Digitizing John Ringling's *Wisconsin* Train Car at the John and Mable Ringling Museum of Art in Sarasota, Florida

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The John and Mable Ringling Museum in Sarasota, Florida is home to the private train car of John and Mable Ringling, named the *Wisconsin* after John's home state. This unique train car served as the house on wheels for the tycoon and circus king during his frequent journeys around the United States. Since John was in charge of book the circus and purchasing new acts and equipment across the country, John and Mable found that most of their time was spent in this mobile mansion. In order to expand the accessibility of the train car to the public and to assist curators in 3D printing new train car parts for conservation and replacement. The University of South Florida's Institute for Digital Exploration (USF IDEx) digitized the *Wisconsin* train car using terrestrial laser scanning (TLS) and digital photogrammetry. The completed digital model was uploaded to the 3D model sharing website, Sketchfab, for dissemination to the public, providing access to the interior of the car which is currently closed to museum visitors. Segmented portion of the 3D models were used to create individual 3D models of furniture, parts of which were 3D printed out in real scale and treated in order to resemble to originals made out of wood or metals. The virtual *Wisconsin* also served to provide valuable information and assist in understanding this Gilded Age train car to curators, researchers, and the wider community.

Key words:
Cultural heritage, train, terrestrial laserscanning, photogrammetry, 3D printing.

CHNT Reference:
Davide Tanasi et al. 2018. Digitizing John Ringling's Wisconsin Train Car at the John and Mable Ringling Museum of Art in Sarasota, Florida.

INTRODUCTION

The grand architectural style of the wealthy Gilded Age mansions in the US, with a climax between 1870 and 1900, impacted also the construction of private luxury vehicles, such as train cars. The ownership of such mobile palaces at the time was perceived as the membership of an exclusive club of tycoons and millionaires – a sort of train-set in contrast with the jet-set of the 1950s. This period marks the rise of industrialization which gave way to the growth of a wealthy upper class, which included people like Vanderbilt and Rockefeller, who could afford to build lavish homes for themselves [Shrock 2004; Cravens 2009; McKnight Nichols and Unger 2017; Richardson 2017]. It was during this period that personal rail cars became a status symbol for the rich. Like at their mansions, it was not uncommon for wealthy individuals to host parties and events on the railroad using their private rail cars. Though they did use them for business as well, these rail cars were designed specifically for their owners and decorated in a similar style to that of their mansions [Beebe 1959; Husband 1972; LaHurd 1999]. While ownership of private railcars in the United States did not come to prominence until the Gilded Age, the concept of wealthy and affluent people owning a private railcar, or several, was not a new proposition. Since the 1830s, individuals of status from the United Kingdom owned and rented private railcars to make travel more enjoyable and convenient for them. By the 1840s, American presidents started using private railcars for their frequent travels. President Lincoln had a private rail car for his travels during the Civil War. Lincoln's car even became part of his funeral procession around the United States, making Pullman cars all the more famous [Beebe 1959; Stamp 2013].

These train cars became popular during the 1870s when the Pullman Company began making private railcars for those who could afford such a luxury. Anything a person requested could be integrated into a railcar by the Pullman Company [Beebe 1959]. Unique designs, exclusive patents, tariffs, and the ability to buy out competition allowed

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the Pullman Company to become synonymous with luxury travel on the railroad. Pullman cars were even popular in Europe. It is also important to note that Pullman kept up with the safety standards and regulations, ensuring the Pullmans were the brand known for traveling safety on the rail lines [Beebe 1959; Husband 1972; White 1978]. One such regulation stated that there must be one continuous pathway down the entire length of the car that was cleared of all obstacles in case of an emergency, thus, cars had to be built with one hallway down the length of the car [Beebe 1959].

Even with each Pullman as distinct as their owners, the cars developed relatively similar properties for various reasons, not all of them being related to transportation regulations. There seemed to be a commonality between exterior design in that there was often a platform at the back of the car and the exteriors were painted relatively similarly [White 1978]. Other facets that became popular included heating, plumbing, electricity, and later, air conditioning, as well as full-sized bathtubs, concealed safes, large beds and bedrooms, staterooms, kitchens and dining rooms, and ice closets or refrigerators. These amenities become popular after individuals requested them and the Pullman Company obliged. Other similarities between private rail cars were imported marble and solid silver or gold fixtures, chandeliers, murals or other magnificent works of art, lavish wood panel designs, and fireplaces [Beebe 1959]. The cars were no less than Gilded Age mansions on wheels, complete with all the modern convinces and designs that one could afford. Convoys of serval private railcars for the affluent and their servants was common, and later became relevant to the United States elite who wanted every comfort they had at home to be available to them on the road. These they of convoys included various cars for designated purposes, like eating and sleeping, as well as separate cars for their servants.

By around the 1940s, the ownership of private Pullman railcars was on the decline [Beebe 1959]. The Second World War and, in the 1950s, the beginning of the Eisenhower Highway System caused the railroad to become less prominent than other means of travel, likely the causing further decline to the ownership of private Pullman railcars. While the Pullman Company is notable for its railcars, it would be remiss to not mention that it is also known for its labor strikes in the 1950s over poor working conditions and for being part of the history of the Plessy v. Ferguson United States Supreme Court case which was used to constitutionally justify segregation [White 1978; Stamp 2013].

JOHN RINGLING AND THE WISCONSIN TRAIN CAR

John Ringling was one of the five founders of the Ringling Bros. Circus which first began in Baraboo, Wisconsin in 1884. Eventually, John was put in charge of booking and moving the circus between locations. For this reason, he often traveled around the country, at first by wagon, and in 1890, by railroad. With the railroad, the circus became a national success, rivaling the Barnum and Bailey Circus, which the Ringling Bros. Circus acquired in 1907. John's wealth also allowed him to partake in other businesses, such as land investment, particularly in Sarasota, railroad, and oil. In 1905, John and Mable Ringling were married and bought their first private Pullman rail car, the Wisconsin. In 1926, John built a Gilded Age mansion for him and his wife, Mable, in Sarasota, known as Cà d'Zan [Barry 2014; McCarty 2018]. Due to John and Mable's love of fine art, the Ringling's began collecting pieces from all over the globe, opening a museum of art in 1930 at their Sarasota property. The property and its contents were left to the State of Florida after John's death. In 1948, the American Circus Museum was created on the property. Currently, Ringling property is the John and Mable Ringling Museum of Art which contains the renovated Cà d'Zan to look as it did when John and Mable lived there as well as the art museum, the circus museum, the gardens, and several performing arts centers [De Groft and Weeks 2004].

Fig. 1. Wisconsin train car, side view

John and Mable Ringling traveled frequently—not only for John's work for the circus—but also for pleasure. Since much of their time was spent on the railroad, the Ringlings purchased a private Pullman wooden railcar which they named the Wisconsin (Fig. 1) in honor of the state from which John came [McCarty 2018]. The private railcar was originally built in 1896 and was renovated by the Calumet Shop of the Pullman Company to the Ringlings' specifications in 1905 [The Ringling 2018]. The inside of the car was decorated by Mable to make the mobile home look as extravagant as the era demanded [McCarty 2018]. The Wisconsin was used for parties and as an office for working out contracts for the circus [The Ringling 2015].

The interior of the car contains eight separate rooms, an entryway, a platform with a railing on the back of the car, and the outside is a dark green color with gold lettering and accents, which seems to be a common Pullman Company design. This large sitting room in the back of the car would allow the Ringlings and their guests to overlook the American scenery with the windows which covered three sides of the room. The other rooms served various purposes to allow the Ringlings to live, work, and entertain on the rails. There are two bedrooms – the larger of which served as John's room and, being in the middle of the train, was likely the smoothest ride. Between the two bedrooms sits a bathroom which connected via doors to both bedrooms and the hallway. The Wisconsin has two smaller sitting rooms, which currently house a single bench seat. One is near the front of the car, just behind the kitchen and before the first of two large sitting rooms, and the other is near the rear of the car, connecting to the smaller bedroom and the hallway (Fig. 2). The entire space is decorated lavishly and allowed the Ringlings to travel in style around the continental United States. From the front entrance to the back entrance, excluding the platforms on either end, the car is about 22.6 meters long, or just over 74 feet, and about three meters wide, or just under 10 feet. The individual rooms inside the car range in size, with the smallest room being the entryway, which is about 0.9 meters long and ends at the hallway which runs the length of the train, and the largest being the large sitting room in the back of the car, which is about 5.1 meters long and includes in its width the hallway (Fig. 3).

Fig. 2. Interior of the back large sitting room of the Wisconsin

The Wisconsin railcar served as the Ringlings' mobile mansion until 1916 when they purchased a new railcar – the Jomar – named after the combination of John and Mable's names [McCarty 2018]. The purchase of the Jomar came after the Wisconsin and other wooden rail cars were banned from using tunnels in the New York City as it was a potential fire hazard [Lower 2017]. The Jomar was larger and more magnificently decorated than the Wisconsin and was used by the Ringlings until John's death in 1936 when his nephew inherited the luxury railcar [LaHurd 1999].

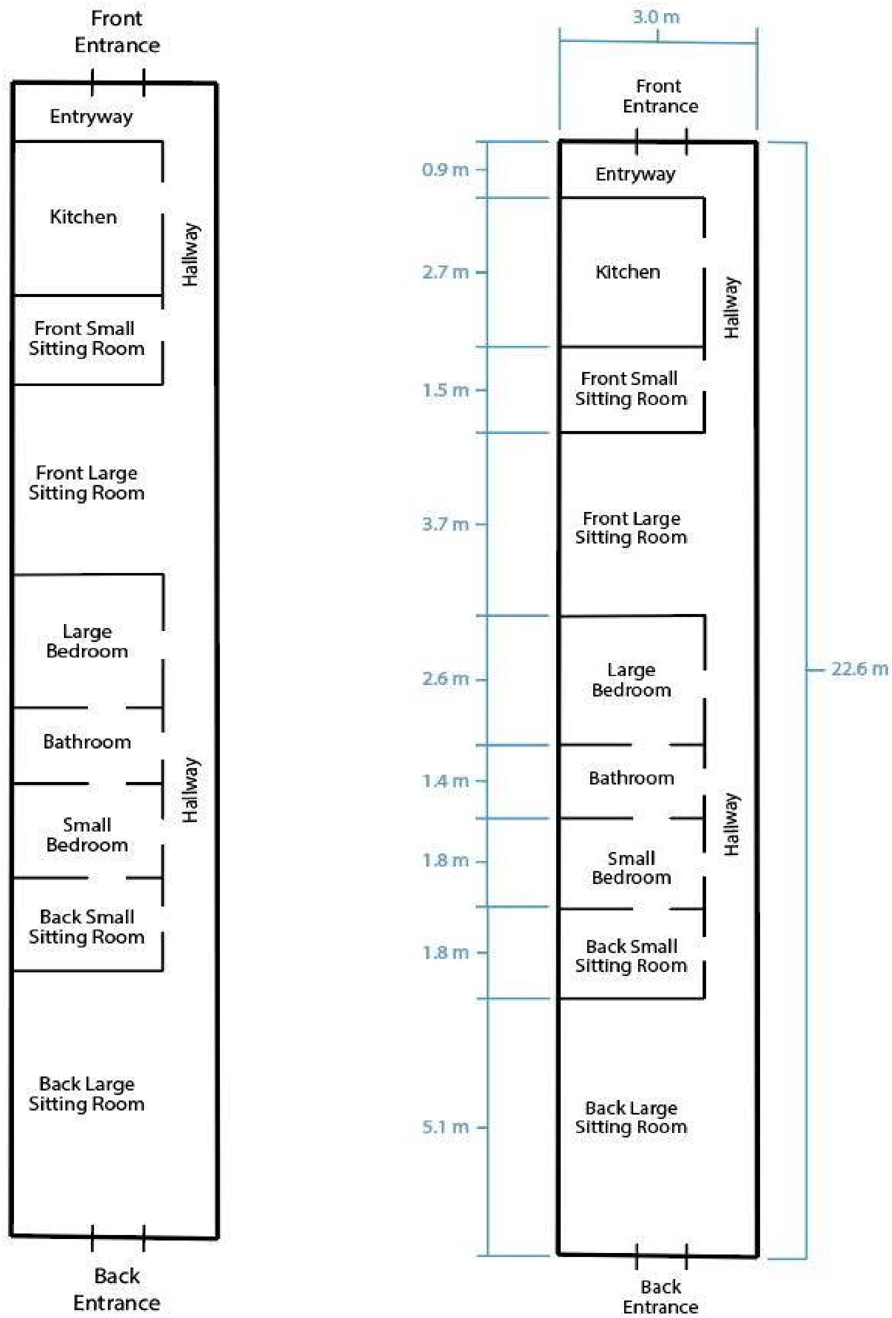

Fig. 3. Schematic layout map of the Wisconsin train car with measurements

After the Jomar was purchased, the Wisconsin was sold to various other railroad companies until 1989 when the railcar became part of the North Carolina Transportation Museum collection in Spenser, North Carolina. In 2003, the North Carolina Transportation Museum Foundation gifted the railcar to the John and Mable Ringling Museum of Art in Sarasota, Florida. At this time, the car no longer looked as it had when John and Mable were using it, as railcars from Pullman were renovated depending on where they were and who owned them. After restoration was completed in 2009, the Wisconsin was opened to the public at the American Circus Museum, housed in the John and Mable Ringling Museum of Art in Sarasota, Florida [Lower 2017; The Ringling 2018]. Today, the decor as been restored by the Ringling Museum to accurately reflect what John, Mable, and their saw inside their mobile home [The Ringling 2015].

The Wisconsin is one of the few surviving wooden Pullman Company private luxury railcars. The Wisconsin has been restored to the period when it was the Ringling's home on wheels, reflecting the unique styles of John and Mable. Although it can be considered a 'controversial heritage', due to its nature of being the luxury vehicle of an early 20th century millionaire, the Wisconsin train car is a unique piece of history, like the Ringling's Cà d'Zan, due to Mable's involvement in its interior design. It is the only surviving example of translation of the fashion of the Gilded Age into a train car. Unfortunately, the Wisconsin's age means that there are several issues with the accessibility and continuing conservation of the car.

THE VIRTUALIZTION OF THE WISCONSIN

In the interest of preserving and researching the Wisconsin and the ability of 3D technologies to enhance current curatorial methods and public access, the "Institute for Digital Exploration" (IDEx)[1] at the University of South Florida used "terrestrial laser scanning" (TLS) and digital photogrammetry to digitize the Wisconsin train car in the spring of 2018, a combination of techniques which have largely proved their potential in the field of Heritage Studies [Lerma 2010; Chapman 2013].

3D SCANNING

IDEx team used two Faro Focus 330x laser scanners to capture 124 scans over a total of three days. Scans were of both the outside and inside of the Wisconsin in order to create a complete and comprehensive digital twin of the train car. There were 84 scans taken on the outside, including the roof, through the use of a cherry picker, and the undercarriage, and 40 scans on the inside (Figs. 4-5).

Fig. 4. Laserscanning data capture in progress laser scanning

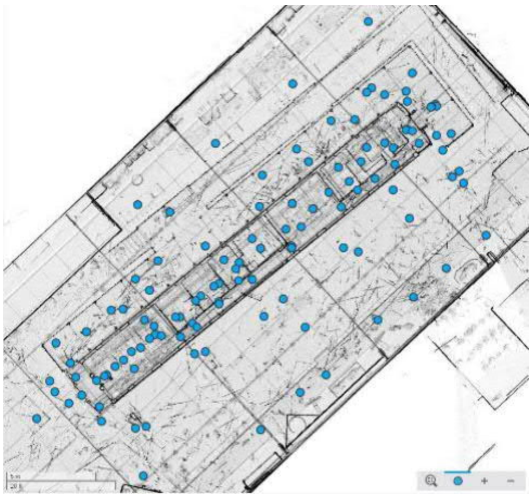

Fig. 5. Overview map generated by Faro Scene showing the placement of each scan

These scanners collect a colored point cloud of the site which is, with the applied setting being accurate within six millimeters. Uniquely textured spheres were set-up and moved intermittently during scanning to facilitate the registration during the processing. Upon the completion of data collection, the scans were processed with Faro Scene 6.2 using settings such colorization and minimal filtering and find spheres function. Registration occurred after all 124 scans were processed, and placed scans in their location, using the spheres placed during scanning. Since the scanning took place over three days, no permanent spheres could be set-up in between days, therefore, the groups created during the importing of the scans were registered together using target-based registration and they were registered manually to connect the individual days. The digital Wisconsin was systematically exported in slices

[1] http://history.usf.edu/idex/index.html

from Faro Scene software as PTS files for analysis. Decimation, when necessary, was carried out using the free software CloudCompare v2.9[2]. The results were very accurate but also rather photorealistic at the same time (Fig. 6).

Fig. 6. Several screenshots of the point cloud from the TLS. Top and Bottom: Outside of the train car. Middle: Inside of the train (right) large front sitting room and (left) top down view of the large back sitting room.

DIGITAL PHOTOGRAMMETRY

While the laser scanning provided geometrically accurate data to create technical drawings and for metrological purpose, the capturing of the train car via digital photogrammetry was necessary in order to achieve a photorealistic 3d model to enhance the experience of a virtual visit. Such technique is becoming increasingly popular among archaeologists and curators in museums for its low costs and high-quality results [Olson 2016].

[2] http://www.cloudcompare.org/

Fig. 7. Screenshots of the digital photogrammetry model of the outside (top and bottom right) and inside (bottom left)

One Canon EOS 5DS camera was used to capture a total of 621 images of two of the largest rooms and the outside. Out of the 621 images, 489 images of two of the largest rooms inside the Wisconsin and 132 of those images were captured of the outside. The images were captured at a resolution of 5792 by 8688. Portable LED lights were used inside the train in order to better capture the images, though the train still remained fairly dim in terms of lighting. The inside and the outside of the car were run as separate models in Agisoft Photoscan Professional 1.4.4. The general workflow was used to create the models. During the alignment of photos and the building of the dense cloud, the accuracy and quality (respectively) were set to high. Upon these two initial steps, the point cloud was manually cleaned to remove stray points. The mesh was created with a high face count. If not otherwise specified, the default settings were used. Upon final inspection, the model was exported as an OBJ (Fig. 7).

DISSEMINATION

For the dissemination and public engagement, it was used on Sketchfab, an online 3D model viewing platform which is freely available to the global public audience[3], where IDEx regularly shares its digital cultural heritage collections[4]. The colored point cloud model was decimated and exported in PLY in order to match the format requirement and models size of Sketchfab and subdivided in 6 individual models: front large sitting room, kitchen, front small sitting room, entryway, back large sitting room and bedroom suite (Fig. 8). The train car can be viewed in its entirety as well as in segmented versions[5]. Sketchfab also allows for a built-in VR experience on mobile devices and on other virtual reality headsets. This means that individuals around the globe will have access to view and visit the Wisconsin regardless of where they are, going around any accessibility issue.

3D MANUFACTURE OF SPARE PARTS

Small parts of the train car and its contents, like wooden elements of furniture and metal parts of the undercarriage, were exported individually for 3D printing [Balletti 2017] in order to create realistic spare parts but also to initiate establishing a little tactile collection, available in the Wisconsin Museum pavilion, for visitors with visual impairments and cognitive disabilities [Franco et al. 2015], but also the general public [Wilson (in press)] (Fig. 9).

[3] https://www.sketchfab.com
[4] https://sketchfab.com/cvast/collections
[5] https://sketchfab.com/cvast/collections/wisconsin-rail-car-ringling-museum-of-art

These individual parts or pieces were cleaned and saved as an OBJ file and were 3D printed in various materials. These 3D prints were also painted to reflect more accurately the original. To achieve both visual and textural similarities to the original materials for this project (here rusted iron and aged wood) a multi-step reproduction process was employed. Materials selection is essential to achieving a similar texture and appearance to the original product. With the cleaned digital meshes and high resolution images as a starting point, the models were scaled and printed on conventional FDM-type 3D printers. They were all printed at 0.12mm layer height and using PLA (Polylactic Acid) filament. The outer shell of the parts were printed at a relatively slow velocity of 40mm/s to reduce mechanical artifacts such as ringing visible as repeated patterns near the edge of parts. After the objects were printed, they underwent a modification process aimed at reproducing realism structured through three main phases: materials selection and part filling, preparation and surface modification, final patina application (Fig. 10).

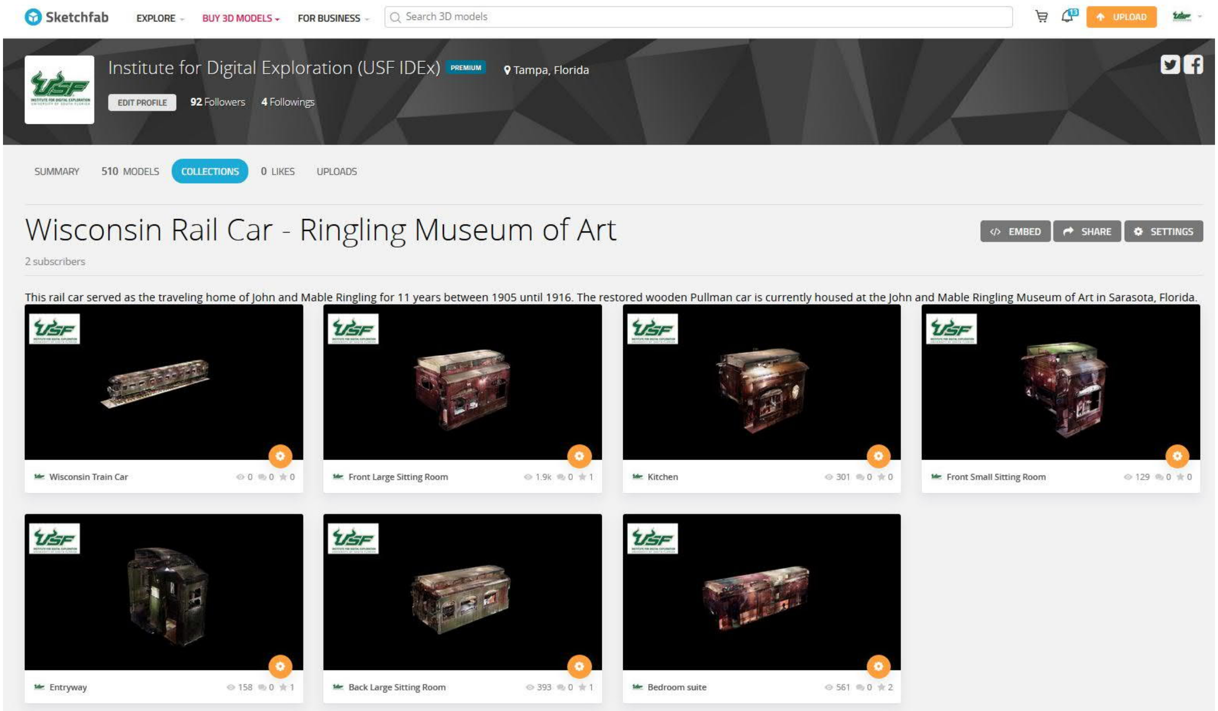

Fig. 8. The Wisconsin rail car Gallery on IDEx's Sketchfab collection

Fig. 9. Left: Part of a chair in the back large sitting room. Right: A hook from the undercarriage of the train.

Fig. 10. Process of 3D printing and painting the part of the chair (top) and the hook (bottom)

MATERIALS SELECTION AND PART FILLING

PLA filament was selected for its low shrinkage and relative hardness compared to ABS polymer contributing to its ability to be worked and sanded. For parts intended to replace wooden components, a wood fiber filled materials were used with up to 25 % (v/v) wood fiber loading. Similarly, bronze and metal particle-filled polymers are available for printing metal simulants. It should be noted that these solids-bearing filaments cause excessive wear on the 3D printer nozzle and typically require the use of a hardened nozzle material to ensure continued extrusion accuracy.

Where possible, all objects are printed with extremely low or zero infill. This permits the filling of the internal void space with density appropriate simulants to match the target weight, density, and balance of the original item. Where possible, a minimum wall thickness of 1.2mm is used which allows surface modification, sanding, and damaging to match original pieces. For parts ranging in the 10-20cm size range, this results in about 95% void volume internal to the part. This void, in turn, is packed with a blend of materials which can be weighed out in advance with volumes measured to ensure the target density is achieved. Highest density filling can be achieved by filling initially with lead shot and backfilling with silica sand (Tab. 1). After that, the overall composite can be infiltrated with low viscosity cyanoacrylate glue which binds strongly with the silica. This density perfectly equates to steels, irons, and cast irons. Using a blend of the different materials below, a very wide and continuous density range can be replicated.

Tab. 1. Densities of various part fillers used in their respective maximum random packing factor

Filler	Typical Density (g/cm^3)	Maximum Packing
Lead Shot (4-5mm)	11.34	64 %
Steel Shot (2-4mm)	7.78	64 %
Silica Sand	1.22	100 %
PLA Plastic	1.25	100 %
Glass Microspheres	0.6	100 %
Expanded Polystyrene Foam	0.05	100 %

PREPARATION AND SURFACE MODIFICATION

Immediately after printing, any support material(s) and structures were removed from the part manually and the parts were given a rough sanding with 100 grit sandpaper. The parts were loaded into a sandblast chamber and blasted with coarse crushed walnut shell media at a pressure of ~60psi (4 bars). This process greatly reduces the visual appearance of 3D printed layer lines and smooths any imperfections resulting from the scanning and printing process. Following this, a further sanding with 600-800 grit paper replicates the natural burnishing and wearing that would occur over time with wooden and metal parts.

In the case of wooden parts, a further treatment is recommended to realistically depict decades of aging, shrinkage, and damage from normal use. These damages mostly commonly come in the form of: visual enhancement of wood grain due to uneven shrinking of the wood, wood destroying organism damage, scratches and abrasions, small wood pore visibility, microcracks, macrocracking, and darkening of the wood. It is important to mimic each of these elements to ensure a realistic part is produced. A rotary tool with a wire brush attachment is used to create a grain-like surface texture. Alternatively, this can also be applied to the digital model but a more sharp appearance is typically realized through manual application. Sharp awls and needles are used to apply much of the rest of the damage with the addition of a rasp near the end of the process to reproduce abrasions. Cleaning with a damp cloth prepares the parts for final treatments

FINAL PATINA APPLICATION

Continuing in the case of wooden parts printed with wood fiber-loaded filament, it is possible to directly stain this material as one would with an actual wooden part. The parts were all stained using commercially available penetrating oil stains. These were applied intentionally unevenly using a crushed paper applicator as 1-2 thin coats and allowed to dry for 2-5 days. Following this, brown and black oil paints were liberally applied and towel wiped with functioned well to fill low lying areas with darker pigment. After a further 5 days of drying, a matte or gloss spray clear coating was applied to protect the surface.

In the case of metallic parts, metallic paints and sprays were used to achieve the bulk of the effect. During the wet painting and application process, coarse salt and metallic powders matching the original object to be imitated are sprinkled on to the surface. The result is the partial embedding of the painted surface with these real metallic species. These metallic particles can be rusted or aged synthetically through the use of corrosion accelerating chemicals thus compressing decades of neglect and corrosion into a matter of hours or days. In addition, oil paints which match the oxide, sulfate, and chloride state of these metal species are painted onto the surface to further enhance the parts where needed. As before, the parts are left to dry for 5 days and then protected with a thin matte finish clear coat. It is possible to also embed further metallic particles into the clearcoat. The final result speak for itself, as the objects have now same weight and appearance of the originals (Fig. 11).

Fig. 11. Photo of several painted 3D prints

TECHNICAL ISSUES AND PRACTICAL SOLUTIONS

The site being open to the public was not of particular concern since visitors cannot enter the inside of the car. One issue discovered after the completion of data collection was that, due to the railcar's need to move when riding the rails, the rail car moved slightly whenever someone inside walked around. Several scans had visible issues within their images that showed a movement of the car which individual scanning technicians could not feel themselves caused the scanner to capture data that was slightly off from the rest. These scans, thankfully, could be saved and used for the most part as there was overlap in scan positions. Parts that aligned with the rest of the train were kept while parts that were slightly skewed within the same scan were removed.

A unique challenge faced with scanning something like a rail car presents itself in the space that one has to maneuver. The Faro Focus scanners can be quite versatile in small spaces, but places like bathtubs, and on top of fabric surfaces, like beds, because a particular issue. Smaller scanners, like the Leica BLK 360, may be able to fit in these smaller locations, however, since the rail car has unique special management, flat surfaces on a higher plane that the rest, like the top bunk in the small bedroom, cannot be easily reached by the scanner and placing the scanner in order to cover these surfaces causes specific challenges. Even places like the kitchen, which for the most part is an open space, has different necessary machinery tightly packed together, so that even the smaller terrestrial laser scanners would have difficulty reaching every area of the space.

Similar to other discussions of 3D datasets is the issue of computing power and dissemination. While this project was small enough to be processed on most of the computers at IDEx, the end product consisted of billions of points, making it necessary to decimate the digital twin for dissemination purposes. The size of the original data is large enough to cause even the most modern computers to have trouble viewing the full Wisconsin 3D file. Dissemination of the data to the broader public would make it necessary to decimate the files as many individuals in the broader public likely do not have the highest level of hardware and older computers, or even newer computer with lesser specifications, would probably have difficulty viewing the full dataset. Even the decimated versions which are available to the public are difficult to view on most mobile devices due to its size. It is likely that the development of new technologies will help lessen the prevalence of these problems in the future.

CLOSING REMARKS AND FUTURE WORKS

The 3D digital versions of the Wisconsin will provide a valuable resource for the future. Not only will researchers and the public be able to view the Wisconsin from anywhere in the world, but it also creates a specific view of the Wisconsin as it was at the time of the digitization. The Sarasota location is at risk for natural disasters like hurricanes due to its bayside location. The fact that cultural heritage, as a physical remnant of past and lost civilizations, has come to us after centuries and in good condition in many cases, despite all the forces that threatened it, does not allow us to take for granted that we will be able to pass it as it is to future generations.

In that case, the virtualization of the Wisconsin will become useful to assist curators to restore the car if it were harmed [Minucciani and Garnero 2017]. This digitization will also provide restoration and curation work with the ability to use 3D printing techniques out of various materials if a part or piece of decor ever needs to be repaired or replaced for any reason. Small or large pieces can be virtually removed from the digital model and 3D printed without harming the car or its part for reproduction like other analogue methods, such as casting [Neumeuller et al. 2015]. Not only will this provide the Ringling Museum to be able to conserve the train car better but also to catalogue how the car may have changed overtime. Continued 3D printing efforts regarding the train car will be employed for the restoration and research of the train as well as to bring the train to the public.

Another important part of the digitization is that the increased accessibility of the Wisconsin. Currently, the public cannot physically enter the Wisconsin; instead they can only look from the outside into the car via the windows. The digital version allows visitors and researchers alike to view the Wisconsin from anywhere in the world and even walk through the rail car using virtual reality methods. This provides the public with the ability to access the inside of the train car digitally which they are currently unable to do. It also provides those who have a disability and may otherwise not be able to experience the Wisconsin with the opportunity to visit the car, allowing for greater accessibility to the public. Researchers and curators will be able to analyze, view, and get a sense of what it was like for the Ringlings and their guests in living, working, and traveling in the Wisconsin without experiencing the constraints which tend to come along with research such as scheduling and travel. The digital Wisconsin also provides perspective visitors and researchers with the ability to better find and evaluate the American Circus Museum and the Ringling Museum as the digital version provides a greater online presence which exposes potentially new individuals to the train car. A digital presence makes the heritage more accessible to those who may not have known about it prior to a physical visit to the Ringling.

One major issue is that the Wisconsin's technical drawings were not inclusive of all parts of the train car, such as the layout. With the 3D digital model, IDEx was able to create an overview map of the train and future users can similarly generate technical drawings in a significantly smaller amount of time than using analogue methods. Technical drawings can also be verified for accuracy since laser scanning provides more accurate measurements than those which have been manually measured [Du et al. 2015]. The measurements taken using this 3D digital Wisconsin can be done with accuracy which may not be possible in real life. Technical drawings can be produced of every area of the Wisconsin, such as the ornate details on the ceiling or the floor plan with furniture, which currently has not been done. These will help researchers and curators to better understand how the Ringlings used the space.

Further dissemination practices will include a clickable map which allows digital visitors to understand better how the train car is laid out. By clicking on a specific area of the map which was generated via the laser scanned point cloud, the digital visitor will be linked with that specific section of the digital Wisconsin. It provides a better context for the individual sections of the digital Wisconsin and allows for integration of a 3D digital exhibit and tour of the historic rail car. Future work on the rail car should include the integration with augmented and virtual reality. As these technologies become more accessible, with decreased cost and greater understanding of programing and using these devices, the integration and ability for the public and researchers to use these technologies will increase.

The Wisconsin train car is a magnificent piece of cultural heritage. Like Gilded Age homes, private rail cars for this elite class of wealthy individuals brings insight to the era and the individuals to whom they belonged. Digitization of these cultural heritage is necessary for the preservation and continued research. The digital Wisconsin increases the ability for preservation, research, and restoration, especially with the incorporation of 3D printing technologies. The increased accessibility for the global public and research is a valuable aspect of the digitization efforts. Continued work on 3D printing and augmented and virtual realities presents a promising future for increased accessibility and research on the Ringlings, their legacy, and the Gilded Age.

The virtualization of a such elaborate vehicle as the Wisconsin and the production of its digital twin is a significant advance for the knowledge of Florida cultural heritage but at the same time it represents a challenge for those scholars called to disseminate properly the results. Without entering in the debate of the best 3D Web Viewer/Platform [Scopigno et al. 2017], in order to fulfill the expectations of the public on the virtual Wisconsin project, it has been decided to prioritize in the future research agenda a Unity-based customized platform for a virtual visit of the mansion, derived from previous experiences [Stanco et al. 2017]. The platform, Virtual Wisconsin, which at this stage is still in the design stage will be web-based, will use visual navigation tools, inspired to the Virtual Ca'd'Zan platform, already produced for the luxurious mansion of John Ringling at Sarasota [Tanasi et al. forthcoming]. From the plan of the train car with a simple point-and-click, users will be able to visualize the 3D models stored in an online server through a customized 3djs-based viewer with the option of choosing between low, medium and high resolution. The platform will also incorporate multimedia contents as text, hyperlinks to external websites, audio and video related with the history of the Wisconsin and the Ringlings and have an embedded VR output in accordance with the current trends in the field of Digital Cultural Heritage [Bekele et al. 2018].

ACKNOWLEDGEMENTS

Authors are grateful to Jarred Wilson and David Berry, namely Associate Registrar and Assistant Director of Academic Affairs at the John and Mable Ringling Museum of Art for the extremely valuable help they provide facilitating the agreement between the University of South Florida's IDEx and the Ringling Museum of Art and for the invaluable help they offered on the field.

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Imprint:
Proceedings of the 23rd International Conference on Cultural Heritage and New Technologies 2018.
CHNT 23, 2018 (Vienna 2019). http://www.chnt.at/proceedings-chnt-23/
ISBN 978-3-200-06576-5

Editor/Publisher: Museen der Stadt Wien – Stadtarchäologie
Editorial Team: Wolfgang Börner, Susanne Uhlirz