apart from the title and a digital file. The technical description can be added later using CDWA extended with PREMIS standard.

Each artwork has a subject, which can be a person, event or concept. Often a subject is two or three of those simultaneously. *Artwork* and *Subject* have a many-to-many relationship because an artwork can have multiple subjects and a subject can be part of many artworks. *Subject* is further related to the *Person/Corporate Body* and *Event As Subject* entity. It is important to make a distinction between *Event* and *Event As Subject* - the former describes events related to artworks and visual documents such as exhibitions, examination, residency, art fair, loan, etc., while the

latter describes events which are parts of artworks' subjects. For example, many *Live Transmissions* drawings were performed while observing a specific event, e.g. a ballet 'Giselle' rehearsal at the London Studios of the English National Ballet, and these events are described in detail by the *Event As Subject* entity.

Event	Corresponding CDWA field
Event Type	Exhibition Type; Examination Type; Examination Agent
Event Description	Exhibition Description; Provenance Description
Event Name	Exhibition Title or Name
Event Place	Venue Name/Place; Examination Place; Ownership Place
Event Organizer	Exhibition Organizer; Cataloguing Institution

Table 2. Partial table of Event attributes with corresponding CDWA field

Event As Subject	Corresponding CDWA field
Event Name	-
Event Description	-
Event Location	-
Notes	-
Weblink	-

Table 3. Partial table of Event As Subject attributes with corresponding CDWA field

The model contains a *Person/Corporate Body* entity, which describes individuals and organizations. It is related to *Artwork* and *Visual Documentation* entities since a person/organization acts as a creator and/or an owner of artworks and visual materials. It is, therefore, important that these people/organizations are described in detail. *Person/Corporate Body* is also related to *Subject* entity, since many of the artworks showcase aspects related to specific people, who are often well-known.

Person/Corporate Body	Corresponding CDWA field
Type	Person/Corporate Body Authority Type
Name	Person Name
Name from Vocab	Name Source
About	Display Biography
Birth/Creation Date	Birth Date

Table 4. Partial table of Person/Corporate Body attributes with corresponding CDWA field

The *Vocabulary* entity was created to contain terms from the Getty thesauri, which describe attributes of other entities such as *Artwork* (type, material, style, support surface), *Visual Documentation (*same as *Artwork's* attributes*)*, *Place* (city, country) and *Person/Corporate Body* (name).

Table 5 shows a list attributes of *Vocabulary* entity. *VocabType* contains the name of thesauri – AAT, ULAN or TGN. *Vocab Term* contains a term of interest (e.g. drawing*)*, that would describe *Type* attribute of *Artwork* entity. *VocabExternalID* contains the ID of term in a thesaurus (e.g. 300033973), while *VocabLink* contains a web link to the term on thesaurus page (e.g. https://www.shorturl.at/jCHRW)

Vocabulary	Corresponding CDWA field
VocabType	-
VocabTerm	-
VocabExternalID	-
VocabLink	-

Table 5. Partial table of Event attributes with corresponding CDWA field

3.2 LOGICAL MODEL AND FILE MAKER PRO IMPLEMENTATION

The entities and attributes of the conceptual model become tables and columns in a logical model. Each row in the table is a tuple representing a single record in the database, and the domain of each column is the set of possible values it can take. The order of the rows is not important since a table is a set of unordered tuples, but the order of the columns is significant as it corresponds to the structure of the tuples.[120]

Figure 13 shows the *Artwork* table created using File Maker Pro. The *Artwork_ID* field acts as a Primary Key, which is a unique identifier and a constraint that ensures that each row in a table can be represented exclusively. The *Type* field contain datatypes that columns can take, which is a Check constraint used to ensure that values in a field meet a chosen criterion.

Field Name	Type
Artwork_ID	Text
InvNum	Text
Catalog Level	Text
Type	Text
Title	Text
Title Language	Text
Title Date	Date
English Title Translation	Text
Alternative Title	Text
Alternative Title Language	Text
Alternative Title Date	Date
Series	Text
Subseries	Text
Creator	Text

Figure 13. Partial list of fields of Artwork table in File Maker Pro

[120] Flanders, J., Jannidis, F. (2019). *The Shape of Data in Digital Humanities: Modeling Texts and Text-Based Resources*. Routledge, Abingdon, United Kingdom. 57-62

Figure 14 shows a logical model consisting of interconnected tables. Tables are either connected with Primary Keys or with Foreign Keys. For example, the field *Series* in the *Artwork* table (red) acts as Foreign Key used to link *Artwork* with the *Series* table (grey). It is called a Foreign Key constraint.

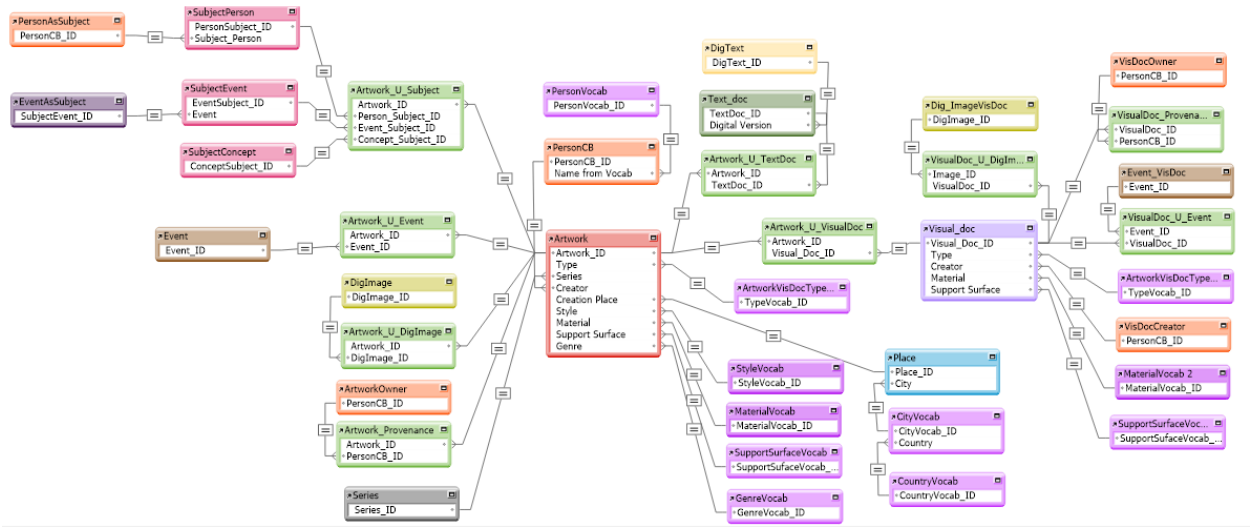

Figure 14. Logical database model in File Maker Pro

The peculiarity of File Maker Pro is the so-called table occurrences, which are placeholders or, in other words, table representations in the database model used to improve clarity in showing table connections. For example, *Event* and *Event_VisDoc* are the same table containing metadata for events' description. Similarly, *Person CB, ArtworkOwner, VisDocCreator, VisDoOwner* and *PersonAsSubject* all represent the *Person/Corporate Body* entity.

The *Vocabulary* entity was divided into several tables (purple) all containing the same metadata. For example, the *StyleVocab* table contains terms only related to style description, while *CityVocab* contains city names. The same goes for the *Subject* entity which was divided into *Subject_Person, Subject_Event* and *Subject_Concept*.

In the case of many-to-many relationships, the join tables (light green) act as connections allowing to use data from various tables and combine it into a single set of records. For example,

Artwork_Provenance table is a join table connecting *Artwork* and *Person/Corporate Body*. The fields of this table (Figure 15) are *Owner_ID* (Primary Key), *Arwork_ID* and *PersonCB_ID* (Foreign Keys) and metadata related to the artwork's provenance. The *Artwork_Provenance* is the only join table in the model containing fields other than Primary Key and Foreign Keys.

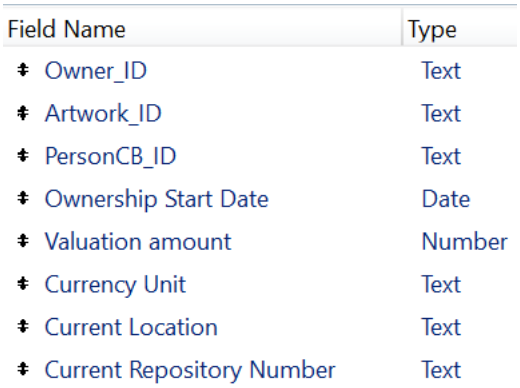

Figure 15. List of fields in Artwork_Provenance table in File Maker Pro

File Maker Pro allows the creation of value lists, in other words, controlled vocabularies, which can be created from custom values or existing fields. The lists ensure data consistency and accuracy and can be subsequently represented in layouts as drop-down menus.

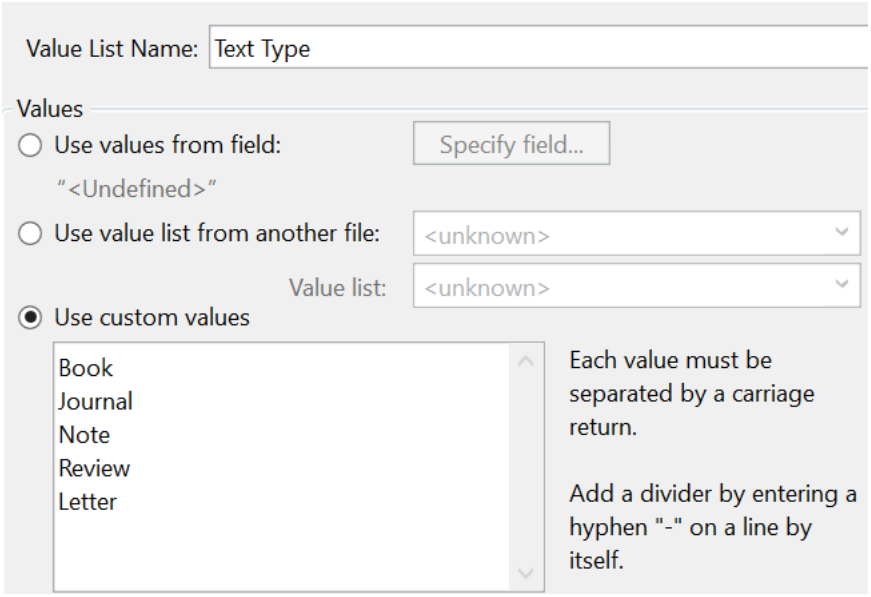

Figure 16. Custom value list for Type field in Textual Documentation table

3.3 EXAMPLE OF THE ARTWORK LAYOUT IN THE DATABASE

Table relationship organization in File Maker Pro differs from other relational database management systems primarily because it does not require coding to retrieve data from multiple tables. Instead, it provides a graphical user interface to build customized layouts for an end-user-cataloguer, artist or any other person who will interact with the archive database. For this reason, some tables were split to make layout building straightforward.

Figure 17 shows the end-user layout representing *Artwork* table with fields from related tables.

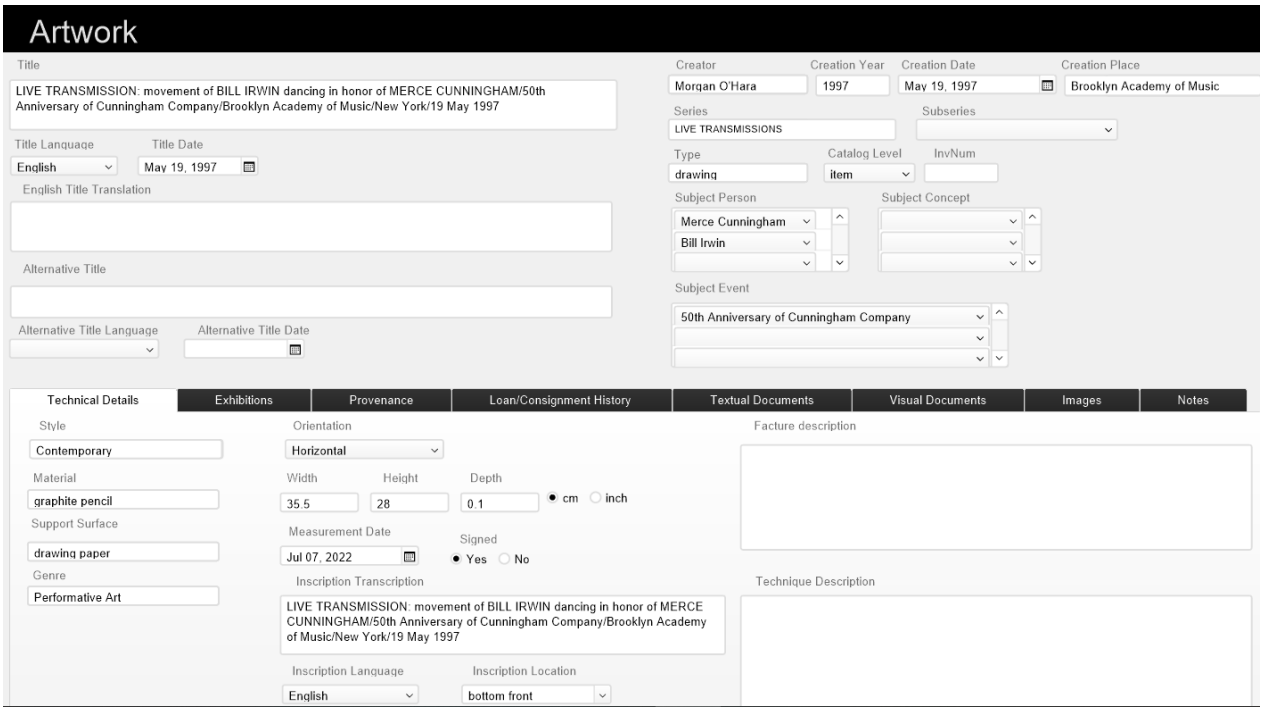

Figure 17. Artwork layout

This example shows an artwork titled *'LIVE TRANSMISSION: movement of BILL IRWIN dancing in honor of MERCE CUNNINGHAM/50th Anniversary of Cunningham Company/Brooklyn Academy of Music/New York/19 May 1997'*. The title, like in case of all the *Live Transmissions* drawings, contains information about the creation date, place, subjects and

series. In this case, there are three subjects – two people (Bill Irwin and Merce Cunningham) and one event (50th Anniversary of Cunningham Company).

Information about subject persons was retrieved from the *Person/Corporate Body* table, and Figure 18 shows metadata describing Merce Cunningham – an American dancer and choreographer. *Name From Vocab* field contains the term from the *PersonVocab* table (Figure 19).

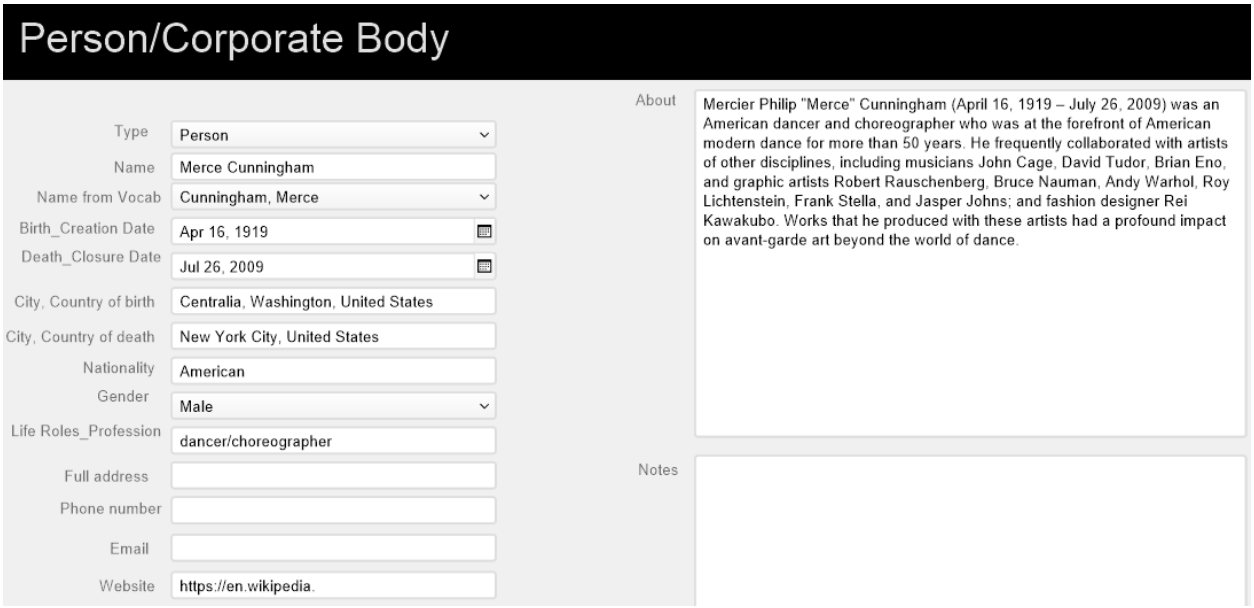

Figure 18. Person/Corporate Body layout

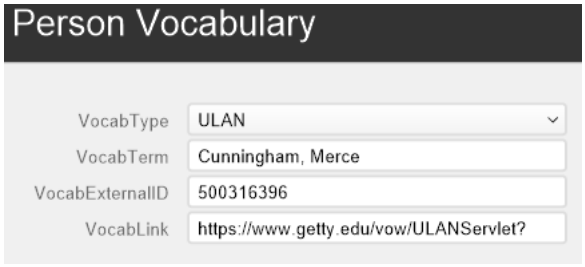

Figure 19. Person Vocabulary layout

The *Creation Place* field contains a term from *Place* table, which describes the Brooklyn Academy of Music in detail (Figure 20).

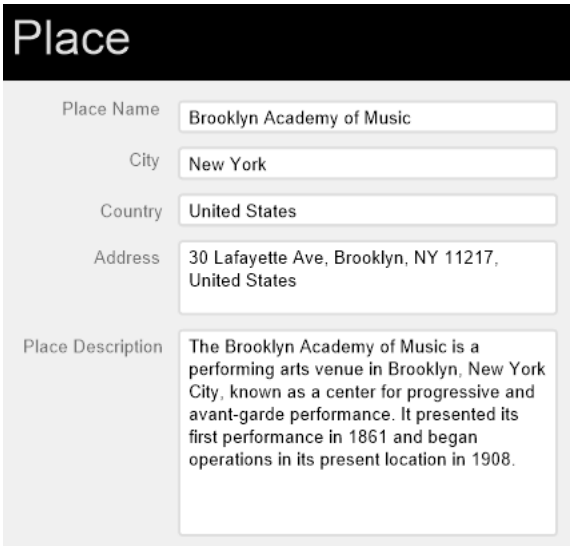

Figure 20. Place layout

The bottom part of the Artwork layout contains a menu, which includes the list of exhibitions where the artwork was shown (Figure 21), provenance and loan/consignment information, related textual (Figure 22) and visual documents (Figure 23), and images of the artwork (Figure 24).

Figure 21. Exhibition field in Artwork layout

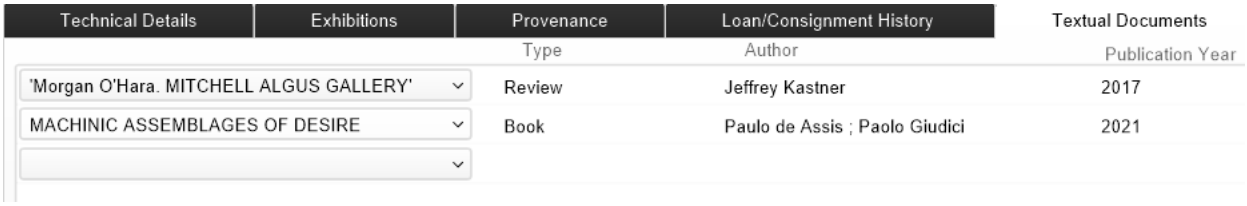

Figure 22. Textual Documentation field in Artwork layout

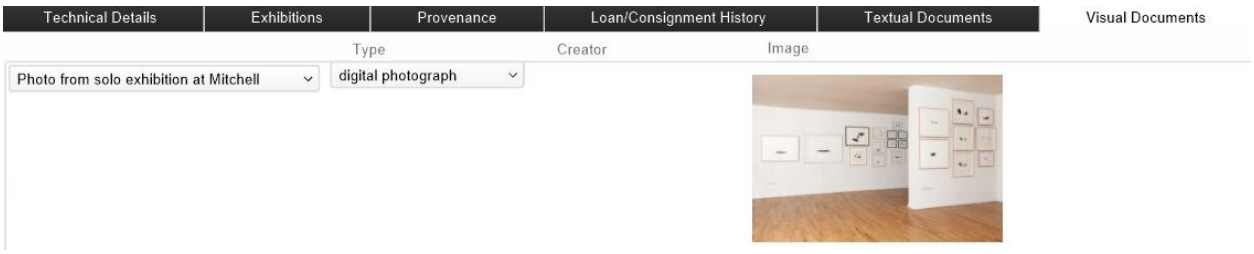

Figure 23. Visual Documentation field in Artwork layout

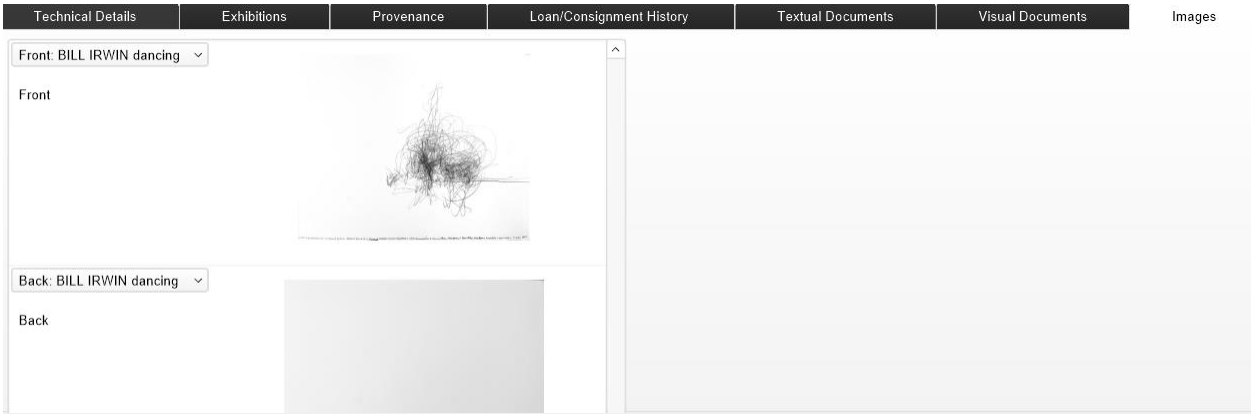

Figure 24. Images field in Artwork layout

The *Visual Documentation* layout is structured similarly to the *Artwork*. Figure 25 shows an example of the visual document that is not related to the artwork, and is a cartoon cut from the New Yorker Magazine and sticked in the artist's journal. As Morgan O'Hara says 'I love it as a cartoon, as a drawing, with the dark humor in it, with the practical advice, with the cat's calm, etc. It was a great surprise to find it'.

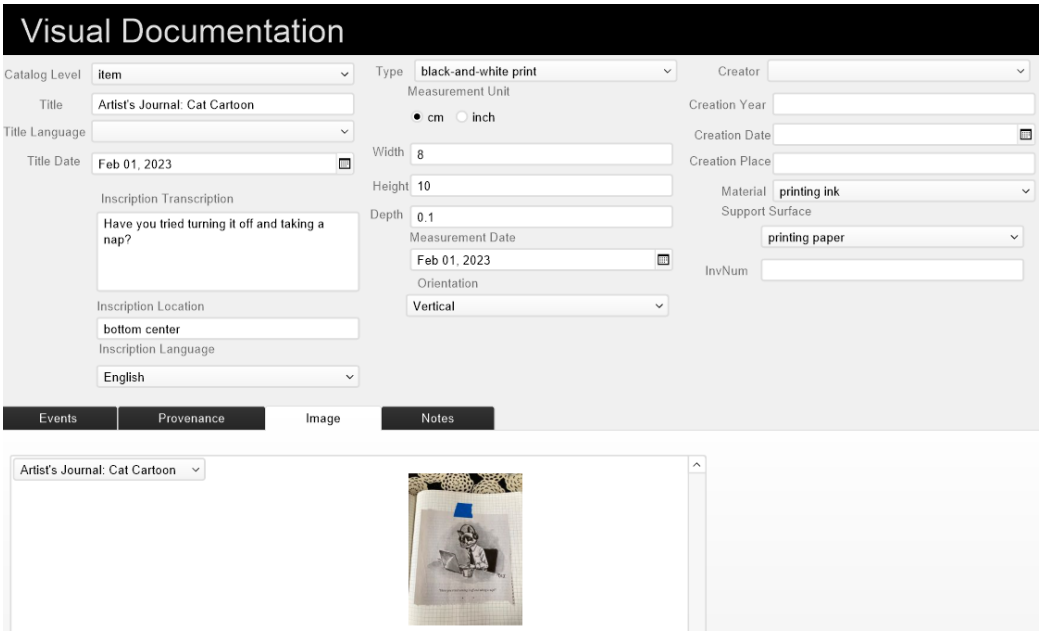

Figure 25. Visual Documentation layout

The use of File Maker Pro tools made a creation of a logical model straightforward and testable. The layouts were created to show the initial possibilities for data fields representation and data entry options. The layouts are not the final version of end-user interface and should be improved with a more user-friendly structure. This can be achieved by a more detailed study of File Maker Pro capabilities and user interface design.

CONCLUSIONS

The goal of this project was to create a database as the first step in the development of a comprehensive digital archive of artworks and documents related to the artistic practice of the conceptual artist Morgan O'Hara. The database creation process was based on 1) the theoretical research regarding the best practices of contemporary art digitization process, focusing on metadata, controlled vocabularies, data model and database technology, which are important aspects contributing to preservation and accessibility of the digital materials, and 2) review of extant single-artist archives to identify the motivation behind their choice of the aforementioned aspects and evaluate its effectiveness to then derive the best solutions and apply to the case study.

As the research showed, a relational database model was preferred by the analysed archives due to the established, reliable, and widely supported database technology, its popularity in the field of contemporary art and the availability of cost-effective CMS solutions with modern and intuitive interfaces. Indeed, relational databases are an efficient and powerful tool for storing and managing data as it eliminates redundancy and increases cross-referencing capacity. Therefore, this model was selected for Morgan O'Hara's archive due to its purpose and the nature of materials. The review also showed that there are software solutions for custom-made and pre-made databases designed specifically for art collections. While the custom-made databases provide more autonomy and flexibility, the pre-made ones provide a comprehensive framework for tracking administrative aspects. For the case study, the preference was given to the File Maker Pro tool due to its ease of use and robust set of features that would allow creation of custom-made database.

None of the reviewed archives used internationally recognized metadata standards necessary to ensure searchability, interoperability and preservation of archival metadata. To adhere to the best practices and recommendations, the CDWA categories and subcategories in combination with personalized system of metadata was chosen for the description of Morgan O'Hara's works. It allows customization to meet the needs of the artist, is beneficial to data integrity and longevity, is well-documented and easy to use, and can be extended with PREMIS for technical information

description. The controlled vocabularies of the reviewed archives were not based on the established thesauri used to maintain data consistency, improve term findability and retrievability. To comply with goals of preservation and accessibility, Getty thesauri in combination with local lists were used for the O'Hara's archive - AAT for artwork properties, ULAN for people and TGN for geographic locations.

Nevertheless, the results of this study should be viewed with some caution due to certain limitations. There were only five contemporary single-artist digital archives that could be studied, and further attempts to include more were unsuccessful due to a lack of response from archive representatives. To ensure more comprehensive results, the project could be continued with the inclusion of additional archives. Moreover, a longer-term approach could be taken to track the growth and development of various single-artist digital archives over time, which would allow to identify changes in digital archiving practice.

The interviews with representatives from digital archives and software technology were limited due to some archives not being publicly available, such as the Joan Mitchell, Andy Warhol, and Franz Erhard Walther archives. As a result, it was not possible to gain insight into the reasons for choosing a particular software or view the archives' internal structure. However, generic information was gained from the interviews with CMS and DBMS representatives who provided services to the archives. The Sigmar Polke archive is also not open to the public, but its structure and functionalities were made accessible by its developer. It was not possible to conduct an interview with the owner of the TOMIKO archive, artist Patrizia Bach, but some insight into its structure were learned from the archive's developer. To overcome this limitation, further research could be conducted in the form of an online survey of digital archives and software technology representatives. The survey could ask questions about their experiences with creating and managing digital archives as well as explain the choice of the software technology. This would provide more insight into the issues and solutions they have encountered and provide more comprehensive data.

After discussions with Morgan O'Hara, an abstract representation of her artworks, documents and other relevant components of the archive was established. However, as the comprehensive inventory of materials is yet to be conducted, the digital archive (database) structure, its functionalities and database management system may need to be revised. The limited knowledge

of File Maker Pro's features hindered the use of the most efficient and user-friendly methods for data representation in the layouts. Nonetheless, it must be underscored that the primary objective of the project was not data representation. To improve the process in the future, deeper understanding of the File Maker Pro features is necessary. That includes generation of invoices, press materials and authentication certificates, as well as user friendly interface.

Despite the mentioned limitations, the implementation of the relational data model, metadata and controlled vocabularies in File Maker Pro showed the end-user result, that would allow future storage and management of inventoried and digitized materials, assurance of their physical and digital preservation, and making them accessible for the artist, archive managers, scholars, and potentially the public. Hence, this project provides the initial ground from which a full-scale digitization project can take off, as there are many other aspects to consider, which would require a multidisciplinary team. It is hoped that this research will be beneficial in the course of Morgan O'Hara's digital archive creation.

APPENDIX A: LIST OF CONTACTS

Archive Name	Software/Developing Company Name	Archive Representative	Sofware Provider Representative/Developer
Joan Mitchell	File Maker Pro	Laura Morris *lmorris@joanmitchellfoundation.org*	-
Sigmar Polke	File Maker Pro	-	Diego Mantoan *diego.mantoan@unipa.it*
Patrizia Bach	LightSignalMediaGroup	Patrizia Bach *info@patriziabach.de*	Max Schafgans *max.schafgans@lightsignalmedia.group*
Franz Erhard Walther	Art Butler	-	Clara Gutmann *cgu@artbutler.com*
Andy Warhol	Art Systems	-	Deven Golden *deven.golden@artsystems.com*

Table 6. (App. A). List of contacts

APPENDIX B: LIST OF QUESTIONS

1. What database model was used for digital archive creation?
2. Is archive metadata based on metadata standards such as CDWA, LIDO, etc.?
3. Are controlled vocabularies based on thesauri such as AAT, ULAN, etc.?
4. Can data be exported any time?
5. In what formats can data be exported?
6. How often does data backup happen?
7. What technical support is offered by software provider?

APPENDIX C: TABLES AND ATTRIBUTES WITH THE CORRESPONDING CDWA METADATA FIELD

Artwork	Corresponding CDWA field
InvNum	Object/Work Record ID
Catalog Level	Catalog Level
Type	Classification Term
Title	Title Text
Title Language	Title Language
Title Date	Title Date
English Title Translation	-
Alternative Title	Alternative Title
Alternative Title Language	Alternative Title Language
Alternative Title Date	Alternative Title Date
Series	-
Subseries	-
Creator	Creator Identity
Creator Statement	Creator Statement
Creation Place	Creation Place/Original Location
Creation Year	Creation Date
Creation Date	Creation Date
Style	Style/Periods Indexing Terms
Measurement Unit	Dimensions Unit
Width	Dimensions Value
Height	Dimensions Value
Depth	Dimensions Value
Measurement Date	Dimensions Date
Technique Description	Materials/Techniques Name
Material	Materials/Techniques Name
Support Surface	-

Inscription Transcription	Inscription Transcription or Description
Inscription Location	Inscription Location
Inscription Language	Inscription Language
Signed	-
Facture description	Facture description
Orientation	Orientation/Arrangement Description
Genre	General Subject Terms
Subject	Specific Subject Terms
Condition Description	Condition/Examination Description
Notes	Remarks

Table 7. (App.C). Artwork table

Visual Documentation	Corresponding CDWA field
InvNum	Object/Work Record ID
Catalog Level	Catalog Level
Type	Classification Term
Title	Title Text
Title Language	Title Language
Title Date	Title Date
Creator	Creator Identity
Creation Year	Creation Date
Creation Date	Creation Date
Creation Place	Creation Place/Original Location
Measurement Unit	Dimensions Unit
Width	Dimensions Value
Height	Dimensions Value
Depth	Dimensions Value
Measurement Date	Dimensions Date
Material	Materials/Techniques Name
Support Surface	-
Inscription Transcription	InscriptionTranscription or Description
Inscription Location	Inscription Location
Inscription Language	Inscription Language
Orientation	Orientation/Arrangement Description
Notes	Remarks

Table 8. (App. C). Visual Documentation table

Textual Documentation	Corresponding CDWA field
Citation	Source Full Citation
Type	Source Type
Digital Version	-
Title	Source Title
Author/Editor	Source Author/Source Editor
Publisher	Source Publisher
Publication Year	-
Publication Place	-
Notes	Remarks

Table 9. (App.C). Textual Documentation table

Series	Corresponding CDWA field
Catalog Level	Catalog Level
Title	Title Text
Title Language	Title Language
Creator Statement	Creator Statement
Creation Start Date	Creation Date
Creation End Date	Creation Date
Components quantity	Components quantity
Facture description	Facture description
Notes	Remarks

Table 10. (App. C). Series table

Event	Corresponding CDWA field
Event Type	Exhibition Type; Examination Type;Examination Agent
Event Description	Exhibition Description;Provenance Description
Event Name	Exhibition Title or Name
Event Place	Venue Name/Place; Examination Place; Ownership Place
Event Organizer	Exhibition Organizer; Cataloguing Institution
Event Curator/Cataloguer/Examiner	Exhibition Curator; Cataloger Name
Event Date from	Venue Date; Examination Date; Cataloguing Date
Event Date to	Venue Date; Examination Date; Cataloguing Date
Event Object Number	Exhibition Object Number; Current Repository Number
Condition Description	Condition/Examination Description
Cataloguing Language*	Cataloguing Language
Notes	Remarks
WebLink	-

Table 11. (App.C). Event table

Place	Corresponding CDWA field
Place Name	Place Name
Place Description	Place Broader Context
Country	-
City	-
Address	-
Notes	Remarks

Table 12. (App.C). Place table

Person/Corporate Body	Corresponding CDWA field
Type	Person/Corporate Body Authority Type
Name	Person Name
Name from Vocab	Name Source
About	Display Biography
Birth/Creation Date	Birth Date
Death/Closure Date	Death Date
Birth Place	Birth Place
Death Place	Death Place
Nationality	Nationality/Culture
Gender	Gender
Life Roles/Profession	Life Roles
Address	-
Phone number	-
Email	-
Website	-
Notes	Remarks

Table 13. (App.C). Person/Corporate Body table

Subject	Corresponding CDWA field
Subject Description	Subject Display
Concept Name	Subject Name
Event Name	Subject Name
Person Name	Subject Name
Notes	Remarks

Table 14. (App.C). Subject table

Event As Subject	Corresponding CDWA field
Event Name	-
Event Description	-
Event Location	-
Notes	-
Weblink	-

Table 15. (App.C). Event As Subject table

Vocabulary	Corresponding CDWA field
VocabType	-
VocabTerm	-
VocabExternalID	-
VocabLink	-

Table 16. (App.C). Vocabulary table

Digital Image	Corresponding CDWA field
Title	-
Image	-

Table 17. (App.C). Digital Image table

Digital Text	Corresponding CDWA field
Title	-
File	-

Table 18.(App.C). Digital Text table

Artwork Provenance	Corresponding CDWA field
Owner	Owner/Agent
Ownership Start Date	Ownership Date
Current Location	Current Repository/Geographic Location
Current Repository Number	Current Repository Number
Valuation Amount	Valuation Amount
Currency Unit	Currency Unit

Table 19. (App.C). Artwork Provenance table

APPENDIX D: REPOSITORY LINK TO FILE MAKER PRO DATABASE FILE

https://drive.google.com/drive/folders/15XEF58riOd8E5O53caiuTxWU8Ymsrd5c?usp=share_link

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