Bringing Together the Digital with Research, Teaching, and Conservation[1]

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Abstract. The United States Holocaust Memorial Museum recognizes the increasing importance and use of Digital Humanities (DH) in Holocaust research, teaching, and conservation. To that end, the Museum instituted the Material Culture and the Holocaust Initiative (MCHI) in 2018 to explore the state-of-the-art approaches in material-culture research that could create new opportunities for Holocaust scholars, teachers, and conservators. MCHI requires large-scale collaboration to bring in a wide range of expertise from across the institution and beyond. MCHI explores the nexus of historical knowledge, technical art history, conservation, and archeological practices within emerging technologies. Specifically, the Initiative is investigating how digital collection and representation of artefacts can aid Holocaust scholars, teachers, and conservators in their work, recognizing that they all have different perspectives and demands in terms of resolution, interactivity, and capability. The three authors represent three different contributions to the cooperation and discuss the goals, objectives, and preliminary results of this collaboration. One of the program's initial conclusions is to recognize the need to treat data as fully articulated data objects that can be used for computational and scientific analysis, technical history, and advanced instructional tools rather than as just surrogates of the originals. Equally important, is the construction of interoperable systems with equivalent approaches to data at other institutions, so that computer actionable datasets can be easily combined, mined, and used in collaborative projects among geographically distant teams. This effort would not only dramatically increase the research, teaching, and conservation value of these collections but also level the field between large and small institutions for access to the material culture of the Holocaust and eliminate the potentially controversial collection by any one institution of Holocaust-era artefacts, as well as respect national and international cultural heritage laws. MCHI also demonstrates the importance of pandisciplinary cooperation and the need to collaborate to create shared vocabulary and experimentation with new uses for old and new technologies.

Keywords: Digital humanities, Digital history, Holocaust, Material culture, Data objects, Pandisciplinarity.

1. The Humanities Research Problem

Social scientists and humanities scholars have long used digital technologies to analyze and visualize large datasets to enhance understanding in their fields. Holocaust studies, however, has predominantly remained rooted in traditional archival research. Realizing that Holocaust studies needed to capitalize on the innovations provided by Digital Humanities (DH), the United States Holocaust Memorial Museum (USHMM) began encouraging the application of DH technologies to the study of the Holocaust thirteen years ago. Our first foray into the field was a 2007 Summer Research Workshop on Geographies of the Holocaust. By bringing together geographers, GIS experts, and Holocaust scholars, we explored how digital technologies could help expand and deepen our understanding of this horrific crime. The Workshop resulted in the participants securing follow-up grants from the National Science Foundation (NSF) to continue their work and produce a major publication on the subject [1].

Although a great first step in our understanding of DH's usefulness to analyze such areas as population movements during the Holocaust and space and place within concentration camps and ghettos, this study only scratched the surface of how DH could further Holocaust research, teaching, and conservation. One of the next programs initiated was a five-year, pilot Digital Humanities Associate Fellowship (DHAF) in 2016. Early career, DH-proficient scholars were awarded nine-month associate fellowships at the Museum to apply the wealth of new digital techniques and technologies to the problems of Holocaust research and education and thus increase capacity for this

[3] The assertions, arguments, and conclusions contained herein are those of the author or other contributors. They do not reflect the opinions of the United States Holocaust Memorial Museum.

work within our institution and across the field of Holocaust and Genocide studies more generally. The numerous projects conducted (e.g., the use of machine learning to identify and retrieve the official death certificates scattered throughout the International Tracing Service's Central Name Index of over 46 million cards; an in-depth statistical analysis of the history and stories of incarcerated clergy in Dachau, based on the recorded dates and locations of arrests, transport histories, and fates; the tracking of movements of Jews within the city of Lodz and their forced relocation into the ghetto based on the Lodz Ghetto Inhabitants List; and the use digital tools to analyze textual and visual aspects of postwar memorial books, including meta-data analysis, Yiddish language OCR, N-grams, and Topic Modeling) were so successful that the Museum adopted DHAF a year ahead of schedule.

Another example of a DH foray conducted by the Museum was a citizen history project called *History Unfolded: US Newspapers and the Holocaust* (**https://newspapers.ushmm.org/**). *History Unfolded* invited students, teachers, and members of the public to investigate how newspapers in local communities in the United States reported on a number of Holocaust-era events in the 1930s and 1940s. The program had two objectives. First, it taught participating citizen historians about archival research, including how to read old newspapers, what newspaper collections they could access both on-site and online through subscription accounts or free public access, and how to identify, conduct, and submit a research project to the project database. Second, the project database was a test to determine whether citizen history projects could serve as an exhibition resource. The project was a great success on both counts. It taught people more about historical research and the Holocaust and assisted in the creation of an interactive element on "Nazism in the News" for the Museum's temporary exhibition, *Americans and the Holocaust*. Data created by the project will also be made available to scholars for future research in the field.

A final example of a DH project initiated at the USHMM focused on the prominent, multi-floor display, the Tower of Faces (TOF), within the Museum's main exhibition. The over 1,000 photographs displayed depict life between 1890 and 1941 in Eishishok, which was one of many Jewish communities across Eastern Europe destroyed during the Holocaust. A USHMM team conducted audience research in 2018-2019 to learn more about how visitors experience the TOF and included the design and creation of an Augmented Reality (AR) prototype that allowed visitors to obtain more information about many of the photographs via their smartphones (Fig. 1). Once again, the program was a success. Based on audience research findings, the AR app was determined to be not only an appropriate and compelling medium for fostering visitors' sense of connection to the people, community, and history represented in the TOF but also reinforced the message that *one flourishing community with many years of history was destroyed in three days*.

Fig. 1. Students using the DH app to learn more about the photographs in the Tower of Faces (USHMM)

Although highly successful, these DH-oriented projects focused on specific aspects of research or teaching as well as having only minimal application for the Museum's conservators. It became clear that an increased focus on the potential of 3D scanning, beyond 3D microscopy, would contribute to a fuller understanding of the objects under the conservators' care. The information that we garnered about the use of databases to augment our understanding of the Holocaust and the transmission of new information and ideas, however, led us to seek a more ambitious and pervasive direction in which to grow. Based on a 2017 USHMM workshop and conference on *Material Culture of the Holocaust*, we started to investigate what appeared to be an especially fruitful area in the development of a standard platform in which documentation of Holocaust objects could be made accessible to all users for Holocaust research, teaching, and conservation: 3-Dimensional (3D) modeling.

2. The Solution

We selected 3D modeling as the next DH area for investigation because of its applicability and benefits to all areas of research, teaching, and conservation. The online dissemination of 2D images of archival documentation has dramatically increased over the past few decades and provided access to materials in numerous far-flung institutions without the cost of travel or the degradation resulting from moving and handling the documents themselves. There may be cases in which researchers must view the actual documents, but digitization has greatly enhanced the rate at which new materials can be discovered and analyzed. The question we asked was whether 3D digitization of Holocaust objects could be as useful and provide as much information as 2D digitization of documents.

In terms of material-culture research projects, 2D photographs of objects are useful for determining whether particular objects fit a certain typology, but not much more. 3D imaging provides a host of advantages. First, the ability to view the artefact in detail and rotate it to permit viewing from all angles allows closer examination of its characteristics, properties, manufacture, and materiality. For example, Martin Spett traded a piece of bread for a handmade brooch (USHMM Accession Number 1990.51.2; Fig. 2) with a young Polish girl while both were in Bergen-Belsen in May 1943 as a birthday gift for his wife, who was also in the camp with their two children. This transaction and the brooch's production raise many questions about prisoner networks in Bergen-Belsen during the Holocaust: How did Martin Spett find the Polish girl? How did they negotiate the sale? From where did she obtain the cloth, paint, and metal for the brooch? How and when did she make the brooch? How did Martin get the gift to his wife? A closer examination of the brooch would also help identify the materials and methods used in the brooch's production and provide some clues as to how this young Polish girl had to maneuver within the camp system to make it. If 3D scans of holdings at other Holocaust institutions were also freely available online, similar examples of such artefacts may be discovered, shedding light on the prisoner networks that existed beneath the administrative histories of these sites. The existence of distinctive tool marks or materials might also allow the identification of other objects made by the anonymous Polish girl, perhaps even producing an oeuvre of her work and reasserting her ingenuity, agency, talent, and thus humanity.

Fig. 2. Sara Spett brooch (USHMM Acc. 1990.51.2)

The use of objects in courses and exhibitions forge a visceral connection between viewers and Holocaust history. From the piles of shoes to wedding rings (Fig. 3) discovered discarded by Jewish victims at mass shooting sites and graves in Ukraine [2], these everyday objects humanize the victims and make them real people with unfulfilled lives, plans, hopes, and dreams rather than mere numbers. Locating and obtaining objects for exhibitions can be difficult, however, due to the limited number of artefacts extant, the variety of institutions in which they reside, and the inherent risks of transporting and displaying such objects, many of which were made from found materials and thus ephemeral in nature. The inability of most people to visit such sites and institutions also make the viewing of such objects possible only to those who can travel. The use of 3D imaging would provide students and the public greater access to these objects and a level of interactivity not available within traditional exhibits. For example, the Ringelblum Milk Can that is on loan to the USHMM from the Jewish Historical institute, Poland, is one of the most significant and compelling objects in the Museum's main exhibition (Fig. 4). The Milk Can is one of three used by Emanuel Ringelblum and the clandestine "Oneg Shabbat" organization in the Warsaw ghetto to hide its archives during the ghetto's destruction in order to ensure that future historians could tell the ghetto's story from the perspective of the inhabitants versus the perpetrators [3]. When recovered, the survivors and conservators made the deliberate decision not to thoroughly clean the object but leave the traces of the object's "trauma" extant on the interior and exterior of the Milk Can to provide a more tangible link to what the object—and by virtue the population—endured. 3D imaging both in the exhibition and online would allow viewers to interact with the Milk Can in detail. Viewers could rotate the object, look inside, and zoom in on certain features. It would also allow such objects to be integrated into virtual reality, augmented reality, and other similar technologies to enhance object-based education outside physical museums (Fig. 5).

Fig. 3. Rings recovered approximately 10 meters from a mass grave in Busk, Ukraine (USHMM Acc. 2008.76.1–2008.76.5, gift of Father Patrick Desbois and Yahad-In Unum). © Photo by Jane Klinger

Fig. 4. Ringelblum milk can, courtesy of the Jewish Historical Institute (Photo courtesy of Conservation, USHMM IL 2014.2.1

Fig. 5. Digital facsimiles of objects could be incorporated with Virtual and Augmented Realities as was done in this prototype educational experience built with digital copies of documents from the Ringelblum collection (USHMM)

Conservation was a new partner in these Museum's efforts to pursue 3D imaging of artefacts. Although tangentially involved in early investigations of the technologies to ensure the safety of the objects during the scanning process, the potential use of this technology for conservators was not fully incorporated into consideration. It quickly became apparent, however, that 3D imaging provided new and important visual information and documentation to be collected that was previously unavailable. For example, the incorporation of scanning under different controlled angles of light reveals vulnerabilities of the three-dimensional surface that are not apparent under ambient light typical of two dimensional photography and permits additional insights while formulating conservation plans. It also fully documents the object at a specific point in time, providing a detailed record of the object including features that could be changed or lost as its condition changes. 3D scans would also provide visual access to artefacts that are far too fragile for direct use, which has always been a point of contention between conservators, exhibition designers, and researchers. An example of such an artefact is the exquisitely produced flowers that are contained within the Museum's Fife Collection (USHMM Accession Number: 2016.502.1; Fig. 6). These objects are far too delicate to be displayed in an exhibition or studied by researchers. A detailed 3D scan of the object online would allow the public and researchers to see them for the first time as well as detailing their state and perhaps providing clues as to how these intricate objects were made.

Fig. 6. Paper Flowers from the USHMM's Fife Collection (USHMM Acc. 2016.502.1)

3. The Collaboration Experience

Defining the criteria for selecting a 3D-scanning system was a slow, deliberative process among the three authors of this paper, and it continues today. Each of us approached the project with unrealistic expectations based on a limited understanding of each other's methodologies and vocabularies as well as the complex techniques and technologies for capturing, storing, and manipulating 3D images. The four-day workshop and conference on the *Material Culture of the Holocaust*, mentioned above, aided us in our quest to understand each other's fields. Historians, archaeologists, artists, and educators all participated in the program, discussing their approaches and methodologies to the material culture of difficult histories and grappling as a group to come to terms with the goals, methodologies, vocabularies, and ethical considerations of our different fields.

Based on this foundation and with the aid of experts at the National Institute of Standards and Technology (NIST) [4], we then began tentatively reviewing some potential 3D-scanning systems and scheduling some demonstrations of their capabilities. All these discussions allowed us to establish eight general criteria, which are summarized in Table 1: Depiction, Interactivity, Resolution, Accuracy, Multispectral analysis, Ease of use, Throughput, and Collaboration. The safety of the object during the scanning process and the cost of purchasing, maintaining, and upgrading a system were, of course, critical, overarching considerations. A scan-once approach was also preferred in order to decrease wear-and-tear to the object, reduce the risk of potential accidents, share resources among the different offices, and maximize efficiency. We, of course, would not consider any process that could potentially put the object at risk.

Table. 1. Eight general criteria for selecting a 3D scanning system

	Research	Teaching/Exhibitions	Conservation
Depiction	✓	✓	✓
Interactivity	✓	✓	✓
Resolution	✓		✓
Accuracy	✓		✓
Multispectral	✓		✓
Ease of use	✓		✓
Throughput	✓		✓
Collaboration	✓		✓

The two criteria that were of greatest relevance to all of the authors were depiction and interactivity. We all quickly agreed that the basic production of a color, high-resolution, easily manipulated rendering of the objects that could be easily shared among different systems locally and via the internet was of paramount importance. An initial, online examination of potential artefacts for research, exhibition, or conservation requires that experts can review numerous objects quickly and easily. Such a capability is highly important for exhibition and educational purposes, since any delay or impediment to user interaction with an object would diminish the visceral link between the user and the artefact. Thus, the online depiction and interactivity of the final product must be seamless and intuitive to maximize impact and meet exhibition or education objectives and goals.

The ease of use and throughput of the different systems was also critical to all of us. Although 3D scanning is an inherently slow process, it was important that such work was limited to hours versus days. Although scanning the entire collection would take years regardless of throughput, keeping abreast of acquisitions and research, exhibition, and conservation needs was a priority. The learning curve related to the system's use had to be considered. Busy staff would need to be able to learn how to use a system safely and productively in limited time and with limited handling.

The remaining criteria were relevant mostly for scholarly and conservation research. The resolution and accuracy of 3D scans, especially of complex objects, are important for the production of typologies, identification of methods of production or potential origin, and determination of the sources, types, and extent of damage. Researchers should be able to analyze surface characteristics and measure different sections of the objects accurately and reliably in order to compare objects and aid in the production of conservation protocols. Multispectral and controlled-angled, as well as ambient, light analysis are also important because they can provide greater insights into how an object was made, what materials were used, and whether it was repaired or modified during the course of its lifetime. Of course, increasing the resolution and accuracy of 3D scans, especially of complex object shapes and surface characteristics, would slow throughput and demand balancing competing criteria for each stakeholder's end use.

4. Conclusions and Recommendations

As always, bridging the terminologies and practices of our diverse areas of expertise has been the most difficult part of the project so far. Our efforts to collaboratively unite research, education, exhibition, and conservation needs and practices with emerging technological methods and practices have resulted in a much clearer and precise set of project goals and requirements that simplify the process of final system selection. This new, joint understanding will support the final market research for a flexible 3D scanning system and ensure that the system either satisfies our requirements or clearly demarcates the needs still unfulfilled.

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