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**2018**  
**MUSEUMS IN THE DIGITAL WORLD**  
**LES MUSÉES À L'ÈRE NUMÉRIQUE**

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**46<sup>TH</sup> CONFERENCE OF CIMUSET**  
INTERNATIONAL COMMITTEE  
FOR MUSEUMS & COLLECTIONS  
OF SCIENCE & TECHNOLOGY

# **MUSEUMS IN A DIGITAL WORLD**

**15<sup>TH</sup> -19<sup>TH</sup> OCTOBER 2019**  
INGENIUM - CANADA'S MUSEUMS  
OF SCIENCE AND INNOVATION,  
OTTAWA, CANADA

# INTRODUCTION

It is with great pleasure that we present the CIMUSET-IATM joint conference proceedings, which include full papers presented at the conference in Ingenium Museums, Ottawa on 14-19 October 2018.

We wish to thank our host Ingenium (Canada Agriculture and Food Museum, Canada Aviation and Space Museum and the Canada Science and Technology Museum) and our partner International Association of Transport and Communications Museums (IATM) for accepting to join us in our 46th annual conference.

I'd like to thank also all the speakers for their insightful presentations and for accepting to share with us their professional experiences in safeguarding science and technology heritage. The success of this conference also is largely due to the active participation and involvement of local organizers and volunteers; they deserve our gratitude for their engagement.

This conference was based around a topical theme which concerns, not only scientific and technical museums, but all museum's community in the world: "Museums in a Digital World": It was highly topical issue which stimulated a particular interest among all participants, because the rise of mobile technology, the cloud and the Internet of Things has made digitization the core driver of digital disruption and it affects every industry, including museums and science centres.

We all agree that the digital world will never be able to replace the real artefact, but the challenge for museums is how we can use those digital platforms to engage our visitors/users with their scientific and technical heritage.

We are confident you will find the following papers and abstracts interesting and useful information. Thanks again to everyone who contributed to CIMUSET-IATM conference in so many ways, and thank you for participating!

We hope you enjoy reading our conference proceeding.

Ech cherki DAHMALI  
CIMUSET Chairperson

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# IN THE JUNGLE OF DIGITAL WORLD

MARINA BERGSTRÖM  
HEAD OF EXHIBITION  
FINNISH RAILWAY MUSEUM

We need to be present in the digital lives of our customers. The government, our stakeholders, and funders, want us to be open and digital. Our visitors expects us to provide online material, information, and entertainment from our exhibitions. We try to find the best way to deal with the digital jungle.

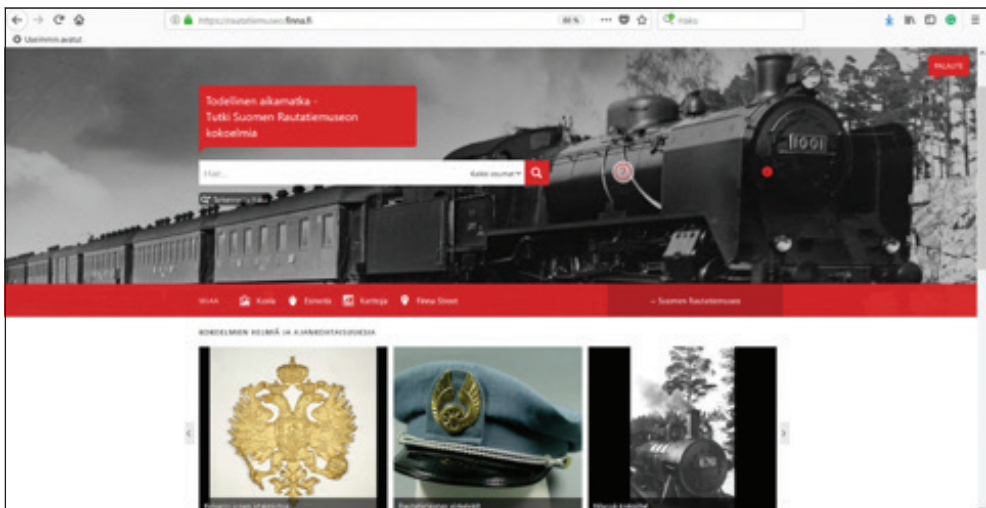
At the Finnish Railway Museum, we have no expertise in digital, being only 10 employees with 100 pieces of rolling stocks, 20,000 pieces of small objects, 200,000 pieces of pictures, 20,000 blueprints etc., a library of 23,000 volumes and 5,000m<sup>2</sup> of exhibition space in an old railway area. We are dealing with the pressure to digitalize and virtualize our collection and the stories it carries. Since 1997, we have been identified as a national specialised museum in the field of railway history, and that puts even more pressure on us to have an online presence to reach our audience nationwide.

Luckily, we have been able to cooperate really well between museums and other GLAM organisations in Finland.

Our collection management software, originally developed by and for the National Board of Antiquities, has become outdated. Because we are not alone, there are a couple of bigger joint development solutions: one is run by a museum consortium and the other by the Finnish Museum Association. The advantages of designing and purchasing software together are, besides sharing technical support, the sharing of policies and built-in thesauri, and other classification systems specific to museum materials. We can trust that the cataloguing system is standardised and suitable for Finnish museum practice.

But the best aspect of all of those softwares is how compatible they are with Finna, the web-interface of Finnish libraries, museums, and archives, led by

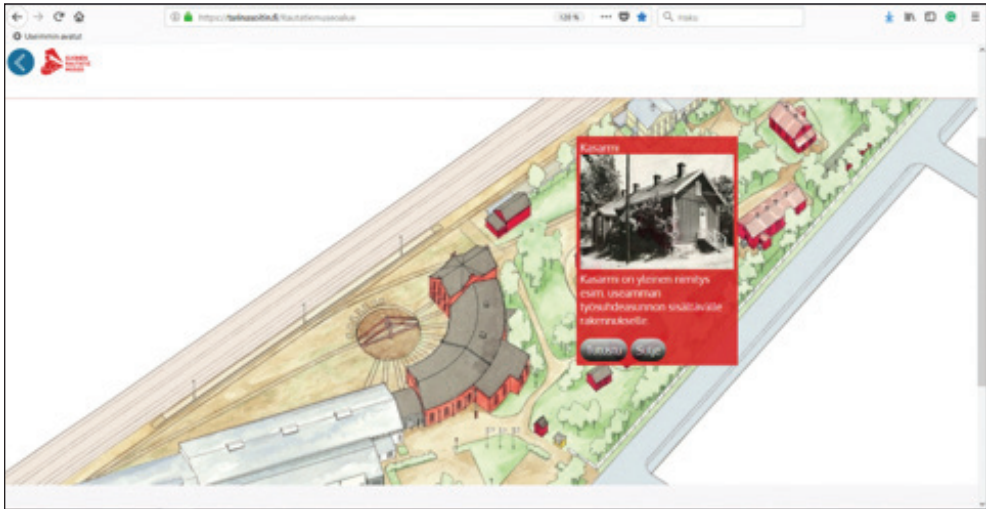
the National Library. Our online collection is available on “finna.fi” (among the materials of all other participants), “museot.finna.fi” and our own webpage “rautatiemuseo.finna.fi”. These different interfaces gave us the possibility to either be found when people were randomly searching for pictures or other materials related to a topic of their interest, or when they were particularly interested in our objects. On the main page of our interface, we can highlight our collections of current or special interest. It is also convenient for customers because they can easily find all of the historical material through the same address.



Ownfinna: The front page of our Finna view

We also have the ability to receive help from our peers with our mobile guiding applications. The so-called “Museum without walls” was created with the Finnish Museum Association. It gives us the possibility to create mobile guides with audio-visual material for customers with little effort and without prior knowledge of coding. Because the app runs on a web page, it is not bound to any device or operating system, or locality. It provides unlimited access from home and also serves as an online exhibition.

Social media is a place to keep in touch with our audience. The best practices in collaboration have been the videos we made together with our partner museums that are part of the Transport and Communication Museums



Museumwithoutwalls: Our first mobile guide tells the story of our museum area

Association (Trafikiikki), and taking part in virtual events like #MuseumWeek or Onni museoon - tallennus (Happiness to the museum - documentation). Sharing expertise and knowledge while making videos together gave us the courage to try it ourselves.

Some collaborations in which we have not taken part yet, but hope to join, are in the field of visitor engagement. One of them is the “Ask a Museum” service, and the other is the “Log stories” sharing platform. The former provides a platform to share museums’ answers to public questions. The latter is a platform that allows sharing stories of people’s experiences in museums and locations around the world worth visiting.

And of course, we cannot neglect helping people gain concrete knowledge related to railway history. That is the reason of why we have a joint online workshop with our partner museums that are part of the Trafikiikki association.

Ultimately, we can do our work and serve our customers, while pleasing our stakeholders, by co-operating with the right organisations. The time, the money and the effort we are saving by co-operating is huge. We can do more for our audience and concentrate on the content instead of the digital instrument. This is our way of dealing with the digital jungle.

# DIGITAL TECHNOLOGIES IN MUSEUM ACTIVITY – THE LEARNED LESSONS

NINA A.BORISOVA,  
THE A.S.POPOV CENTRAL MUSEUM OF COMMUNICATION  
S.PETERSBURG, RUSSIA

The A.S. Popov Central Museum of Communications, founded in 1872, is located in the historic centre of St. Petersburg. Our museum stores, collects, and studies the following collections: about 8 million items relating to philately, about 25,000 communication devices (telegraphs, telephones radio equipment, broadcasting, television), about 50,000 fonds, about 50,000 library books, and about 60 people that are part of the museum's staff.

The main objectives of digitization in our museum:

1. Construction of ICT infrastructures (2003) and its maintenance (2003-2018)
2. Data management of the museum's digital assets
3. Working with external environment
4. Electronic database of collections
5. Registration work
6. Scientific activity
7. Exposition space

All of the objectives are important to the digital museum and they have been listed in no particular order.

The first objective of digitization was the construction of an ICT infrastructure and its maintenance (from 2003 to 2018). This infrastructure was implemented in 2003 after the major repairs and restoration of the museum building. The structured cable network was laid out and served as the hub on which was built the local computer network allowing transmission of data and telephone traffic. One part of the network was supporting the exposition, and the other supported the museum staff. The advantages of a powerful ICT infrastructure in the museum are: automation of staff and management operations of the

exposition (therefore increase in the efficiency of museum work), possibility of demonstrating modern info-communication services online (it was something new in 2003) and educational programs for students of the University of Telecommunications. The disadvantages of having its own ICT infrastructure (based on the results of many years of service and maintenance): high cost of maintenance due to additional staff, spare parts, version updates of software, etc. Nowadays, construction of a museum's own ICT infrastructure is unnecessary. Cloud computing technologies gives us an opportunity to rent external ICT infrastructures and digitize museum activities while working remotely.

The second objective of digitization was managing the museum's digital assets. The digital assets of our museum is managed as follow: All projects are distributed on separate servers to avoid reaching a point where they could merge and fail; the digital assets' management system is based on the ICT infrastructure; it consists of different application programs that facilitates the digitization of the Collection, the website, museum programs, and the automation of different types of museum activities; An easy to use administrative interface that allows to operate the content without having preexisting skills in programing.

The advantages are: flexibility in changing the content and quick access to content.

The disadvantage is: it is necessary to run regular expensive system updates of the programs (issues from older versions of the software became our problems instead of the supplier's). This is a trade-off for all the advantages of the ICT system since it is not possible to avoid these expenses in a budget

The third objective of digitization was working with external environments. The first external environment being the museum's website; the second is the automated ticketing and booking system: it consists of an automated workplace for the cashier, an automated workplace of the booking office, and an automated workplace for accounting/administration; the third is the CRM system.

Advantages of having a website, a booking, and cash system are obvious. I am not going to talk more about them.

Our experience of using a CRM system was unfortunately not good. What is CRM? The CRM (Customer Relationship Management: "control of the

relationship with customers”) model arose in the 1990s by joining three points of focus: contact centers, help desk apps and sale force automation. Museum customers are not only museum visitors, but also suppliers, partners, colleagues, sponsors, people from the municipal government etc. A CRM software records customers’ contact information such as emails, telephones, websites, social media profiles, and more. After having purchased a CRM system, we cross-referenced data from the CRM software with data from the digital office’s switching station. This gave us the opportunity to quickly visualize the customers’ data (and their history) that were entered into the database.

Theoretically, CRM helps users focus on their relations with customers and make their job more effective.

In real life, regular computer processing new data and correcting outdated information requires a lot of time. It became a problem for the museum’s marketing department. The efficiency of museum operations from CRM application did not improve.

The lesson learned: it is necessary to compare costs of digitization of museum operations with the resulting effect.

The fourth objective of digitization involved the electronic database of collections. To implement an electronic database, we had acquired the Complex Automated Museum Information System (CAMIS), which is widely used in Russia for any kind of museums (on the basis of ORACLE). This system turned out to be universal and worked for various collections, except one: a collection of signs of postal payment. For this collection, we had to order the development of a special module. To create a backup copy, all of the signs of postal payment fund were scanned and kept in an electronic format.

Our collections belong to the state, and are included in the Museum Fonds of Russia. According to the law, information about each of the museum’s objects must be included in the Electron State catalogue of Museums’ Fonds of Russia. Today, the electronic catalog of this museum’s fonds is being compiled and we have to include our electronic resources to it on a monthly basis, and should finish this work by 2025. Now all of the museum’s new exhibits are registered in an electronic database as soon as they are received.

While developing an electronic database of the collection, our museum has met a number of difficulties: problems with the creation of dictionaries, standardization of descriptions of museum exhibits, technology of how to record everything (example: how to keep track of the repeated copies of stamps); full digitization of our collection demands a lot of expenses and is very time consuming; the amount of time digitization requires leads to obsolescence of carriers and the necessity to rewrite the digitalized material. The lessons learned: use of a scientific approach to the organization of an electronic resource, as well as the solution of a set of terminological and classification problems, are needed; it is important to use modern technologies (for example, cloud data centers for the digital storage of the museum collection).

The fifth objective of digitization was the registration of work. It is based on the use of the electronic database of the collection. The advantages are: efficiency of drafting electronic documents and calculation of museum objects. The disadvantage is the lack of having a physical paper document. In Russia, there is a requirement imposed on the state museums to store a number of museum documents on paper.

The registration of work has a bright future in the context of the developing technology “Internet of Things”. Our museum has had some experience by introducing RFID Radio Frequency IDentification (the first versions go back to the beginning of the 2000s) – the predecessor of “Internet of things”. The lesson learned was that one should not hurry and use tags such as “Internet of things” for management of museum exhibits because the museum’s budget might not sustain the introduction of “crude” technologies.

The sixth objective of digitization was scientific activity. Advantages: a possibility to quickly access and research the digitized collections, a possibility of quick search for information on the Internet; access to global digitized archives. Scientific activity, on the one hand, benefits from the use of digital technologies, but, on the other hand, is at a loss (Internet and social networks are full of misrepresentations and untrustworthy info). It is necessary to not forget (young museum employees tend to forget!) that scientific approach assumes a research of various sources, not only electronic resources.

The seventh objective of digitization was exposition of space. Different ICT technologies are widely used in exposition space.

Multimedia equipment provides more detailed extended information on the exhibits, on the museum, and demonstrates archival and video materials. All of the media equipment (projectors, touch screens, plasma display panels, webcams operated from computers) are conditionally called “exposition automated work stations” at our museum, and we have about 50 of them.

To get acquainted with the museum’s objects, visitors can use the audio guide based on a program that uses QR codes.

There is a row of interactive exhibits in our museum that use computer equipment, but they are often left alone in favor of the simplest interactive exhibits. The computerization of exhibition space and its transformation into a game zone (instead of demonstrating historical collections) is not really popular with the museum’s visitors.

Is it worth competing with science centers in interactivity? Our museum has accumulated a lot of experience using touch screens as the so-called “virtual labels” in the exhibits. Unfortunately, we see that people rarely spend time playing with touch screens, focusing mostly on very short texts, video files or audio recordings. They are more interested in the exhibits and their description texts (not in electronic form!), wall graphics, the simplest interactive models (without computers), installations reflecting the environment of the equipment. We have noticed the lack of interest and even negative attitude to computer technologies used in museum exposition is more typical for technical museums. The reaction from visitors to “virtual labels” and other computer equipment in museums of a nontechnical profile (art, historical, etc.) is less negative. Perhaps, the humanitarian aspect favorably influences the visitors’ mentality, and computers fit into the exposition space of these museums. While, at technical museums, visitors experience a double exposure to technology: computer technologies are used for demonstrating the technology. Perhaps, museum visitors will want to take a break from home computers and mobile phones while at the museum?

### Conclusions:

1. Digitization of museum activities is an irreversible process.
2. Development of electronic database of the collection and the automation of work for staff are the priorities.
3. Implementation of expensive solutions has to be economically justified.
4. A balanced approach in choice of digital decisions should be used

# FROM EMPLOYEE-CENTRIC TO USER-CENTRIC: MIGRATING FOUR DISTINCT MUSEUM WEBSITES TOGETHER UNDER ONE NAME

LAUREN DIVITO

INGENIUM – CANADA'S MUSEUMS OF SCIENCE AND INNOVATION  
OTTAWA, CANADA

## Introduction:

In 2017, the Canada Science and Technology Museums Corporation rebranded as Ingenium, Canada's Museums of Science and Innovation. Ingenium and its three museums: the Canada Agriculture and Food Museum (CAFM), Canada Aviation and Space Museum (CASM), and the Canada Science and Technology Museum (CSTM), celebrate creativity, discovery, and human ingenuity, focusing on the stories of people. With this user-centric shift came the need to consolidate four separate websites under one banner while preserving each museum's unique identity. Working within a tight timeline, our aim was to restructure existing content to increase visitor experience and create stronger cross-promotional opportunities, all while emphasizing accessibility and inclusive designs. This article will include a discussion around our process, agile methodologies, challenges, failures, successes, and our roadmap for the future.

## Ingenium, its Museums, and the Rebrand

The rebranding of Ingenium did not affect the way we structured ourselves. We were, and still are, a corporation with three distinct museums: CAFM teaches about food and animals on its working farm and heritage site, CASM, located on a former military base, informs its audiences about the history of Canadian aviation and aerospace technology, and contains the most extensive aviation collection in Canada, and CSTM, which re-opened in November 2017, features 7,400 m<sup>2</sup> (80,000 sq. ft.) of redesigned space filled with artifacts and interactives around the themes of science, technology, and innovation in Canada. Our former websites (corporate and three museums) used the same template across all four to indicate this interconnection to the public, using

colour, text, and content as a primary means to distinguish between them: the corporate site is black, CAFM's green, CASM's blue, and CSTM's red; all colours which could be found on the corporate logo [fig 1.]. However, despite these efforts, many of the public (even local) did not realize we were all under one corporate name. The rebranding became not only about a change of name, but about shifting the way we thought about ourselves, internally, and how we projected that, externally, to the public. Ingenium is about celebrating creativity, discovery, and human ingenuity, focusing on the stories of people, and we had to ensure that this was reflected in the redesign of our websites.



**Fig. 1.** Screenshots (not to scale) of former Ingenium websites showing identical template. From left to right: Ingenium's corporate site, CAFM, CASM, and CSTM.

## Project Objectives

We had four major objectives for this project—design a website that was:

1. **User-centric.** Just as the new branding was about placing a focus on the stories of Canadians, we wanted our website to reflect our designs with the visitor in mind, ensuring it was visually stunning with a minimalist approach, accessible and inclusive. This meant employing user experience (UX) methodologies to the research, design, and implementation process.
2. **Mobile-friendly.** While we wanted to ensure that our new websites were functional on all browsers and responsive across mobile phones, tablets, and desktop devices, we designed mobile-first, as our analytics indicated

that a growing number of our visitors were accessing our former websites on their cellphones.

3. **On a common platform.** We decided to use Drupal 8 as our platform as it is easy to maintain, open source, and has a strong community of developers that we could access, when needed. Drupal 8 also allows a component to be built once, and be easily re-used throughout the site—an important feature for ensuring a similar look and feel across the museum webpages. Finally, with only two developers for an entire corporation, we wanted to take this redesign opportunity to empower our staff by uploading their own content. As Drupal 8 is very easy to learn and upkeep, we felt confident that our staff could be trained on this new platform, giving our developers the opportunity to refocus their attention on building and improving our platforms for the future.
4. **A migration, NOT a rebuild.** This was one of the most important and challenging objectives. Due to our tight timeline and budgets, we would not be rewriting or restructuring content but, rather, migrating the content from the former websites, in an agile and phased approach. As we progressed through the project, however, this proved impossible in some instances, which will be discussed in more detail later.

## Timeline

The website redesign was a two-year, three-phased, agile project beginning in 2016, and projected to the end of 2018 (although it is still ongoing due to our need to restructure some content, as described above in objective 4) [fig 2].



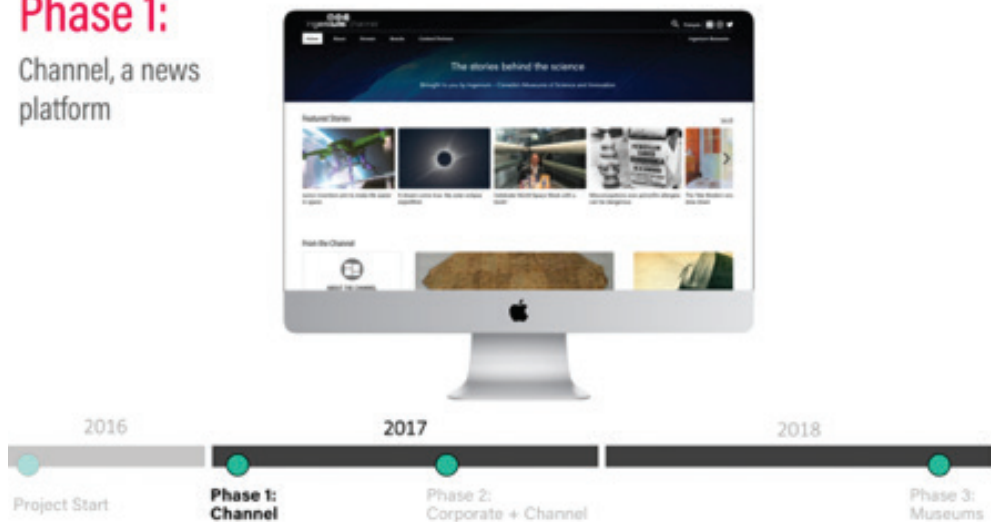
Fig. 2. Timeline of the two-year plan for redesigning the Ingenium website.

In early 2017, work was to be completed for phase 1: the Ingenium Channel ([www.ingeniumcanada.org/channel](http://www.ingeniumcanada.org/channel)), a digital news platform where Canadians can easily understand and engage with complex science and innovation topics [fig 3]. While the Channel differed in that it was to specifically target non-locals

who most likely would never come to our physical spaces, it still needed to be connected to the Ingenium brand and website. A significant portion of the UX research and design was done in this phase including environmental scans of existing channels and websites with similar museum structures, research into strong design, persona creation, journey mapping, information architecture, and wireframe/creative development. A large portion of this work was then able to be re-used during the corporate and museum webpage phases.

## Phase 1:

Channel, a news platform



**Fig. 3.** Phase 1 of the website redesign: the Ingenium Channel to be completed early 2017.

At the end of 2017, phase 2 included corporate pages into the new website. Determining how these pages would be integrated proved challenging as it was the content outlier of the four former websites, containing information about corporate documents, the board of trustees, the executive leadership team, etc. This information was accessed by a very different audience than those who would access our museum pages for locations, hours, and events. After researching and iterating, it was decided that it would be placed in the footer, under the heading *The Corporation*.

Phase 3 [fig 4], projected to end in 2018, was the final stage during which the three museums would be fully integrated into the Ingenium website, along with the corporate information, and The Channel. While a majority of the museum

sites had been incorporated by that deadline, this phase remains ongoing into 2019 as it was concluded that to achieve the best user experience, some in-depth user testing and restructuring of content was necessary. This will be further discussed in **Example of Content Restructure: Exhibitions**.



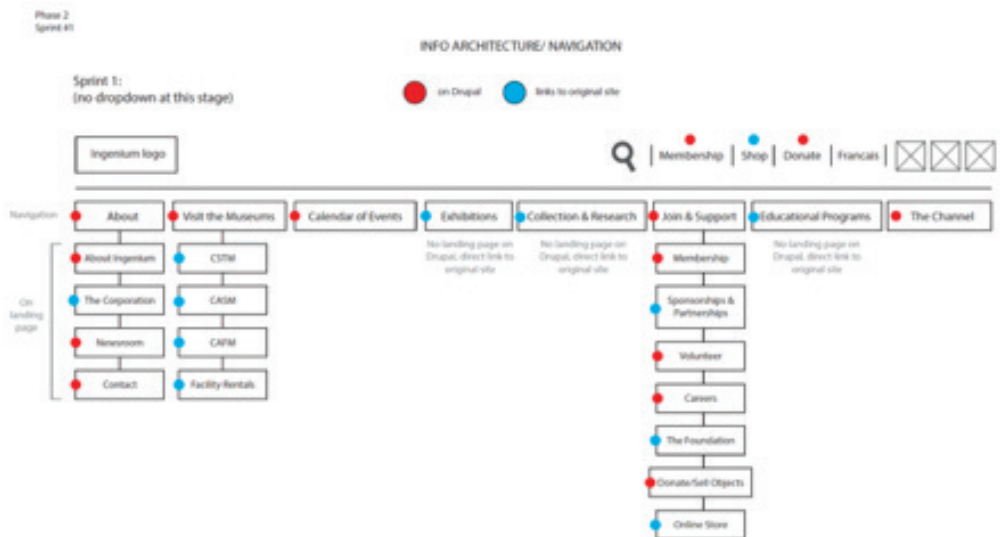
**Fig. 4.** Phase 3 of the website redesign where all pages should be fully integrated, including the Channel, corporation, and three museums.

## Research

Due to our agile approach for the website project, research was done in bulk early on in each phase, but still continued on throughout the project. Some of the major components will be discussed below, but does not represent the entirety of the research completed.

1. **Content Inventory.** Research began with a thorough content inventory of the former websites. Although a large portion of the content was migrating over to the new platform, some of it was purposely discarded. For example, many of our microsites—online exhibitions or museum initiatives that took the user offsite—had old content, outdated technology, and/or were rarely accessed (our analytics supported this). An analysis of our inventory allowed us to strategically clean up the content and only carry over what would be useful for our visitors.

2. **Website Analytics.** While we collect and study our website data internally, for this large-scale project, we hired a company to do a thorough evaluation of user behaviour for our three museums. This included information such as which electronic devices were used to access our websites, ages of our users, key search terms, top page views, etc. Knowing this information helped us determine how we could improve upon areas that weren't gaining a lot of interest (for example, by placing them in a different location on the new website), and also ensured that content receiving frequent views remained easy to find on the new website.
3. **Information Architecture.** While we weren't rewriting or restructuring content from the former websites, we were changing the new website architecture. While the previous website was very internally-focused, we wanted to ensure that the names used in the new navigation menu and footer were easy-to-understand for the visitor. As our websites are in both official languages (English and French), it's very helpful to design French-first as the words are often longer, taking up more website real estate. This, along with general best practices for usability, and how the menu would appear on other devices were factors in determining how many



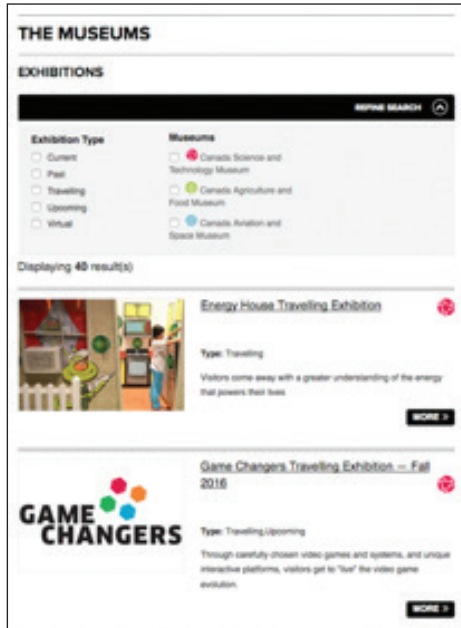
**Fig 5. [top]** Early drawing of the information architecture for the new website based on the sprint of the project. This is showing the menu for the Ingenium website with red dots indicating content that will be live on the new website, and blue dots indicating content that will link back to the former website.  
**[bottom]** Screenshot of navigation menu on live website.

items we showed in the navigation. One of the major challenges with our agile approach was that we had to migrate content over multiple phases and sprints. This meant carefully considering how the menu would change as more and more content was added, including having no dropdowns for the earliest sprint. Fig 5 shows an early drawing (not the final model chosen) of our planning for the menu. Red dots indicated content that would be brought over in the current sprint, and blue dots indicated content that would link back to the former websites. Having both the former and current websites operating simultaneously and forcing users to move between them was not ideal, but was the only solution for a project of this magnitude, budget, and timelines.

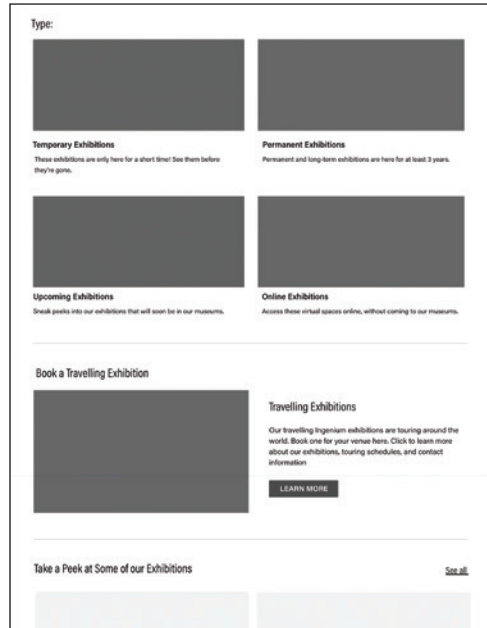
### **Example of Content Restructure: Exhibitions**

While one of our objectives for this project was content migration—not content restructuring— this was unavoidable in instances where we knew content was confusing for the visitor. One such example of this was with our exhibitions page. Whether at the corporate or individual museum level, a visitor was able to refine their exhibition search using a filter box and selecting the types of exhibitions: current, past, travelling, upcoming, or virtual [fig 6].

It was found that these names were very internally-focused, and not clear to an outside user. Thus, it was decided that further user research and testing were needed. Environmental scans were completed for exhibition pages on other museum websites to look for commonalities in naming conventions. Special attention was also given to local museums in the region, as local visitors who attend Ingenium’s museums will most likely attend the others and having consistent naming could aid in understanding. Meetings were set with internal representatives from Ingenium who could speak to the exhibition process and a new naming structure was developed [fig 7]. “Current” exhibitions was divided into “Temporary” and “Permanent” for exhibitions that are only around for a short while and those present for at least three years, respectively. “Upcoming” remained the same, “Virtual” was changed to “Online”, and “Past” was removed as it was found that it was rarely accessed by visitors. “Travelling” exhibitions was the outlier. While all other exhibitions pertained to something you could visit (be it in person or online), travelling exhibitions were about advertising exhibitions that could be booked by a venue. This was pulled out of the filter options, and given its own call-to-action. Each new name was given a short descriptor to help with user comprehension, and while they were



**Fig 6.** Screenshot of Ingenium's former corporate exhibitions page, with filtering.



**Fig 7.** Wireframes showing the new suggested layout and naming for exhibitions.

also given icons, these were removed shortly after as they did nothing to aid the visitor experience. Due to budget and tight timelines, we weren't able to test this new approach with users but have plans to do so in the future. We will continue to monitor the analytics and adapt, as needed.

## Next Steps

The Ingenium website redesign is currently in its final phase of completion. While migration was a major objective of the project, the progress had to halt to invest time in staff consultation sessions and in-depth user research for the restructuring of its Educational Programs. User testing is being conducted on the current redesign of many of the sections and the results of this will determine if more work is needed to achieve a user-friendly website. At the same time, online tools like Hotjar have been implemented to obtain data on how users are engaging with the website, and visitors can provide written feedback using a button on the side of the page. A message bar at the top of our website informs the public that our site is under construction, to maintain open

communication and hopefully alleviate some frustrations [fig 8]. The website will continue to update and evolve by adding stronger visuals, and providing staff with training on Drupal to empower them to upload their own content.



Fig 8. Ingenium homepage.

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# A “SLOW MUSEUM” IN THE DIGITAL AGE?

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## Introduction - the context

Technical Museum of Nikola Tesla was founded in 1954, with the aim to create and present a series of collections, as well as to act as an educational center. Since its foundation, the museum was focused on the public and education, which are also some of the focal points of its mission today.

In 1963, the museum was open to the public on the grounds of the former Zagreb Fair, a complex of modern wooden architecture built in 1949. The complex is now listed as part of the protected cultural heritage.

In 2015, the museum changed its name of “Technical Museum” to “Technical Museum of Nikola Tesla” (TMNT) as a tribute to the great scientist born in Croatia (Smiljan 1856).

The Technical Museum of Nikola Tesla always was, and still is, one of the most popular and most visited museums in Croatia. It is also regarded as the main regional museum of science and technology. In 2017, the museum had more than 170,000 visitors.

In 64 years since its foundation, 55 years since it was opened to the public, there has been so many changes in the world and in Croatia<sup>1</sup>: geo-political

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<sup>1</sup> At the time of the founding of the Museum, Croatia was part of the socialist federal state Yugoslavia and the economy was centrally planned. Since the beginning of the 1990-ies Croatia is an independent state. In the period 1991- 1995 there was Croatian war of independence; after the transition period we got market economy; we passed thru the process of privatization of state-owned enterprises and resources. Since 2013 Croatia is member state of European Union.

and economic, social, cultural, in science and technology, way of living, and also to our museum's identity... But for more than 50 years since its opening, the museum has waited to be modernized.

Restoration of its buildings, which started in 2005, is still ongoing. Also, mainly in the permanent display, many things are like they were in 1960s, 1970s, 1980s. While some of the permanent exhibits were refurbished to have modern themes such as renewable energy resources, storage of nuclear waste, and the Nikola Tesla Lab, most of them reflect museum concepts from 1960s to 1980s. On the other hand, museum programs such as temporary exhibitions, educational and engaging programs, use modern practices.

### **TMNT strategic planning for the 21<sup>st</sup> century – searching for a framework**

Today, the strategic plan of the Technical Museum of Nikola Tesla is to be "*A museum for the 21<sup>st</sup> century*". Supporting this idea is the fact that, in 2017, the museum received EU funding for the feasibility study of a new permanent display in the Museum, and the study is ongoing. To make changes to a part of the museum, we must also consider the whole; and that is another reason to rethink the concept of the museum.

How to change a museum that has parts of its permanent display originating from the 1960s and 1970s, and already has a certain historical and museo-graphic value?

How to find ways to position ourselves in a time when many great museums are being modernized, and new museums are opening, in Croatia and all over the world, while there is great interest of the public towards scientific centers, which are educating and entertaining using state-of-the-art technologies?

How to affirm the existing values of a building, of permanent display and collections, and be a museum of the digital age? How to connect all of that with collecting and collection management? How to redefine collecting policies: affirming what we have and collecting what we should have?

How to offer to our visitors an experience that is scientifically relevant, educational, interesting and fun? How to conceive, in digital age, a new

permanent display advocating for some qualities of pre-digital era, which now are the main features of the museum? (Not willingly but as the consequence of historical and economic circumstances, museum management, collection management etc.)

How to satisfy needs and expectations of visitors in 2020s?

These are all the questions to which this paper does not give an answer nor we have one yet. I will just present ideas that may lead to a framework for the strategic plan for our museum.

First, we have to analyze the museum’s capacities, especially 3 of them:

- Museum staff: 33 full time employees, which is not enough for future development. Employment depends on local authorities but, with a developing project and programs, we can lobby for additional staff.
- Premises: the size and the status of the cultural heritage building limits the modernization and introduction of new departments. Also, the future of collecting depends on storing capacities, which are already unsatisfying.
- Budget: very limiting factor; relevant and sustainable projects will serve as the basis for applying for funding.

The museum’s annual budget is about 1.4 M USD, of which, for all public programs, we get about 110,000 USD; from public funding, with the museum’s revenues included, that makes about 150,000 USD. In the last several years, annual investments for modernizing the museum was about 700,000 USD from public funding.

These are not the basis with which we can compare ourselves with renowned museums, or science centers, in the world or in countries with growing economies.

The Technical Museum Nikola Tesla has an intense program of activities, in accordance with contemporary ideas and practices in museums, but also characteristic of NGO sectors, activist movements, social and art practices. In that field, we do not find ourselves “slow”. Nevertheless, our production budget is not high.

In regards to a new permanent exhibit, there was the possibility to apply for the EU funding and get it. But with our regular budget, there was also the question of how to maintain it? (Especially if we would have to install high-tech equipment). It would have had the potential to increase our attendance. Unfortunately, we are limited in size, space, and also limited to how many visitors we can bring in, as well as their financial possibilities.

Financial issues are important, but they are not the main issue. Our biggest problem is having to bring together the “old school” and the digital age; what we currently have and what we would like to acquire; what our public likes, what they need, what they are asking for (I have experienced it in another science and technology museum), what connects existing values and communication tools in contemporary context. We must find our own way: what would be the best solution for us while keeping in mind all of our competitive advantages, uniqueness, and what we are good at. We have to find a concept that will offer our audiences something particular, inspiring and provoke different experience.

## **Slow movement**

The idea of slow movement seems to be the framework for the strategy that we have been searching for.

All I knew about it was the “*slow food*” concept. It began with Carlo Petrini’s protest against the opening of a McDonald’s restaurant in the center of Rome in 1986. Over time, it developed into a kind of subculture in other areas and, since then, the “*slow*” tag has been applied to cities, fashion, design, media, and even science. The slow movement advocates a cultural shift towards slowing down life’s pace, but in fact it is about seeking to do everything at the right speed. Often, it defines itself as paradigm for sustainability.

But what does the concept of “*slow*” means for a museum, especially a museum in the digital age, and even more to a museum of science and technology? Is it suitable for a museum of science and technology to be slow instead of reflecting fast changes in science and technology, instead of being a platform for promoting new technologies while presenting scientific concepts and our collections?

Personally, it was the first time hearing of the concept of “*slow*” being applied in a museum setting. After researching the concept more in depth,

I found that the term slow was mostly associated in context to museums of arts, and focused on slowing the pace of the duration of visits at the museum; encouraging people to look at art pieces with what is considered to be the appropriate amount of reverence and concentration<sup>2</sup>. The "Slow art" movement and "SlowArt day" are two events that focus on helping more people "discover the joy of looking at art slowly to escape the madness of everyday life". The "Tate Modern in the slow lane", for example, is an event that encourages visitors to stop for 30 minutes in front of each picture<sup>3</sup>. An author of a blog writes: "Slow museum visits should be about encouraging people to come in and enjoy the museum at their own pace, not berating people for not doing it right."<sup>4</sup>

A cynical comment, from a journalist, argues that the reason for keeping visitors longer at the museum would be to make them spend more at gift shop or the café on site<sup>5</sup>.

There are 3 texts that resonate how I feel about the topic, 2 of them originate from the museum community:

The first text is "Too Fast to Go Slow" by Elizabeth Merritt, Founding director of the Center for the Future of Museums, American Alliance of Museums and relates to The Slow Museum Project, 2014<sup>6</sup>: *"Professional literature tells us to maintain visitor interest with rapidly changing exhibitions, media and technology, participatory activities and cafés. But do these solutions create better museums? When museums actively compete with the entertainment*

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<sup>2</sup> The Art of Slowing Down in a Museum by Stephanie Rosenbloom: <https://www.nytimes.com/2014/10/12/travel/the-art-of-slowing-down-in-a-museum.html>

<sup>3</sup> Anita Singh <https://www.telegraph.co.uk/news/2018/07/23/tate-modern-slow-lane-museum-will-encourage-visitors-stop-30/>

<sup>4</sup> <http://acidfreeblog.com/views/slow-museums/>

<sup>5</sup> In text in the Observer, the author writes about different apps and multimedia that "enhance the visitor experience so that people will want to stay longer" (in words of a curator) and pointing that "the longer they can keep visitors, the more likely these people will buy something from the gift shop or eat something from the museum café or restaurant, two of the principal revenue sources".

<sup>6</sup> <https://www.aam-us.org/2014/01/14/too-fast-to-go-slow/>

Among other, she writes how six staff members and four community partners, thanks to the Museum Innovation Lab Grant from MetLife grant, are experimenting with slowness, including visitors and staff. "Together, we hope to determine what a museum would look like if it slowed down its own activities while encouraging profoundly pleasurable experiences and meaningful relationships.... like a) more meaningful visitor experiences and community partnerships and b) increased reflection and evaluation of the museum's work, ultimately resulting in a more sustainable and effective institution."

*industry, do our visitors find time to reflect, innovate and dream? Aren't these activities the ultimate goals of a museum visit? ... We wonder, what would it mean to fully embrace the notion of a museum as a transgressive site of leisure, recreation, reflection and respite from the busyness of life?"...*

The second text is by the Associazione Nazionale Musei Locali e Istituzionali, 2010<sup>7</sup>. The Slow Museum is *"opposing superficial and useless consumption. It encourages scientific rigor and deepening of the contents that only a slow and relaxed visit can provide. It shares the same philosophy as the Slow Food and the same style of behavior, affirms the necessity of education as the best defense against the bad quality of hasty and superficial fruition. Even in museums, slowness can thwart the homogenization and the massification of cultural consumerism, it can be a new interpretative key to satisfy the visitors' hearts and minds."* Briefly, Slow Museum is the key for redefinition of the role of museums itself.

The third text is *"Slow Museums: Back to Basics"* (2012<sup>8</sup>), from the exhibition designer David Whitemyer. He advocates contact with real objects from a Collection because it is what distinguishes museums, and educational institutions, from others in an *"overdigitized"* world. For Whitemyer, museums are spaces of reflection and authenticity. He is critical of displays of techniques *"overloaded with bells, buttons, and blinking screens"*, instead of real artifacts with simple interpretation, because visitors retain more contextual content than factual. So, *"exhibits that provide endless amounts of information aren't very effective"*.

By no means is he suggesting that museums abandon high-tech exhibits and revert to the past. But museums should not and cannot compete with the entertainment industry. Whitemyer concludes: *"In the spirit of the Slow*

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<sup>7</sup> <http://www.anmli.it/news/slow-museum>

<sup>8</sup> David Whitemyer AIA / Fall - 2012: Memory (Volume 15 n3) <https://www.architects.org/architectureboston/articles/%E2%80%9Cslow-museums%E2%80%9D-back-basics>: "Exhibit designers and museum educators are eager to embrace state-of-the-art tools and toys with the hope they'll enrich the museum experience. This trend comes at the cost of losing the reflective spaces and authenticity that, more and more, only museums can provide. Museums are one of the few educational spaces where visitors can come into contact with real objects ... and disconnect from our overdigitized world for an opportunity to simply look and think. Museums are about collections? If so, let us use this opportunity that distinguishes us from all other places of learning and scholarship, research, education, enlightenment, and entertainment."

*Food movement, perhaps there’s a need for “Slow Museums”, where we can periodically step away from the computers and devices that fill our lives and interact directly and thoughtfully with artifacts and ideas... As visitors, we should take advantage of the respite that “old school” museums offer and patronize those institutions.”*

Following those ideas, particularly in the last sentence, we can find a niche for our museum. Of course, we have to change, renovate, interpret and reinterpret, redesign, etc. but valorize and foster what became particular and unique for us.

### **Main slow concepts applicable to museums**

There are no examples or lists of elements specific to a slow museum, as far as I know. But, deriving concepts from different branches of the slow movement, I have made a list of some of the characteristics of slow museums. Many of them are already present at the museum but not labeled as “*slow concepts*”.

Major characteristics of slow concepts can be applied to museum designs, as well as in work and management in general:

- A holistic approach to designing a museum, taking into consideration a wide range of material and social factors, as well as the short and long term impacts.
- Elegance – finding the simplest and most concise solutions that provide the desired results.
- Tailored – creating specific solutions that fit a particular situation and wellbeing.
- Democratic – keeping the process and results accessible on various levels.
- Adaptable – developing solutions that will continue to work over time or that can be modified as needed.
- Durable – making sure solutions can be maintained over time while minimizing the need for repairs and replacement.
- Efficient – minimizing waste of time, labor, energy, and physical resources.

- Distinctive – promoting cultural, social, and environmental uniqueness and diversity.

And:

- The sustainable<sup>9</sup>, eco, green, and ethical.
- Slowness in human relations: reflection and togetherness – visitors and staff.
- Resistance to the homogenization and globalization.
- The alternative to mass-produced.
- Choosing artisan products to support smaller businesses, fair trade (museum shop, café, other...),
- Use of sustainable, ethically-made or recycled materials.
- Choosing quality materials and equipment that will last longer, transcend trends (a “*classic*” style), and be repairable.
- Quality over quantity.
- Enjoyment of local and regional products.
- Slow media.<sup>10</sup>
- Manual techniques and working methods to work slower, manually and in constant dialogue with the physical materials, for example, guided tours instead of audio-guides or similar products.

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<sup>9</sup> reducing harm as much as possible including the precautionary principles

<sup>10</sup> Slow Media is a media consumption movement that opposes the high rate of media production and consumption in the digital age. It advocates for media that is thoroughly researched and widely accessible, not limited by the time necessary to produce or observe the work. Slow media developed in response to complex media formats and instant communication methods characteristic of digital culture, in which “*high volumes of information are updated in real-time and are perpetually at your fingertips.*” (Jolly, 2014). Supporters of slow media criticize the spheres in which media is produced, shared, and consumed as valuing tempo and dramatic presentation over the substance and credibility of a work, in order to draw the attention of consumers.

- Longer processes with more time for research, contemplation, real life impact tests, and fine tuning. Example: Time required by scientific staff to study and publish, and prepare exhibits.<sup>11</sup>
- The slow technology approach aims to emphasize that technology can support reflection rather than efficiency.<sup>12</sup>
- Machines are not always the answer to human problems.
- Meetings, dialog and sharing of knowledge; establishment of a free and democratic platform for knowledge exchange and access.
- Green concept in architecture and management.
- Recycling of people: part time work status for former museum staff or industry workers.
- Diffused university.
- Raising campaigns and advocacy activities.

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<sup>11</sup> The element specific for the slow science movement, which objective is to enable scientists to take the time to think and read. The prevalent culture of science is publish or perish, where scientists are judged to be better if they publish more papers in less time, and only those who do so are able to maintain their careers.

<sup>12</sup> This approach has been discussed through various examples, for example those in interaction design or virtual environments. It is related to other parallel efforts such as those towards reflective design, critical design and critical technical practice.

# GAMIFICATION WITHIN THE FRAMEWORK OF MODERN MUSEUM ENVIRONMENT

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A newly-coined but already quite widely-spread term “gamification” means applying fundamental principles and elements of game design in non-game context. The introduction of this approach allows enriching, for instance, learning process or cultural experience by submerging a recipient in an amicable and exciting game environment, thus facilitating the acquisition of new information.

However, gamification is not necessarily about fun all the time: the implementation of game design principles and high-end technology allows channeling a person’s attention in order to create immersive experiences.

The forms of gamification are quite numerous and diverse: for instance, business training, the usage of various simulators in order to let surgeons, pilots, and drivers acquire necessary skills in digital environments where the consequences of mistakes are not as drastic as in reality.

Digital games have some unique characteristics:

First of all, they are able to let a user experience a so-called “flow”: a mental state which is characterized by an utmost concentration on the activity a person is taking part in and a feeling of elation and happiness.

Secondly, digital games develop complex sets of in-game values that can even evolve into a value system, which is especially obvious in some computer role playing games. This in-game value tends to splash out in real world which results in some digital items being sold and bought for considerable sums of money.

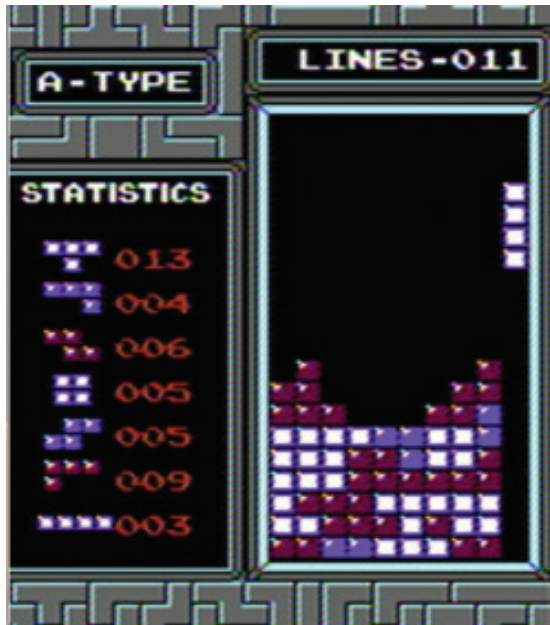
Thirdly, any game takes place within certain spatial-temporal parameters that are called magic circles<sup>1</sup>. A circle is generated when a user voluntarily accepts the rules of the game and abides by them. This agile and flexible state of mind allows a person to accept new information and adapt to new environments more easily.

Games, especially digital games, due to their lush visuals and interactivity, are an endless source of readily available knowledge, which is easily and quickly absorbed by an eager mind (Pic.1, Pic.2).

Modern digital games revel in most advanced technologies, which enable developers to create amazingly believable digital worlds able to represent historically and culturally accurate environments, as well as mythical and archetypal aspects in gameplay.



**Picture 1.** A series of casual games for mobile devices “Cut the Rope” was first created by the Russian company Zeptolab in 2010.



**Picture 2.** The world-famous game “Tetris” was originally designed by the Russian computer engineer Alexey Pajitnov.

<sup>1</sup> The term “magic circle” was coined by a Dutch historian J. Huizinga and is currently widely used in game design.

Besides their ability to boost a user's interest in such fields as history, anthropology, engineering and others, digital games facilitate acquiring new skills in a fun and easy way.

These, and some other traits of digital games, make them an ideal instrument when it comes to conveying complex ideas and concepts such as understanding a foreign culture.

Multimedia environments, engaging human perceptive system to its full extent, have become a real lingua franca of our times, and digital games enhance this excellent communication tool even more, by adding interactivity.

There are quite a lot of successful examples of multimedia integration in museum environments in the Russian Federation, almost all of which are aimed at making a visit to a museum as pleasurable and educational as possible, for a wider audience of all ages.

Nowadays, more and more museums are using multimedia and encourage a usory attitude<sup>2</sup> in visitors. For instance, the Hermitage Museum in St. Petersburg offers virtual tours to visitors who prefer to admire its vast Collection from afar.

In the Jewish Museum & Tolerance Center, in Moscow, 4D cinema and lots of gadgets are available to visitors on site, and are used to create an exciting and vivid insight into the history of the Jewish people (Picture 3).

The Yeltsin Center, in Ekaterinburg, uses digital games to invite visitors to participate in simulating certain aspects of Russia's history; for instance, make a fortune during the post-Perestroika period (1990s) (Picture 4).

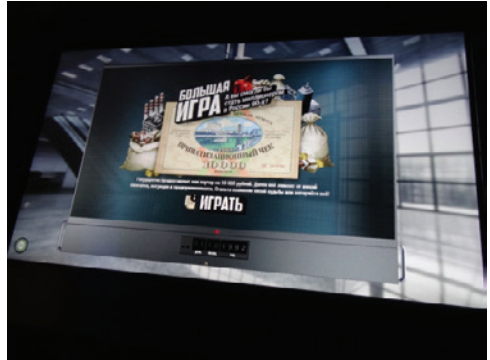
Game design has become an interdisciplinary field of knowledge. By combining applied sciences and various art forms, it is able to provide invaluable tools for enhancing cognitive processes, with the help of highly-sought technologies like virtual and augmented reality and, along with traditional approaches to museology, may achieve excellent results. Virtual reality can not only enrich the gameplay, but is also used to deepen cultural experience; an example of which is The Dali Museum in the USA (Picture 5).

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<sup>2</sup> The term "lusory attitude" is used by game designers K. Salen & E. Zimmerman to describe a player's state of mind necessary to start a game.



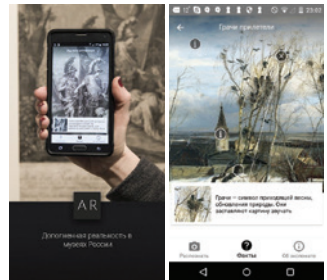
**Picture 3.** The Jewish Museum & Tolerance Center, Moscow



**Picture 4.** Yeltsin Center, Ekaterinburg, Russia



**Picture 5.** Virtual Reality Experience in the Dali Museum, St. Petersburg, USA



**Pictures 6 and 7.** AR platform ARTEFACT is widely used in museums, such as the Hermitage, to allow visitors to learn more about exhibits while using an AR application on their mobile devices

Augmented reality successfully bridges the gap between virtual reality and the real world. The Russian Ministry of Culture has developed an innovative system called “Artefact”. This platform uses augmented reality (AR) and artificial intelligence to generate an image recognition system (IDS) to show the state of an exhibit before and after restoration, and perform other tasks. The AR platform “Artefact” is currently being implemented in a number of Russian museums (Pictures 6 and 7).

In conclusion, it needs to be stressed that, although it is technically possible to introduce material manifestation elements in a game for museums, or various display areas, digital game environments seems to be a much more

viable option when it comes to enriching cross-cultural experience in a most effective and yet enjoyable fashion.

Digital games, in the form of dedicated video games developed to cover a certain field of knowledge, and applications for mobile devices, as well as game-like activities made available to users via web-sites, and other digital resources of museums, might prove extremely useful as an innovative method to bridge cultural gaps.

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# SOUNDS OF CHANGES – A SILENT HERITAGE?

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*“The digital shift has had a significant impact on society, and museums have their own role to play in this process. It has the potential to add considerable value to the work of museums. Through digitisation and new media devices, museums can engage with a wider and more diverse audience on various levels and play an increasingly interactive and educational role within society.”<sup>1</sup>*

The theme of the 46<sup>th</sup> CIMUSET annual conference “*Museums in the digital world*” was perfect to illustrate, with examples of practices, how we deal with this reality. Although one of the claims in the exposition of the theme was that *the digital world will never be able to replace the artefact, the real thing*<sup>2</sup>, the preservation and conservation of heritage, including in museums, cannot and should not be envisioned without its use. Digitisation is a companion to everyday work in museums, and it complements, upgrades and optimises our work processes. However, sometimes it is more than that, it can become the best, or even the only way to preserve heritage. I particularly refer to movable industrial, technical and science heritage, which often poses a special challenge. Preserving it in its original condition is practically impossible, because it is complex – with elements of tangible and intangible heritage and/or movable and unmovable heritage; It is “*big*” – large areas, large objects, a lot of information; It is “*expensive*” to preserve, maintain and run; economically “*attractive*” to different stakeholders; “*unpopular*” – with the public, it is often equated with (legitimately) negative impacts on people and the environment

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<sup>1</sup> The Network of European Museum Organisations (NEMO) is an independent network of national museum organisations representing the museum community of the member states of the Council of Europe. <https://www.ne-mo.org/our-topics/museums-in-a-digital-world/nc/1.html> (last visited 25th March 2019)

<sup>2</sup> <https://cimuset.ingeniumcanada.org/theme/> (last visited 25th March 2019)

(smelly, loud, dirty, dangerous,...). These and a number of other factors are the reasons behind losing invaluable heritage. Digitisation can and could be one of the answers how to insure we keep it for future generations, and recording sounds can be one step down this line.



**Photo 1** - The launch station from the 1930s was part of the closed torpedo factory in Rijeka, Croatia. It is a testimony of the technical knowledge and an important landmark of the industrial heritage at a global level. But what can be done to preserve it? (Photo Irena Marušić)

## Why Sound?

Why not? Sound is part of our lives, because we do not really know what true silence is like. It is omnipresent, whether we are aware of it or not. This is the reason why it is such an important element in studying, understanding, interpreting, learning and experiencing cultural heritage. Sound tells us about history, culture, a way of life; it evokes memories and it is emotionally charged. It is an important source of information, because it complements and improves knowledge of an individual object and rounds off the insight into a given period.

It plays an important role in the integrated conservation of heritage, since it is an inseparable part of many museum artefacts. Also, or especially, the objects from the fields of industrial and science heritage. This information was long neglected in nearly all aspects of museum work: from collecting, preserving, documenting, studying and interpreting. With the exception of exhibitions, where sound has been used as an interpretative tool since around the end of the 20th century. This can be ascribed to several subjective and objective reasons. On one hand, lack of awareness that sound is an inalienable part of heritage, as well as a source and carrier of information, and the unavailability of appropriate technology on the other.

Sound has been recorded and reproduced for a good hundred years, but these were just the beginnings. Recording as a means to preserve and reproduce sound has been a larger-scale and systematic practice since about the mid-20th century.

The reason why in the field of heritage sound lagged behind other material and immaterial forms of conservation (artefacts, photography, written sources...) could well be its omnipresence; despite being constantly surrounded by sound, we often overlook it (or in this case, 'we do not hear it' would be a more appropriate expression), or we are not aware of it at all.

The next reason is technology. Problems arise both in recording as well as subsequent reproduction, and consequently the conservation of audio material. In the past, the technology was not available, while recently it has been subject to (too) rapid development. This does allow for a huge quantity to be collected, but gets complicated when it comes to long-term storage of this data.

The earliest known sound recording dates back to 1860, and it was made by Frenchman Edouard Leon Scott de Martinville. His invention, the phonautograph, created visual images of sound waves. The recording was of such poor quality that it wasn't until 2008 when a team of scientists, with the help of modern technology, managed to decipher it and convert it to a playable digital audio file; it turned out to be the recording of the French folk song *Au Clair de la Lune*<sup>3</sup>. At the same time, this is the earliest

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<sup>3</sup> Audio and the deciphered phonautograph recording are available on the link below:  
<https://www.youtube.com/watch?v=dRXayuBa7ZI>

known recording of human speech, which adds to its value. From then on, development was ever faster. Starting with Edison's phonograph in 1877, through gramophones, the introduction of radio broadcasting in the 20<sup>th</sup> century, to tape recorders, cassette players and compact discs. However, a genuine revolution and unimagined development has been brought about by the use of computer technology and the switchover from analogue to digital sound recording.

The development of technology and its widespread and everyday use results in an increasing number of sound recordings. If there is a shortage of the sounds preserved from the earlier period, today we are confronted with opposite phenomenon – a flood of recordings.

Many sounds of the past are lost forever. We do not know what the world used to sound like. Did the people in the past hear the same sounds as we do today? How did nature, a city or a rural area sound? For the moment, we can only make educated guesses. Individual sounds can be reconstructed by employing similar work processes, tools, machinery, etc. (a blacksmith's workshop, a joiner's workshop, weaving...). However, soundscapes are a different story; based on limited information, they are difficult and often impossible to reconstruct.

When studying literature on the history of sounds, I came across extremely interesting work by R.M. Schafer, *The New Soundscape*, which despite being published back in 1969, gives a somewhat different view of music and sound, and provides an original and simultaneously simple option how to, at least in part, reconstruct sounds of the past<sup>4</sup>. An experiment was conducted with the help of the students. Each student was asked to take a literary or art work from different historical periods and make a list of all the sounds or potential sounds in it. The sounds heard were then divided into three categories: natural sounds, human sounds and the sounds of tools and technology. Despite a small sample, the results were surprising. This is definitely an interesting, useful and to some extent also objective way of reconstructing the sonic past, which could be used to good effect also by museums.

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<sup>4</sup> R. Murray Schafer, *The New Soundscape, A handbook for the Modern Music Teacher*, Ontario 1969  
[http://monoskop.org/images/0/03/Schafer\\_R\\_Murray\\_The\\_New\\_Soundscape\\_A\\_Handbook\\_for\\_the\\_Modern\\_Music\\_Teacher.pdf](http://monoskop.org/images/0/03/Schafer_R_Murray_The_New_Soundscape_A_Handbook_for_the_Modern_Music_Teacher.pdf)

## Heavy Metal in Museums?

By arriving into a museum, an object is stripped of its true identity and becomes a part of museum reality. The more information we manage to collect and record, the closer we get to what it was in its original environment. Otherwise, we might be left with practically “*dead*” objects, which can be, exaggeratedly, nothing but a pile of scrap iron (literally ‘heavy metal’), deprived of their identity, their life story, their “*soul*”.

Therefore, we should not forget sound when collecting information about an object. Modern technology allows us to record this segment of heritage. It goes without saying that curators cannot replace experts in this field, but we can at least acquire basic, documentary data (which we take as self-evident in photography and photographs). No matter how bad a recording is, it might be worth a fortune one day. More data and more information provide grounds for a better quality, comprehensive, diverse and credible museum interpretation. This also applies to (or, better yet, especially) the objects of technical and industrial heritage, where “*voice*” is an important element in understanding their operation, original environment, their impact on humans and nature, etc.

The presence of sound in various departments of the museum work brings a number of benefits, it is an important source of information, and can help us answer many questions. Did our ancestors work in louder or more silent work environments? Were the machinery and devices in the past louder or more silent compared to modern days? When does sound become noise? What effect did sound have on people in different work environments? How has the soundscape in factories changed over the last century?

## Sounds in Museum

- Allows better understanding of the past and comparison between the past and the present.
- Provides a more comprehensive information on the museum objects and collections (sound as an important source of information).
- By way of recorded sound, the museum objects “come to life” without being touched or operational; their voice enables a more comprehensive understanding.

- In demonstrating the usefulness of an object, it allows its longer-term preservation (reduced possibility of damage and defects).
- Provides many possibilities for interactions on the exhibitions, for different target groups.
- Gives interdisciplinary dimension to museums.
- Allows multisensorial perception.
- Increases accessibility and the harmonisation of interests of different target groups.

Of course, the use of sound in museums comes with some pitfalls and problems. One of the problems is the rapidly changing technology and related costs, and in particular security and long-term storage of data. Furthermore, visitors might find sound disturbing, which calls for careful judgement and a consideration of its effects.

### **Sound in the European Projects**

Sounds of Changes is the continuation of the project “*Work with Sounds*”, a cooperation between six European museums<sup>5</sup>. The project records and preserves the sounds of industrial and civil society. In our collection, you will find everything from the clunking of machines from the industrial revolution, to the sound of modern town-life in city squares. Our goal is to spread knowledge about these sounds and their context, and also to encourage the use of them in contemporary projects, such as theatre, music and exhibitions.

During both projects, all participating partners recorded about 1,200 isolated sounds and soundscapes, while our end goal was 1,400. All of the sounds were uploaded on the website [www.soundsofchanges.eu](http://www.soundsofchanges.eu)<sup>6</sup>, where they are freely available to anyone and for any purpose, be it as originals or processed.

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<sup>5</sup> Coordinator is Flygvapenmuseum (SE), other partners are Arbetets Museum (SE), LWL-Industriemuseum (DE), Museum of Municipal Engineering in Krakow (PL), Tehniški muzej Slovenije (SI), Työväen museoyhdistys ry (FI).

<sup>6</sup> [www.soundsofchanges.eu](http://www.soundsofchanges.eu) (last visited on 27th March 2019)

## Sounds Recorded

During the preparations for both projects, we came to an agreement that each museum decided for itself what sounds would be recorded. There were several general criteria, but they all revolved around work in the broadest sense of the word. Since the term “*work*” is very broad, we gave priority to the sounds that are still part of our everyday life but are rapidly disappearing, and those that can still be reconstructed in a museum environment. Strictly technical issues also had to be considered (suitability of available recording equipment, accessibility of machinery and devices, external influences, etc.). The choice was also dictated by the missions of the participating museums: some of us mainly recorded the sounds of the past, while others the sounds of the present; we tried to illustrate some national specificities, but also what we had in common and what connected us. We tried to capture those work environments, which are specific to our territory, or are becoming a real rarity in this world of globalisation. We are proud to have managed to record all of the important steel production stages of the company Metal Ravne, the sounds in Trbovlje – Hrastnik Mine, which has been in the process of closing, and we also recorded the last operating mine in the country, the Velenje lignite mine.



**Photo 2** - The mine is in the process of closing, and we managed to capture individual sounds by the skin of our teeth. The ore hasn't been excavated for years, but the remediation and closure works are still underway, and they “produce” interesting sounds. Currently, the only operating mine in Slovenia is in Velenje. (Photo Irena Marušič)



**Photo 3** - Field recording, Ošlak homestead in Skomarje near Zreče, June 2014 (Photo Irena Marušič)



**Photo 4** - Recording at Slovenia partisan printing shop, Vojsko, October 2014 (Photo Irena Marušič)

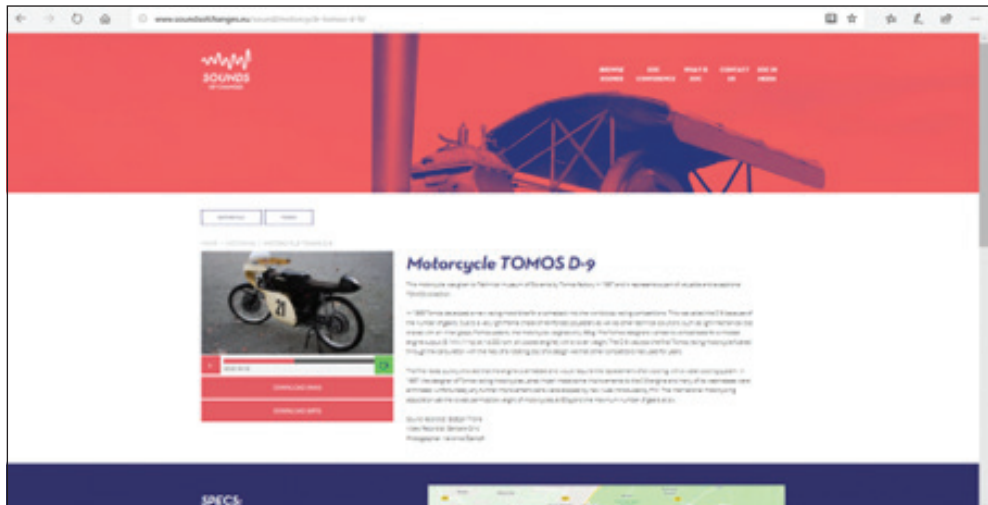


**Photo 5** - Sound recording can often be a feast for the eyes, not just the ears; welding process in the company Metal Ravne, November 2014 (Photo: Veronika Štampfl)

## Recording Process

Each museum had a team that participated in the realisation of the project. A special challenge was sound recording and processing, because museum staff had to be trained for that. Other than sound, we recorded a short video, took pictures and collected information for textual description. At this point, I would like to commend the members of the recording crew for their commitment and willingness to discover new and completely unknown territories, and record with a lot of good will at very diverse locations: a production plant, a museum environment, or even underground.

We were aware that the quality of our recordings often did not meet professional standards, because we did not have the appropriate equipment, knowledge and experience. But they were good enough for use and further processing. During the project, it turned out that experience made a big difference, hence the recordings were of an even better quality.



**Picture 6** - The sound of TOMOS racing motorbike on the website [www.soundsofchanges.eu](http://www.soundsofchanges.eu)  
(Photo: Printscreen)

## Useful Value of Recorded Sounds

We wanted the recordings to be useful for as wide range of users as possible: museums (and others involved in cultural heritage), schools and faculties, as well as computer game programmers, musicians, producers and everybody else who “*works with sounds.*” To facilitate the users’ access, the recordings were promptly uploaded on the project’s website<sup>7</sup>, as well as on Europeana and Wikicommons. You can also follow us on Facebook<sup>8</sup>. So far, we have been very pleased with the outcome: we received positive responses, offers for collaboration, as well as suggestions as to what else to record from a number of countries all over the world and from various users (museums, media schools, musicians, theatre people, teachers, etc.).

<sup>7</sup> <http://www.soundsofchanges.eu/> (last visited on 25th March 2019)

<sup>8</sup> <https://www.facebook.com/workwithsounds>

## What Does a User Get?

All recordings, as with other information, bear the authenticity stamp guaranteeing a user that the sounds are authentic, not fake or artificially generated. What is also special about this project is that all recordings are freely accessible (must be properly credited) to commercial and non-commercial users. Their utility is left to the imagination of the users, be it in their original form, modified, or processed.

## What Is Left After the Project?

The project partners are left with a lot of experience and knowledge acquired during all this time. We also have the recording equipment that will definitely allow us to continue recording in the future and expand the database of recordings. Of course, the project's greatest value is a freely accessible collection of sounds available to a wide variety of users worldwide.

## Jerk, Fool and Rabbit on a motorbike?<sup>9</sup>

Using of the sounds in practice can be illustrated by *Let the work be heard* project, implemented by the Technical Museum of Slovenia in 2015. We wanted to use some sounds, recorded as part of the project, at our permanent exhibitions, and provide our visitors of various target groups a somewhat different experience of individual exhibits. We integrated the object, its sound and story into a whole so that a visitor would learn something new in an interesting and exciting way.

We were quite lucky in the selection of the objects, because many tools, devices and machines have Slovenian the standard language and/or dialects with very surprising and unusual names. Hence, our visitors are invited to find and get to know a madman, a jerk, fairy-tale cars, a rabbit on a motorbike, a dragon, a fool, a foxtail, a little flying boat and even a lion roaring in the Slovenian forests.

The results of the collaboration among the students of the Faculty of Architecture, illustrators and the museum staff were nine interactive stations, which complement the permanent exhibitions. Each tells its own story, while their consistent concept and design round them off into a single project.

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<sup>9</sup> <https://www.tms.si/en/e-books/>



**Picture 7** - Interactive station *A fool doesn't thresh over old straw* (Photo: Irena Marušič)

## To conclude

Sound is not a novelty or a craze in museums, there are many examples of good practices and initiatives. However, it has to become part of our everyday practice. Museums have to move faster and do more in the field of sound preservation, thereby contributing to a more comprehensive conservation, presentation and interpretation of heritage. Sound is important and needs to be included in all segments of the museum work. Let us not forget that *“the voice of the object”* is universal, it does not need any translation or explanation. What we miss, though, is a more systematic approach and standardisation of the museum work in this field.

# AR TECHNOLOGY APPLICATION IN SCIENCE AND TECHNOLOGY MUSEUM

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## **Abstract:**

This paper first introduces what is AR and why we use AR in a science and technology museum, then takes “Roaming in a Science and Technology Museum” of the China Science and Technology Museum as an example, focuses on how the exhibition hall of “Science Paradise” uses AR technology to encourage high participation, interaction and sharing. Finally, this paper analyzes several application scenarios of AR technology in a science and technology museum, such as AR museum guiding, virtual instructor, exhibits full-on display, interactives of exhibits, AR virtual game, AR culture and creative products, and so on.

## **Key words:**

AR Technology, Science and Technology Museum, Roaming in a Science and Technology Museum

Nowadays, we all live in a digital world whether we would like it or not. Museums need to maximize the advantages of technology and bring more and more convenient services to their visitors. The development of digital technology provides a convenient way for deep integration of museums with the public. For example: AR technology has realized the superposition of reality and virtual reality, and vast information of what is real is not completely abandoned, but is properly used and guided. This is greatest advantage of AR technology in daily application in science and technology museums.

## 1. What is AR.

AR stands for Augmented Reality. Some of its definitions on Wikipedia are:

- An interactive experience of a real-world environment
- Seamlessly interwoven with the physical world
- Immersive aspect of the real environment

The biggest difference between AR and VR is that AR alters one's ongoing perception of a real world environment but VR completely replaces the user's real world environment with a simulated one.

## 2. Why use AR in a science and technology museum

(1) AR is based on real exhibits

Science and technology museums emphasize interaction and participation. AR is the combination of reality and virtual scenes, which provides a deeper look and feel for the visitors, the visitors and exhibits are not separated, but integrated.

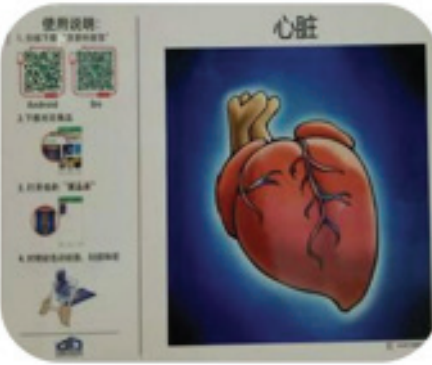
(2) Devices are easier to acquire

AR equipment is based on cameras and on the basis of camera images (real scene), it combines with the virtual image to display and interact. Strictly speaking, devices equipped with a camera can be used for AR, as long as the AR software be installed on the devices (iPad, smart phones, and so on).

## 3. The case of the China Science and Technology Museum

In order to supply users with more convenient and richer services, the China Science and Technology Museum developed an App named "*Roaming in the Science and Technology Museum*". This App includes AR exhibits corresponding to the real exhibits in the "Science Paradise" hall of the China Science and Technology Museum.

Visitors need to download the App first in order to use it. There are two ways that they can use to find the link to download the App:



Next to exhibits, visitors can find the corresponding QR code, scan it and download the App.



From the website of [www.cdstm.cn](http://www.cdstm.cn), visitors will find a specific page for the App.

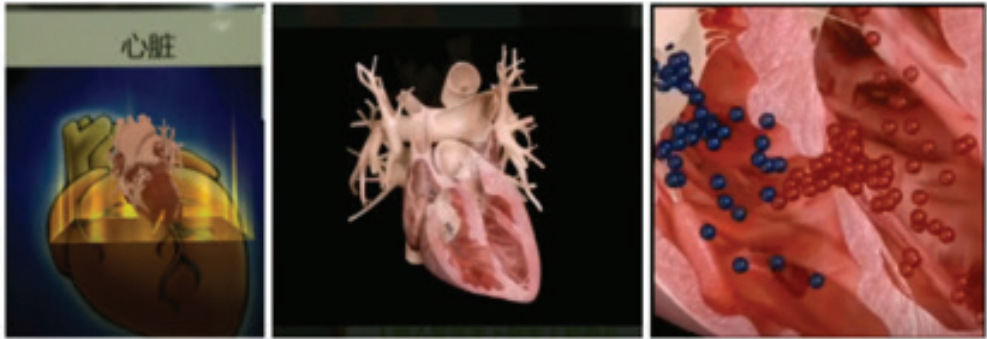
Here is a case of how visitors use this App during visiting.

This real exhibit named Heart in the “*Science Paradise*” exhibition hall.

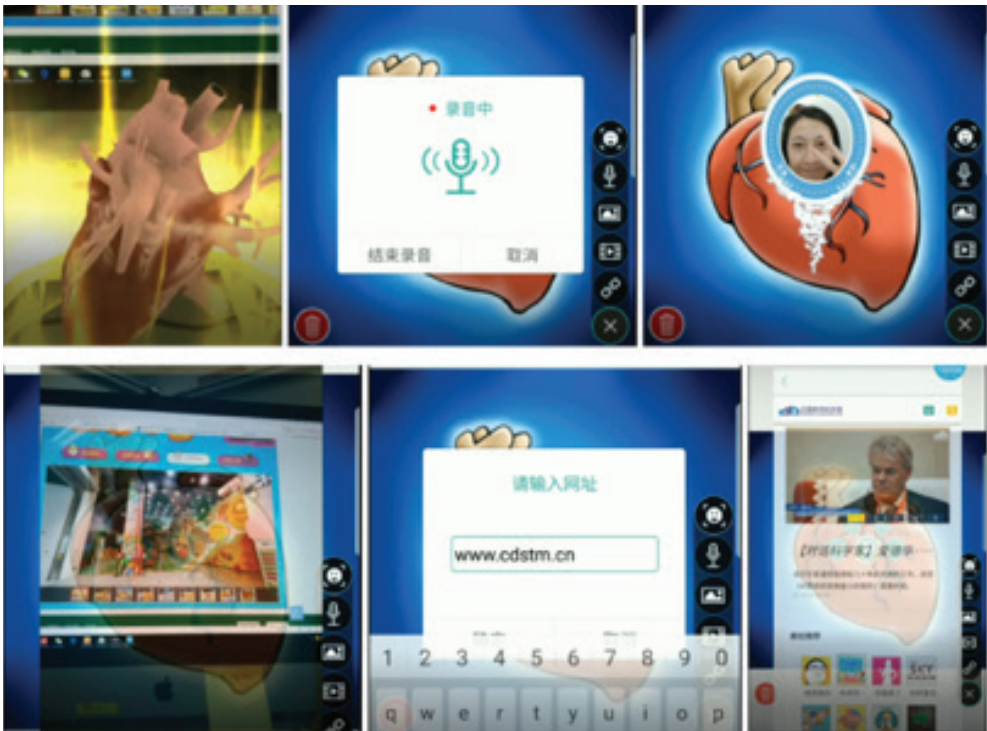
Visitors can use their smart phone to scan the QR code placed near the pieces of the exhibit and then they will be able to watch a VR video which will help them get detailed information of the exhibit.



27 exhibits from the “*Science Paradise*” exhibition hall were selected to be part of this App for the first phase of development. Those exhibits mainly focused on human bodies and animals.



Users can also see the VR exhibits when they are not in our museum.

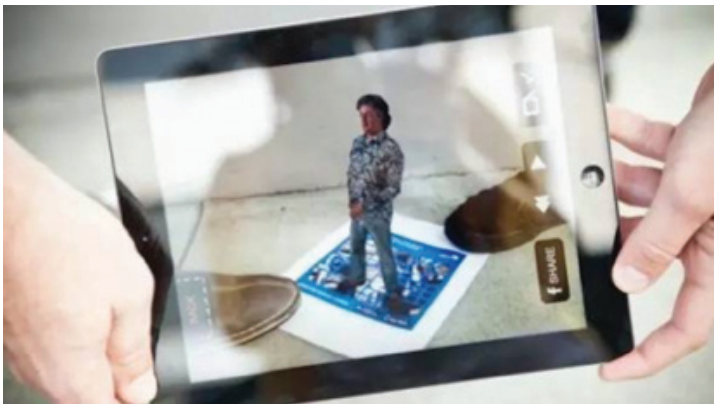


Users can use their smart phone to download the App “Roaming in the Science and Technology Museum”. Then they can watch the VR videos at anytime and anywhere; they can also add video, audio, pictures, web links and other tags depending on their needs, and play back at any time.

#### 4. Future applications of AR technology



**AR Museum Guiding:**  
AR technology is used to provide visitors with an overall overview of the exhibition hall and indoor positioning, and display virtual paths and directions for visitors according to their needs.



**Virtual Instructor:**  
Museum is rich of content, involving history, nature, science and technology, and many other fields. It is difficult for the visitors to fully understand within limited words and pictures. Virtual instructors can provide a full range of interpretation services to the public by AR technology, combined with animations, videos and other demonstration means.



**Full-on display of Exhibits:** Museums, especially history and art museums, often have exhibits with traces of time on them. Even if they are painstakingly restored using "original photographs" and painted by computers. With AR technology, we can compensate for those defects.



Interactive operation of exhibits: Using AR, virtual exhibit components with complex structures and systems can be decomposed and reassembled to let visitors understand their internal structure and operation mechanism.



AR virtual game: Museums can use AR technology to create applications or interactive events to attract more visitors. Such AR games will undoubtedly attract more young visitors than before while passively receiving information from the exhibition.



Full-on display of Exhibits: Museums, especially history and art museums, often have exhibits with traces of time on them. Even if they are painstakingly restored using “original photographs” and painted by computers. With AR technology, we can compensate for those defects.

# **DIGITIZATION AND SHARING OF THE COLLECTION - CRACOW SALTWORKS MUSEUM IN WIELICZKA**

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Our society is often referred to as the visual society in contemporary literature because the visual form of communication is present and even predominates in all aspects of human life, influencing also the way we perceive the surrounding world. Visuality means visual reception of messages that are meant to simply and precisely explain human reality. When images are used to convey messages, multiple analyses and interpretations of reality or of the addressed topic can be made. Multi-sensory experience, or appealing to multiple senses of people, represents an advantage of visuality as a method for explaining the world.

The growing importance of messages communicated by images results from rapidly developing new technologies, such as innovative 3D scanning methods, new programs designed to read documents, or the progressing digitization techniques and the popularization of access to them over the Internet. The possibilities of image use offered by technology support the concept claiming that culture manifests itself through symbols. In this concept, cultural processes are approached and understood in their visual aspect, and this may represent an effective way to explain the conceptual world of people. Intertextuality of the culture of images thus enables the recipient to reach the semantic layers of the interpreted topic one by one, and this type of reception is very important in the context of museum operation.

A multi-faceted interpretation of culture through visuality represents a great challenge to cultural institutions despite growingly accessible technological facilities. The principal objective of a museum consists in collecting and conserving objects, and making them available for public viewing. In the museum discourse, visuality is a type of communication and the image itself represents a tool useful in interpretation. The context of an image must

be considered as an important factor. The method of communication is enormously important for a museum due to heterogeneity in the group of recipients, i.e. varying knowledge, perception capabilities, etc. For this reason, the meaning of image should be strengthened using additional components that will lead to a clear and comprehensive interpretation of the illustrated topic.

Examples of cultural institutions that achieve notable success in the world of multimedia and new technologies can be found especially in art museums. The Dutch Rijksmuseum represents an interesting example as a leader in creative thinking. Notable museum pieces includes high-resolution photographs of collected works, made available free of charge. There is a growing number of attractive programs and applications designed to display images of art works. Museums of science and technology also use the virtual world with increasing success, though their position is more difficult and more demanding due to the type of their collections.

Museums of science and technology often collect objects without artistic values and with functions or purposes incomprehensible for a common visitor. It is not enough to display an object at a museum to attract potential tourists and popularize knowledge. The nature of technical collections poses a problem to their curators: how to show, in an interesting way, the important role played by historical and technical objects in the past. The museums cannot only display their objects but also show their purposes or illustrate their functioning. Museums of technology use various methods to show the wealth of their historical objects and their roles. Various forms of communication, attractive for the visitor, are used to show physical or chemical processes, or functions of individual devices such as videos, high-resolution photographs, multimedia presentations, or reconstructions stimulating multiple senses. Science and technology museums have the great possibility of showing to young generations the importance of our industrial heritage through visual tools. However, the visitors will see and experience the final effect of popularization of the collection without being aware of the complex nature of the project implementation process.

Digitization of the collection of a museum is a fundamental phase aimed to create digital resources suitable for making the collection available to the largest possible segment of society. Only when such a base is built, alternative forms of use of the collection can be sought. It is important

to note that the entire process of digitizing documents of collections is regulated by the law<sup>1</sup>. The law also provides the definition of a museum that clearly identifies the tasks of this type of institutions<sup>2</sup>. A purposeful process of collection digitization depends on careful preparations of personnel, equipment and frequently on additional expenditures.

The digitization process and its complexity are determined by the nature of collection amassed by a specific institution. The Cracow Saltworks Museum in Wieliczka houses both works of art, ethnographic, historical, archaeological, cartographic objects, and (principally) objects used in historical mining. Due to the heterogeneous nature of the collection, the rate of digitization process significantly varies. The discussed example of Cracow Saltworks Museum illustrates the variety of digitization tasks completed to attractively popularize the museum collection and their main objective: participation in the *Małopolska's Virtual Museums* project.

The Cracow Saltworks Museum in Wieliczka hosts two exhibitions: the first is exhibited in the Saltworks Castle and the other in the salt mine. The historical technical objects are exhibited in the underground salt mine chambers, at stable humidity and temperature but also in an environment characterized by high salinity. Due to conservation considerations, the conditions of storage of the objects should not be changed for a longer period. Thus, the process of digitization requires long-term planning, to complete it *in situ*. Digitization is carried out underground, due to the special micro-climate, the material used to produce or create some historical objects, and their dimensions. For example: hoisting equipment, such as the horse mills with sizes that prevent any attempt at transport, or salt sculptures that must be stored at stable humidity and temperature due to their material. Those objects could not be removed from the mine. Therefore, digitization equipment resistant to the high content of salt in the air must be brought to the mine and a lighting system must be installed. The Museum has been forced to hire an external organization that possesses a full set of devices necessary to complete the process and is capable of

<sup>1</sup> <https://nimoz.pl/?gsearch=digitalizacja>

<sup>2</sup> D. Folga-Januszewska: *A museum is a permanent non-profit institution serving society and its development, available to the public, conducting research on evidence of human activity and the environment of man, amassing a collection, conserving and preserving the same, exhibiting and making available the collection, providing the public with education and entertainment*

meeting all those requirements. Special care for people who stay in the mine must also be organized and the space for the digitization process must be marked and protected against unauthorized access. Each project of this type entails additional costs that must be considered by a cultural institution. The example of Cracow Saltworks Museum in Wieliczka shows that introduction of a mining and technology collection to the public-friendly visual world is practical but with a complex process.

The Małopolska's Virtual Museums project, with the participation of the Cracow Saltworks Museum, was one of the first initiatives aimed to make accessible various collections of Polish museums on the Internet. The initiative also included the establishment of the Regional Digitization Centre at the Małopolska Institute of Culture in Kraków, assigned to conduct the digitization process of cultural heritage. The project was implemented using funds provided by the Małopolska regional government and an amount co-financed by the European Union budget to buy the necessary equipment, software and employ the required experts. 35 museums from the Małopolska region took part in the project. The appointed Council of Experts selected, phase by phase, exhibits to be digitized as 2D and 3D models and then made available in the Internet space. More than 1,000 objects were digitized as part of the project, and eventually were available with in-depth interpretations prepared by experts in texts, graphics and audio formats.



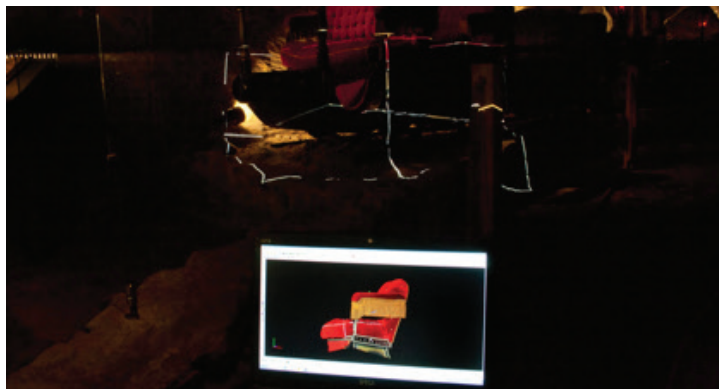
A salt sculpture of St. Barbara by J. Markowski, in the Russeger II Chamber, 19<sup>th</sup> c. (190 cm height)

The Cracow Saltworks Museum indicated 30 historical objects that illustrated the exceptional nature of the mining collection and the role played by the salt mine in the past. The set includes exhibits that cannot be viewed on temporary exhibitions in other museums due to their dimensions and materials. Huge hoisting machines, such as the 17th-century Polish horse mill, with a height that actually reached up to 16 metres, or the historical tourist train dating back to the 19th century attract a lot of interest. Due to the conservator's recommendations, the salt sculptures of miner patron saints cannot be transported out of the mine but their images can be viewed on the website of the *Małopolska's Virtual Museums* project.



A horse mill (called the “Polish mill” with a horizontal shaft, the oldest and the largest winding gear in the museum collection, 17<sup>th</sup> c.

The actions taken by the Museum explore only one of numerous possibilities that contemporary technologies offer cultural institutions. Participation in the project represented a valuable experience for the Cracow Saltworks Museum, enabling it to popularize knowledge of our industrial heritage. High-resolution images of objects that can be viewed at home, texts with curious details of



Narrow-gauge horse railway for the guests visiting mine, 19th c. (the process of digitalization)

their history provide an opportunity for showing a larger audience the wealth and roles of exhibits collected by the mining museum. The *Małopolska's Virtual Museums* project may be described as an alternative form of sightseeing, making the displayed exhibits available to people who cannot go to Wieliczka and other locations due to various reasons. Importantly, the possibilities offered by new technologies facilitate purposeful documentation of diversified museum collections and preservation of information about those collections for future generation.

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<http://muzea.malopolska.pl>

<http://muzeum.wieliczka.pl/zwiedzanie/kopalnia/wirtualne-zwiedzanie/>

Photo by Artur Grzybowski and Ludiwk Kostuś, Cracow Saltworks Museum in Wieliczka

# **DIGITIZATION OF MUSEUM COLLECTIONS AND ARCHIVE FONDS OF THE SLOVAK MUSEUM OF NATURE PROTECTION AND SPELEOLOGY**

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## **Abstract**

The Slovak Museum of Nature Protection and Speleology in Liptovský Mikuláš realized a process of digitization of the museum collection and archive fonds in two projects financially supported by the European Union. The former was coordinated by the Ministry of Culture of the Slovak Republic and the latter by the Ministry of Environment of the Slovak Republic. In both projects, the main goal was the protection of the collection and the usage of digital recordings in museum activities. While most of the first project was explicitly external (outsourced), some of the data from the second project was created with in-house scans or photographs, apart from those outsourced. The goal of the project was the protection of the museum's collection and archived fonds, making them partially available to the public as well as being accessible for publishing, presentation activities, or study purposes. Some of the 3D scans there were digitized geological artefacts (1,603 pieces), zoological artefacts (222 pieces), botanical artefacts (100 pieces), palaeontological artefacts (1,870 pieces), archaeological artefacts (47 pieces), technical artefacts (100 pieces), and history-artistic artefacts (6 pieces). Some of the 2D scans there were digitized technical documents (1,000 pieces), culture-historical documents (1,046 pieces), artistic documents (2,898 pieces), archaeological documents (149 pieces), botanical documents (506 pieces), and museum archive fonds: personalities (64,223 pieces), institutions and associations (255,532 pieces), the state list of particularly protected parts of nature and landscape (98,364 pieces), underground karst phenomena (108,304 pieces), and collections of photo-documentation (62,994 pieces).

Key words: digitization, museum collections, archive funds, Slovak Museum of Nature Protection and Speleology

The Slovak Museum of Nature Protection and Speleology is an all-Slovak specialized museum focused on nature protection: protected areas include caves and protected species, as well the history of nature, and the protection of the territory of Slovakia, from the Austro-Hungarian period through the First Czechoslovak Republic to the present. The museum manages 118,175 artefacts, and 260 m of archived fonds and archived documents. The goal of digitizing the collection and the museum fonds was mainly to protect the documents by limiting or even excluding manipulating them. Digitizing archived documents was possible thanks to the financial support of the European Union and co-financed by the Ministry of Environment of the Slovak Republic. The project of digitizing archived documents (fonds and collections) was realized from 2008 to 2014 with a total cost of 538,119.90 €. In the museum archive are fonds of associations, institutions, organisations, personalities working in nature protection and speleology, as well as a collection of underground karst phenomena, a collection of the state list of particularly protected parts of nature and landscapes, a collection of maps, events, inventory research, expositions, chronicles, log books with comments from people that have visited national caves, articles, and proceedings. There were a total of 633,853 digitized items with 592,232 of those items digitized by outsourcing (Tab. 1).

| Type of the Archive documents | Name of Archive Fonds / collections                                                                          | Number of documents, scans of lists |
|-------------------------------|--------------------------------------------------------------------------------------------------------------|-------------------------------------|
| Archive fond                  | Fond of Associations, Institutions, and Organisations                                                        | 255,532                             |
|                               | Fond of Personalities                                                                                        | 64,223                              |
| Archive Collection            | Collection of Underground Karst Phenomena                                                                    | 108,304                             |
|                               | Collection of the State list of protected areas                                                              | 98,364                              |
|                               | Collection of Maps                                                                                           | 5,726                               |
|                               | Collection of Events, Inventory Research, Expeditions, Chronicles and Visitor Books, Articles in Proceedings | 101,853                             |
| 4 collection, 2 fonds         |                                                                                                              | 633,853                             |

Tab.1. Results of digitization of archives fonds and collections

For the sustainability of the project, the digitizing of the other archived fonds that was realized were self-funded. As an example, we can mention some documents from the first declarations of protected areas and protected species at the territory of Slovakia such as the “Degree of the Hungarian Royal Minister of the Tillage” (no. 127 663 1. B), from 1913 that was sent to

the Hungarian Royal Forest Management in Banská Bystrica; the declaration of today's National Nature Reserve Dobročský prales Primeval Forest, the first area protected by a legislative norm in Slovakia during the Austro-Hungarian period. The preservation of the "Ordinance of the Minister of the Czechoslovak Republic" from 1923 (Fig.1), giving full authority to the Slovak administration to protect natural monuments. The "Ordinance of the Ministry of Culture of the Czechoslovak Republic" (no. 47837/26) from 1927, regarding the protection of edelweiss, intended for the county and the district offices in Slovakia.

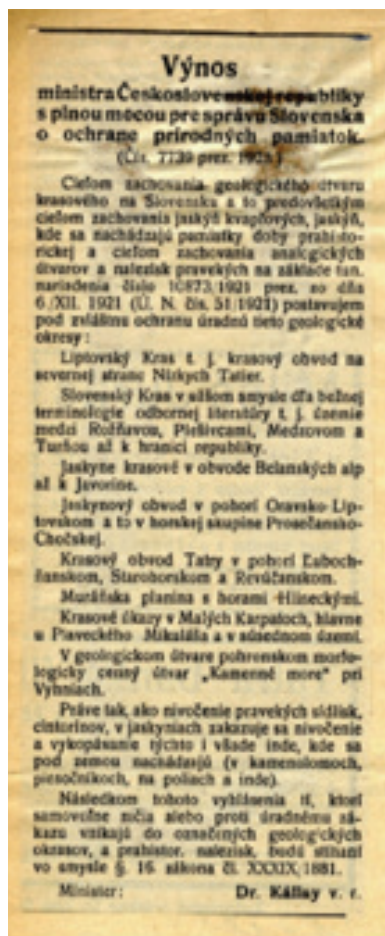


Fig. 1 Ordinance of the Minister of the Czechoslovak Republic with full power for Slovak administration and protection of natural monuments

From these documents, it is clear that the first protection efforts already originated from the Austro-Hungarian period, and became stronger after establishing the First Czechoslovak Republic as an independent state of Czechs and Slovaks.

Digitized documents were made public on the web site of the specialized museum archive (<http://archiv.smopaj.sk/>). Digitizing the collection of the museum was realized by the national project Digital Museum, supported by the European Union and co-financed by the Ministry of Culture of the Slovak Republic. For this purpose, a new department was built: the Digitizing Centre in Banská Bystrica that provided support to 40 Slovak museums. During the project, nearly 200,000 artifact objects in 2D and 3D were digitized. More than 20 different scanning methods were used to create detailed visualisation aiming at catching the unique visual attributes of each object. Currently, there are about 2.7 Pb (Petabytes) of data stored at the Central Data Archive (CDA). For this project, the museum was involved with 9,494 artifact items.

The museum fonds were divided into the geological collection, the palaeontological collection, the zoological collection, the botanical collection, the archaeological collection, the historical collection, the speleological collection, and the art collection.

From natural history sciences, there were a total of 4,301 digitized artefacts from which 506 in 2D (herbarium items) and 3,795 in 3D (geology, paleontology, zoology, botany, including a collection of Lichens and Bryophytes).

As an example of digitized unique collections we can mention the first collection of the museum: a group of stalactites from the Demänová cave system; the longest in Slovakia (evidence no. 1). (Fig. 2).



Fig. 2 The first collection of the Museum — a group of stalactites from the Demänová cave system, the longest one in Slovakia

We can also mention as examples: 4 out of 6 meteorites that were found in Slovakia such as iron meteorite Lenártov found in 1814 (evidence no. 14889), the stone chondrite meteorite Divina found in 1837 (evidence no. 14378), the iron meteorite Oravská Magura found in 1840 (evidence no. P14311), and the stone meteorite Košice found in 2010 (evidence no. 15229).

After digitizing the palaeontological collection, some artefacts were used to prepare the digital section of the exhibit on completed classic presentation of original objects. Through such presentation, it was possible to observe, for example, skull details from the cranium of *Crocutea crocuta spelaea*, a young cave hyena found in the Jasovská jaskyňa Cave. (Fig. 3)

Examples of digitized botany items are: *Viola alpina*, the Chočské vrchy Mts. locality (evidence no. 6650), or *Salix reticulata*, the Červené vrchy Mts. locality (evidence no. 11092) from Václav Vraný's herbarium. This herbarium was part of the Liptov collection from 1904 that became the reason to establish the museum in Liptovský Mikuláš in 1930, under the name Slovak Karst Museum, a predecessor of the Slovak Museum of Nature Protection and Speleology.

Examples of digitized archaeological objects are: a cult mask from Majda-Hrašková jaskyňa Cave made from a facial part of a human skull (evidence no. 223), and an oriental dagger from the Jasovská jaskyňa Cave (evidence no. 323). From the historical and technical collections, there are interesting cave maps and plans, among which, a map of the Dobšinská ľadová jaskyňa Ice Cave from 1870 (evidence no. 09644), a postcard from 1897 (evidence no. 1548), as well as a postcard from 1918 (evidence no. 6494) documenting summer figure skating events in this cave (Fig. 4) belongs to the oldest fond in the museum's collection.

A Slovak figure skater, Karol Divín, the champion of Europe in 1958, 1959, and a holder of the silver medal from the Winter Olympic Games in 1960, trained in the Dobšinská ľadová jaskyňa Ice Cave as well. He was a trainer in Finland and Canada where he also co-trained an excellent Canadian figure skater: Brian Orser, a world champion.



Fig. 3 A cranium of a young individual of a cave hyena found in the Jasovská jaskyňa Cave



Fig. 4 A postcard from 1918 documenting the summer figure skating in the Dobšinská ľadová jaskyňa Ice Cave



Fig 5 A glass plates negative – sinter decoration in the Fialový dóm Dome in the Demänovská jaskyňa slobody Cave



Fig 6 An oil lamp used in lightning of the caves till the beginning of the 20<sup>th</sup> century

In the visitors' logbook of the Dobšinská ľadová jaskyňa Ice Cave, we can also find an autograph of Ferdinand Coburg, a Bulgarian Czar (August 28, 1872) who was, according to history: as writer, a botanist, an ornithologist, and a philatelist. A historically interesting collection is one of glass plate negatives, from around 1930, that were fully digitized for a total number of 5,218 items. We can also mention the sinter decoration in the Fialový dóm Dome in the Demänovská jaskyňa slobody Cave as another example (evidence no. 17337). (Fig. 5)

Among interesting digitized technical objects, we can also appraise a historically known oil lamp used as a source of lighting of caves up to the beginning of the 20<sup>th</sup> century (evidence no. 8943). (Fig. 6)

Digitized objects of artistic work, siderographs for example, or oil paintings, belong to art objects.

Data of digital objects are accessible to the public in the national database Slovakiana (<http://www.slovakiana.sk/web/>).

Besides protecting the collection and the archive documents, digitization has other purposes as well. It is possibility to publish in high quality, as well as create virtual exhibitions, or exhibitions comprised entirely of digital pictures. Digitizing artefacts and archive documents has undoubtedly great utility in museums and archives in regards to protecting as well as accessibility of use. However, it should never suppress the purpose of a museum: provide direct contact with artefacts.

# RETHINKING THE ROLE OF THE SCIENCE MUSEUM: THE COLLECTIVE PROCESS OF REMAKING THE DANISH NATIONAL MUSEUM OF SCIENCE & TECHNOLOGY

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This paper will present experiences from the process of rethinking the Danish National Museum of Science and Technology. It is a process where we completely rethink the role of a science museum in contemporary and future society. The starting point is with citizens, communities, and current topics. This change of focus is part of the work being done to develop and build a new building for the museum on a new site in the greater Copenhagen area, which will open within the coming years. This paper will focus on how we are working on rethinking the museum and its role in our society by asking the question: what visions for the future can be explored in the matrix of museums, citizens, and society in the digital era?

The paper is structured around some of the key areas we are working on at the moment. Naturally, there are still many uncertainties, so the paper will not cover every aspect of the new museum. We do not have all of the answers yet, which is part of the process we are pursuing along with various stakeholders through development work.

## **The museum**

The Danish National Museum of Science and Technology (DTM) was founded in 1911 by Danish Industry and the Craftsman Association of Copenhagen. It was part of an international wave of establishments of science and technology museums to show the progress of the industry, science, and technology. The roots of the museums can be found in the great exhibitions of the 19<sup>th</sup> century; this is also the case for the DTM.

The museum possesses several important collections that are older than the museum itself. These are objects from the University of Copenhagen and the

Danish Technological University, as well as objects from influential Danish scientists, researchers, inventors, entrepreneurs, industrialists, and others. The museum has collected objects relating to the industrial and technological development of Denmark. Some of the highlights in the collection are the Hammel Car from 1888, which is the first car in Denmark and the world's oldest functioning car; the airplane of Ellehammer, who was one of the first to fly in Europe in 1906; the original LEGO from 1958, and the unique collection of Malling-Hansen's writing balls. Additionally, the museum has a unique collection of prototypes from the Danish Patent Agency, as well as several other important Danish inventions, such as the arc converter, the telegraphone, and the loudspeaker. Just this year, the museum acquired the space capsule that brought the first Dane into space in 2015.

The museum used to be among the most attractive museums in Denmark, but has been neglected in recent years. In 2015/16, new management reached the decision that a turnaround was necessary, and developing a new museum became their primary focus. The current museum is located in old industrial buildings from the 1960s in the outskirts of a medium sized Danish city. The new management decided to shift focus from developing the current museum in order to develop a new museum on a new site that is more accessible to people. Presently, the current museum functions as a studio for experiments with new formats and narratives.

A new vision for the museum was approved in 2016. It would create insight, excitement, debates about science and technology, and inspire creativity and innovation. This is the foundation of which our work with the new museum rests on. The new museum project is called DTM 4.0. This name is very significant: it is the 4<sup>th</sup> time that the museum will be relocating, and it also reflects that we are in the 4<sup>th</sup> industrial revolution at the moment.

### **Being relevant for diverse citizens**

Around 65,000 citizens visit the museum per year. The ambition is to create a museum that is relevant to a lot more citizens of Denmark and foreigners visiting each year. Relocating the museum is part of the solution to reach this goal; a complete rethinking of the museum is also necessary to attract new visitors. The majority of the visitors of the museum today are families, either parents visiting with their children, or grandparents visiting with their grandchildren. Another large group of visitors is composed of citizens, mostly men, with a

high level of knowledge about the Collection of the museum. We still want to be relevant to these groups, but we need to develop new formats to be relevant to even more diverse groups of people. This includes a shift in how we work at the museum and how we develop exhibitions, activities, events, etc.

We decided to always take the present as the starting point while considering current topics and challenges. The past and the Collection are used to give us perspectives, inspiration, and insight into the topics that we choose to work with. History and knowledge can only remain important if we are able to make them relevant to people. This requires inclusion of everyone going to the museum regardless of age, educational background, ethnicity, spirituality, gender, sexual orientation, personal interests, lifestyles, or political views.

Co-creation and partnerships are essential to build bridges between the museum and the Danish population, many of whom do not find us relevant today. We are collaborating with a lot of different stakeholders and we are establishing new partnerships with institutions and organizations that can help us along the journey. We cannot, and we will not, develop a new museum by ourselves. Relationships with the general population and communities are essential to develop the new museum. It is the only way forward in order to develop a new social, economic, environmental, and culturally sustainable museum.

The current museum will close within the coming years, when the collection has to be moved to the new site. We are developing new digital platforms and tools in order to be able to continue to reach out to new venues without a physical museum.

## **National and international benchmark**

As part of the work involving the new museum, we wanted to gain a greater understanding about how we, as a national museum of science and technology, position ourselves within Denmark and among other similar museums in other countries. We carried out a national and international benchmark analysis to obtain knowledge about what others were doing and how we should brand the new museum in order to be unique, compared to similar institutions, primarily in Denmark.

The national analysis showed that, even though there are several museums in Denmark dealing with the industrial and technological development of Denmark, we are the only one that has a Collection that can be used to show the

development from an agricultural country to a high-tech society. There are other museums of science and technology, but they are only dealing with certain historical aspects. There is a potential, which has not been unfolded in recent years at the museum, and that is why it has a weak position in the knowledge and cultural environment in Denmark. The Collection of the museum is amazing and has tremendous potential to serve as the foundation of new exhibitions.

The international analysis primarily covered museums in Europe, though we are also looking at museums outside Europe for inspiration as well. The analysis is based on visits and interviews with people from the management levels of the institutions. There are various museums of science and technology across Europe, and most of them are among the most visited institutions in their respective countries. This may be because they appeal to people of all ages, though it seems like the primary target group of most of those museums is children. There has been a fusion of science museums and science centres in recent years. Science museums have strategically established science centres to attract more visitors. Some science museums are challenged by rapidly changing societies. Museums of science and technology no longer have the monopoly of dealing with science and technology. Art museums are dealing with digital and tech art, and cultural history museums are also incorporating these topics in their exhibitions.

The role of museums is changing due to changes in society. As noted earlier, we are in the 4<sup>th</sup> industrial revolution at the moment. This affects how we live, work, and communicate at every levels of our lives. Museums need to reflect and deal with topics that are relevant today, such as the UN development goals. The digital world affects both humans and museums on a great scale. Collections are being digitalized. Museums are becoming digital institutions that need to engage people both in the physical museum and on digital platforms.

### **Engaging citizens with the museum**

We are very inspired by the new approach to scientific communication, which is being developed primarily in the UK at the moment. Science capital is a concept that can help us understand the impact of STEM-activities on citizens. It's a concept that can be used as a tool to qualify the impact of the museum and its role in the society. Science capital provides knowledge on why certain groups of citizens are interested in science and why certain people do not see science as "something for me". It is the role of the museum,

as a fundamental democratic institution in our societies, to create equal opportunities for everyone, and to engage all kinds of demographics in our topics. This is part of the trend where museums take on new responsibilities, and reflects universal goals, such as social justice.

In order to be a strong voice and agent in society, museums need to change and not the public. Organizational transformation is vital for taking on these new roles. The museum is a social learning space, which should create platforms that can support knowledge, culture, and science, producing processes of the public, many of whom use the museum on site or online.

### **Core narratives**

The aim of the project is not only to develop a new museum and rethink the role of the museum, but it is to rewrite the history of Denmark. There are three major narratives about the history of Denmark. First, the narrative of how agriculture saved Denmark economically in the late 19<sup>th</sup> Century after a series of disasters. This narrative of Denmark, as an agricultural country, is still very strong today. Later came the narrative of the labour movement that made the social changes that laid the foundation for the Danish society of today. The last narrative is how the women's movement, in post-war period, made the cultural changes that are still reflected in the Danish society today. Little attention has been given to the history of the Danish industry and technological advances. The new museum wants to challenge how we understand the history of Denmark.

We are looking into how the museum can become a driver for the development of a new Danish history. It is a history about innovation, entrepreneurship, creativity, making, technology, and science. And it is a history that is not only national, but global. The success of the Danish society is based on long traditions of interactions with people, communities, and nations all around the world. We are establishing partnerships with major universities in Denmark to generate new theories about how Denmark changed from a primary agricultural country to a modern high-tech nation, which produced new innovative solutions to counteract the effects of climate and environmental crises.

We are not in a position, at the moment, to come up with the themes for the new exhibitions and activities in the new museum. We are running an inclusive collective process to define what the focus of the programmes in the new museum should be. We do that in order to reflect the needs, skills, interests,

and concerns of people today, in addition to the challenges that modern society has created.

## **Studio 4.0**

As part of the work to develop the new museum, we have created an experimental frame for projects that will generate knowledge and experiences, which will qualify the process of rethinking the new museum. It is called Studio 4.0. All projects that will be part of DTM 4.0 will be developed within this frame. We are running a few projects at the moment within this frame, but more are in the pipeline.

The patent project is a new digital platform that reveals the stories hidden among the collection of prototypes, from the Danish Patent Agency, which are part of the museum's collection. It is a project where we offer new perspectives on the history of Danish innovation and ingenuity. We are not just looking at the prototypes, but also at the people behind the inventions. Who were they? What inspired them? What are the drivers for success or failure in the innovative processes? It will be an open platform, where members of the public can co-create knowledge about the prototypes and the people behind in collaboration with the museum.

Another project will be launched in 2020. That year Denmark is celebrating the 200<sup>th</sup> anniversary of the discovery of electromagnetism. It was discovered in 1820 by the Danish scientist H.C. Oersted. Electromagnetism is the foundation of our modern digital societies. The celebrations will take place in various ways. The museum will experiment with new formats and try to connect with people in new ways while engaging them with Oersted outside the traditional museum spaces. This will include pop-up exhibitions, activities, programmes, festivals, and more.

## **Concluding remarks**

The new museum will open within the next five to seven years, so there is a long road ahead with plenty of opportunities to gain new experiences and insight with modern science, technology, and communication in museum settings. We invite all who wish to embark on this journey to participate by contacting the museum. It is an open process where the direction of the project will be determined by the input we get from people who are interested in creating a new national museum of science and technology in Denmark.

# GREEN MAKEOVER: LIVING AND PRACTICING GREEN CHANGE AMONG THE CITIZENS OF AARHUS

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CIMUSET OTTAWA, OCTOBER 2018

## Introduction

How do the citizens of Denmark's second largest town, Aarhus, practice and live with the green change that has been introduced by the Danish Government and the Municipality of Aarhus? What determine their behaviors and practices concerning heating, use of electrical appliances, washing and showering, eating habits, methods of transportation, sorting and recycling of garbage? How are new habits created and can we observe variations that encourage some people to be greener than others?

I will tell you about my latest research project of 2018, involving 33 in-depth interviews of different families, living within the municipality of Aarhus, regarding their daily habits and practices. Each interview lasted 1-3 hours, were semi structured with an open interview guide, tape-recorded and transcribed. Some interviews were conducted with only the matriarch of the family; some with the patriarch with the wife present in the background, and some with both partners. Participants were chosen according to age and living area; some families lived in semi-detached houses, others in terraced houses, and some were living in flats. Two of the interviews were performed with families living in semi-detached houses from small villages in the countryside. Participants decided themselves how many people from their household should be present at the interview. Three younger female students decided to be together in one flat for the interview during which, for more than 3 hours, I tried to comprehend each of their daily practices. My transcription of the recordings was also a bit complicated. The weakness of qualitative interviews is that they cannot be used statistically, but we have good statistics for the usage and consumption of energy in Denmark. I will also use statistic data of eating and commuting habits. The purpose of the in-depth interviews

was to better understand what people do, why they behave a certain way and how they change their behavior. I am in the process of writing my report to the Ministry of Culture, a partial sponsor of the project. This paper would give me the opportunity to summarize my work.

Due to the serious problems of climate change caused by CO<sub>2</sub> emissions, sustainability and green movement are buzzwords for present development, not only in Denmark, but also internationally. In 2014 the Danish Government launched a new strategy “A sustainable Denmark – development in balance”. Nowadays, words like “carbon footprints” and “CO<sub>2</sub> emissions” should be familiar to children, as well as adults, and found through different media. The Danish Museum of Energy is one of the places where visitors can learn about sustainability and the green movement.

The green movement is far reaching. From changes in technologies of energy production using fossil fuels such as coal, oil, and natural gas, into renewable energy production using wind, water, biofuel, and solar energy, to changes in habits and behaviors such as spending less energy for heating and electric appliances, insulating your house, change windows and doors, taking shorter showers, eating locally grown food and avoiding meat from ruminants such as cows and sheep, eating chicken and mussels, and more vegetables, using electric vehicles or bicycles, avoid long flights, and recycle a lot of commodities such as clothes and furniture, as well as sorting your garbage in a way that hard plastic, metal, paper and glass can be reused, and potatoes peels and coffee grounds and other organic items can be used as compost or biomass for biogas.

### **Theoretical background**

The theoretical background for the project is the British sociologist Elisabeth Shove's concept of social practice as developed in her book “The dynamics of Social Practice. Everyday life and how it changes” (Shove, Pantzar and Watson 2012). She builds on the use of social practices from several different researchers to reach a better understanding of everyday life and changes occurring in daily life. Focusing on climate change, the largest challenge of present day is the need for us to change our behaviors and lifestyles. The political message to the households is to change habits of commodities, save energy, leave the car at home and use a bicycle, eat less meat, save water and recycle. This is hard work because people do not just change behavior

overnight; competencies, motivation, and maybe new technologies are needed. What is practice? For Reckwitz, “it is a routinized type of behavior”. Practices are patterns that consist of interdependencies of bodily activities, forms of mental activities, things and their use, background knowledge, know-how, states of emotions and motivational knowledge. Shore takes the concept and asks the question of how do practices exist and die? What are the elements of which practices are made? How do practices recruit followers? How do bundles and complexes of practices form, persist and disappear? How are elements, practices and links between them generated, renewed and reproduced? Shove sums up that the elements are **1) Materials** (including technologies, tangible physical entities and the stuff of which objects are made of); **2) Competencies** – which encompasses skills, know-how and techniques; **3) Meanings** – in which we include symbolic meanings, ideas and aspirations.

Practices emerge, persist, shift and disappear when connections between elements of these three type are made, sustained or broken. How does an individual change practices? How are practices spread? They are spread through social networks and communities. Individuals engage in many practices and consequently belong to multiple communities and networks at once. It could be from certain age groups like teenagers or students, or societies of sustainability. Social inequality and different systems of classes and power can contribute to the preservation of certain practices that are reproduced through the individual lives of a society. **THOSE WHO HAVE THE MEANS TO ENGAGE IN VALUED SOCIAL PRACTICES ARE IN a special privileged position in that it is they who contribute to the direction in which such practices develop (example: buying an electric vehicle).** The ones that lack the means to become carriers of a new practice become socially excluded from effectively participating in society.

To understand how learning is transferred from parents to children, I will use Bourdieu’s concept of habitus.

## The Municipality of Aarhus and the green movement

The Municipality of Aarhus is the second largest in Denmark with around 336.000 inhabitants. In 2008, City Council decided that the Municipality of Aarhus should be CO<sub>2</sub> neutral by 2030. Soon after, they stated analyzing and planning green strategies, starting in the areas where City Council would have the most efficient results.

City Council has decided to take up the battle. Consumption of energy in Aarhus must go down and has to be free of fossil fuels. Aarhus wants to achieve the vision of being CO<sub>2</sub> neutral by 2030 and, at the same time, be at the forefront of climate changes so that a higher level of water in the bay of Aarhus and extreme rain does not threaten our town (climate plan 2010-2015). City Council could influence about 25 % of the CO<sub>2</sub> outlet, while the rest was up to citizens and business communities. 5 main areas of influence were:

- 1) Energy supply – make it fossil free
- 2) Buildings and housing should be energy optimized
- 3) Transport made more energy efficient
- 4) New intelligent systems of energy should be developed
- 5) Climate adaptation with innovative solutions and new technology developed by business in Aarhus, with possible export of the technology.

In term of energy supply, it was planned that the large central power plant would be transformed to use biofuel and wooden pellets. And In autumn 2016, the power plant started working with wooden pellets, and at the same time, a new central heating plant (also using biomass) started producing heat and electricity. The Studstrup power plant produces electricity for the communities along with wind turbines, and solar panels to generate heat for 95 % of all people of the municipality. This reduced the emissions of CO<sub>2</sub> per inhabitant from 7.5 tonnes to 5 tonnes.

In regards to energy optimization of buildings, the municipality started to renovate its own buildings (cultural centers, swimming facilities, skate halls, music houses, schools, senior homes, etc.) and went on with housing projects. Several homeowners were offered help to insulate their houses and were given the possibility to download an app that could be used to track the amount of heat, electricity, and water used during the day.

The municipality also took the initiative to produce resources, for school children and young people, which could also be used in high schools and ordinary schools. In the summer of 2017, the front of the harbor hosted a Climate Planet composed of a huge Globe, with a smaller globe inside, transmitting live pictures from all over the world talking about climate change, a film about climate change, and what we can do to turn things around.

In terms of transportation, City Council wanted to emphasize cycling and improve the pathways for the cyclists. In some areas, people could borrow

a free electric bicycle to be motivated to stop using their car. Sharing a car was also a possibility, and was made an option for people living in houses or flats with large parking areas. Electric vehicles were also bought by the Municipality for employees in the health department. In 2017, a new light rail system, run by electricity, opened one route for the commuters of Aarhus. In 2019, 4 electric busses will be in use.

In 2016, a new system of sorting household garbage was introduced to the citizens of the municipality to recycle huge amounts of garbage that are produced daily. Since 2017, every home has received two containers to sort household garbage (waste to be burned, glass, hard plastic, metal and paper). It is expected that the CO<sub>2</sub> emissions will be reduced by 7,000 tonnes every year.

It is obvious that the Municipality has taken many initiatives to fulfill the green objectives. Most of the changes have been within the technological and/or resource sectors where new technologies have been made available to people. But individuals might lack the competencies and meaning of the projects. Within the program promoting recycling of garbage only, huge amounts of money have been spent to inform everyone about the new system. My analysis shows that it is also with the habit of recycling that most communities are very active and have changed their practices. Despite very small kitchens and a lack of space in the older apartments in Aarhus, people do their best. By offering electric vehicles and electric bicycles to some of their employees, the Municipality hopes to create a spilling effect on the other inhabitants; many communal businesses have also chosen to offer green meals for lunch to inspire people to change their eating habits.

A special secretariat, named “the climate secretariat”, has been set up to coordinate and facilitate the plans of the municipality regarding a green change. They act as agents of change, helping local initiatives carry out their goals to help fight climate change, as well as the objectives of the Municipality.

### **Improving the house – from my interviewees**

With the oil-crisis of the 1970's came a long list of demands from the government for savings and changes to the energy supply and production. Initially, the Ministry of Commerce surveyed communities to find savings that could make Denmark less dependent of oil for heating systems and electricity

production. In 1976, the Agency of Energy was established; over time, it became the current Ministry of Energy. Energy savings in buildings for businesses, industries and housing; the heating system in Denmark especially needed a lot of energy and, in this area, huge energy savings could be made. The buildings needed insulation in walls, roofs, floors, windows and doors. Now, 40 years have passed since these initiatives were started and, in general, the use of energy for heating has been stabilized and is even going down slowly. The demands of insulation and improvements to their heating systems have been followed by most Danes. 15 of my interviewees lived in their own or a rented semidetached house, 6 lived in terraced houses, and 12 lived in flats either owned by themselves or rented. A common theme for those living in their own house was that they had all somehow improved their building with insulation, changed windows and doors, and set in new kitchens and bathrooms:

*“We enlarged the house as child number 4 was expected ... and we had a new roof and isolation of the roof and walls. That was the first thing we did. We have changed the windows several times, these are the third ones. We have been very aware that the heat did not fade out of the walls, roof, and windows. There was no thermos glass when we bought it in 1971 and the house was built in 1937. There was no insulation only these old newspapers from 1937 so we very quickly put up some insulation of rock wool – we did not want to lose our heat.” (Woman 71)*

Most private initiatives were done to save money by conserving heat in the household. Almost all the houses in my research had district heating coming from the central power plants. Only two interviewees lived outside of the district heating and had to use a central oil burner to heat the building. Later, one of them started using geothermal power while switched to heat exchangers that required electricity to function.

Some of the interviewees living in cooperative housing had to wait for everybody to agree to improve the building, and only when the Municipal community of Aarhus offered to help. Others, however, did the insulation of their own house. Interviewees living in rented flats had some problems since not all landlords had insulated their buildings. In old housing areas of Aarhus, there are still houses with no heat in bathrooms and kitchens. But some housing communities have renovated their buildings with insulation and new windows which improved their heating systems.

We can conclude that some interviewees have had the money and the possibilities to improve their houses while others, especially in the older rented flats, had to wait for the landlords to do something.

Regarding heating of the houses, it seems that experiences and learning from your childhood stays with you. One interviewee told about her partner:

*“He can turn on the heat full power and then open windows and doors. But this is something you learn as a child – I can still hear my father – shut the door not to let the heat out and do not use too much water... It is deeply rooted in me from childhood”.... The partner answers: But I was brought up in Ireland where we had open fires for heating, so to have some heat into other rooms, you would open the doors to get some heat in there; and if it was too warm, you would just open the windows. You could control the heat in an open fire the same way you would with a radiator. Then, you never learnt to turn down the heat when you needed to air (ventilate) the room.” (Woman 57)*

Some of the interviewees, used to colder housing as a child, seemed to accept that the temperature was a bit colder, compared to someone that had always experienced a nice room warmed with district heating. *“We had stoves in the room and not all rooms were heated, and we used to wear warm sweaters and woolen socks to keep warm.”*

Likewise, young people moving from a newer detached house with heating underfloor, used to be barefooted as a teenager, were feeling cold when moved into older flats from 1920's, in the center of Aarhus. A 25-year-old student talks about his flat from 1920's:

*“I bought an electric heater last winter, as it got really cold and the radiators (with district heating) could not at all heat up my flat. I and the guy living upstairs were cold. We had an old system in the basement, in the other end of the building, where the hot water entered. They were looking at it trying to improve it. The heater that I bought was expensive. I use it when it is cold, as I cannot sit down and work or watch TV when it is cold – it is not cozy. The floor is very cold, there is no insulation, and my front door is not airtight; there is a wind coming in all year round, and in the kitchen, there is no heating at all. I would like to walk bare feet all year around, but I can only do that during the summer. I grew up in a house with underfloor heating”.*

Most interviewees told me that on cold days, they would put on an extra sweater and woolen socks, or pick up a blanket for cover when watching television. With the exception of a few, the men from Ireland, and a few students, agreed that they had learned from their parents the habit of turning down the heat when airing the rooms. *“It is in my backbone”*.

When I asked the question of if some had downloaded an app to follow their daily spending of heat, people answered no: “I do not need an extra app... the meter is just here I can look at it every time I pass by. Most interviewees check their consumption of heat once a year when the bill arrives. Only 4 interviewees had the habit of reading monthly consumptions of heat and keeping track of it in a booklet or on an excel spreadsheet of their computer. These were all people with a mechanical or engineering background. Very few related the problems of climate change to their heating systems or the idea of using less heat. They all wanted a comfortable warm dwelling and were not ready to turn down their radiator.

### **Consumption of electricity**

After the oil crisis of the 1970's great efforts were made to teach the Danes to save energy for heating as well as for electric appliances in their home. There were campaigns to remind everyone to switch off lamps, fill up the washing machines, use flat pans with electric stoves, take short showers etc. Energy saving lamps and lightbulbs were developed but today they have been largely replaced by LED lamps, which use far less electricity. Electrical appliances such as fridges, freezers, washing machines, and others, were also changed for low energy consumption appliances. As the Danes realized that, with low energy consumption appliances, they could save money on their electricity bills, they chose to change their fridge as the old one required to be replaced. Appliances were labelled according to their efficiency: A++ was the very best, and it became common standard in the EU. Even though Danes got more and more computer hardware and electrical appliances in their home, their consumption of electricity did not grow very much. Since 2005, while personal spending rose, the use of electricity as stayed more or less unchanged. New technologies made it possible for Danes to consume less electricity.

*“The first year we lived here was in 2010 and we were using 3.109 kWh per year; now we are using 2.450 kWh per year, even though we changed the fridge and the hood (above the stove in the kitchen), and all the lamps are now LED. Only two halogen lamps are left and when they are done, we will replace them with LED lamps.”*

Saving electricity is also deeply rooted in most Danes:

*“We have habits that makes us save energy. We switch off lights when we leave a room. This is something we are brought up to do. We switch off the television when we are not watching. With my oven, I think about not to switch it on if it is not necessary, and when it is hot, I plan to cook or bake something in it as well” (Woman 54)*

A younger interviewee, actually from an immigrant family, said:

*“We always had to switch off the lights in my home when I was a child. We could be sitting in one end of the house while at the other end lights were on in three rooms, we were told (3 sisters) to go switch them off.”*

Earlier, fridges and freezers were among the most energy consuming appliances of a house, but today entertainment takes the lead with 38 percent. In 2018, televisions, computers, iPad, surround sound systems and mobile phones; in addition to that, routers, printers and other stuff that needs to run. iPad and phones require daily charging – though not consuming a lot of electricity, there could easily be 5 phones and 3 iPad to charge in a home every day. And every time they are used for downloads, social media, emails and messages, a long series of routers and servers around the world are spending even more electricity. The big computer games spend the most with up to 1.400 kWh a year. Way more than what a low energy consumption fridge needs for one year, which is around 350 kWh.

Most of my interviewees had at least two televisions, with one of the two often used for games. Only a few of the interviewees had chosen to not use a television, and only listened to the radio, or used their laptops. Most parents had fixed a length of time for how long their children could use computers – but it became a problem with teenagers – as it became difficult to determine if the computer was used for school work or not. Most parents are having a hard time teaching their children to switch off lights and computers when it is not in use.

Mother of a 15 years-old boy:

*“Well my son can leave his room with everything switched on. He does not think about the consumption of electricity. I must then talk to him about it. Sometimes, when I enter his room, it is very warm with all the machines switched on”*

Some of the young people moving from their home do not remember the good practices and habits about saving energy in their new student home. If you are a gamer, that activity takes a good deal of electricity.

*“Yes, I have a fridge, a stove and a dishwasher, and in the living room, there is a TV and a huge computer with two screens and surround sound. I am a gamer, so I need all of those things to play my PlayStation, and a surround sound for hearing; but after my boyfriend came, I started switching everything off. Earlier, everything was on. After he lifted his finger, I switched off the computer and PlayStation in such a way that they are on standby. I use a lot of things, but I also need light and heat for my fish. I do switch off the lights when I leave a room.” (Student 24)*

Most interviewees said that their computers and TVs were set on standby. Very few were switching off light switches on the wall. It seemed that many did not know that modern TVs and computers could be completely turned off without losing their settings. In this case, we have a technology but lack the knowledge about what to do and why to change a practice.

All of my interviewees had a computer and access to the internet. Like most Danes, many used social media, downloaded movies and music. It is true, for most of the younger generation, that they have no subscriptions for television. They download movies from Netflix, Via Play and other platforms. Television is watched on the phone or iPad. This means that they follow big national and international news on social media.

Facebook is the preferred app among the Danes in general. An analysis in 2017 showed that 80% of all Danes are on Facebook; You Tube ranked second. 52% of all Danes regularly check Facebook and would not miss Mobile Pay. So much information in Denmark for most people is digital.

## **Washing Machines and dryers**

Washing machines and dryers were very energy consuming machines, and something was needed to change the habits of the Danes. In 1997, the electricity companies, along with the Energy Agency, and Agency of Consumers, started a 3-years campaign with the purpose of changing the habits of how people did their laundry. For more than one hundred years, Danish Housewives had learned and practiced strong habits on how they

would do their laundry. First, the clothes were soaked in a lot of water mixed with soda, then boiled in a copper kettle, then scrubbed on a washboard, sometimes having to go through the boiling process a second time. Afterwards, the clothes had to be washed in clean water at least 3 times, then twisted to let the water out and hanged out to dry. Many housewives doubted that an electric washing machine could do this job because they were not really in control of a fully automatic washing machine. Doing the laundry yourself was part of the pride of a housewife, showing to neighbors what a proper housewife should do. (Olesen and Thorndahl, 2010)

The Danes eventually got new washing machines and chose to prewash and boil-wash at 90 - 95 degrees with their new fully automatic machine. In 1997, Denmark was one of the nations in Europe where people boil-washed the most: almost 24 % of all laundries were boiled, whereas the average in Europe had 15 % of all laundries boil-washed. If boil-washing could be avoided, 20-30 million kWh could be saved, and 20.000 tonnes of CO<sub>2</sub> emissions avoided.

The message to the homes was: with a new washing machine, and soap powder with enzymes, you only needed to wash clothes with temperatures around 40 - 60 degrees. The campaign worked: already one year after, the number of Danes who boiled their laundry was reduced. The majority of all Danish families had now chosen to use lower temperatures.

But still 1/3 of my interviewees still boil-wash their laundry at 90 degrees. Some of them do it regularly, once or twice a week, and others every three months. A 71 years-old housewife says:

*"I am an old housewife and I never did my laundry at low temperatures. I do all of the white laundry at 90 degrees, the towels and bedlinen at 60, and the rest at 40. I used to hang out clothes during summer and winter, as my mother did, but I do not do that anymore because of my bad legs" (Woman 71)*

Her daughter does the same:

*"I boil-wash every 10th day; I wash the towels and kitchen cloths at 90 degrees. I learned back home, and I have also read somewhere, that you cannot be sure that things are clean at 60 degrees. Anyways, the machine needs a monthly boil-wash." (Woman 45)*

Others also boil-wash because they need to clean the machine. Most of my interviewees used lower temperatures. Some families are more focused on cleanliness and how to do laundry, and habits and practices have also changed over time. In conclusion, the technology of machines and soap powder made a change of practices possible, but the habits of cleanliness are different from one family to the other and they cannot be changed overnight.

Some interviewees did not know how to wash their laundry when they moved from their family home to study in Aarhus; they had to call their mothers to help them out. Therefore, laundry habits are learned from parents, mostly from mothers.

### **Eating and transportation**

When it comes to practices and habits of eating and transportation, we tend to see the same pattern. In general, about 3 tonnes of the CO<sub>2</sub> emissions comes from the consumption of food in Denmark; of this, 75% originates from meat and dairy products (ox meat being the largest cause). The News media have pointed out this problem on multiple times, urging Danes to eat less meat and use leftovers instead of throwing good food away. The consumption of meat has fallen in Denmark because we now eat less meat. This is also true for my interviewees from Aarhus: almost half of them try to or eat less meat, and most interviewees also buy organic food grown ecologically. A young family mother of two small children says:

*“We have very consciously cut down meat consumption, and we agreed on that. It is because of the climate. I am the one who likes meat, but now it gives me a bad taste. We do have days when we do not eat meat and we have falafels – we buy them finished in the store”*

*“I only have meat when it is offered to me. When I cook for myself I only make vegetarian meals” (Young female student)*

Within families, there are different attitudes:

*“My wife stresses the importance of the family eating lots of greens. I do not, but my wife cooks, so this is the way it is. She and the children do not eat meat very much, and for my wife and children there is always a green salad. I do not like fresh green salads but I like cooked vegetables. She sometimes*

*cooks green beefs or green lasagnas without meat, at least once a week, and she only eats meat about 3 times a week". (Man 45)*

*"My daughter is very green and almost eats her own food. A lot of greens and hardly any meat... I think they talk about the subject at her high school because she tells me about climate change problems, what to eat and what not to eat, and she does not want meat from cows at all" (Mother of 18 years old daughter)"*

*"I think a lot about trying to eat healthy. We eat very different vegetables and not traditional Danish foods... During the last few years, we have cut down consumption of meat. I started by buying food boxes with meals from Årstiderne (The Seasons). Between using the Slimbox and the Fastbox, I found out that we did not need all the meat that we used to eat. Compared to 5 years ago, we only eat half of the meat we used to. Now, we eat 100 to 120 grams of meat when we used to buy 500 grams and eat it all. Now, we have meat for two days". (Young woman 35)*

*"When I lived back home with my parents, meat would always be served every day. You could not have a proper meal without meat. Eating sandwiches with rye bread was not considered a proper meal. Now my two sisters have become vegetarian and I would like to eat more vegetarian food too" (Young woman 26)*

## Transportation

The municipality of Aarhus would like to be a town of bicycles, and it is. Three quarters of my interviewees regularly use a bicycle to get to work, school, visit friends or do their small shopping. Aarhus is close to the sea, the forest and several open areas like parks, and many citizens enjoy riding on their bike. A few interviewees owned an electric bicycle that made it much easier to get around in a hilly town. One of the interviewees had chosen to buy an electric bicycle instead of a car, while other interviewees owned a car or both methods of transportation. Depending on where they worked, younger students managed with bicycles. Two families had chosen to not own a car, using instead bicycles for their commute to work, and rented a car or were members of a car-sharing project where they could easily have access to a car if needed. One family had decided to get rid of their car completely. They managed with bicycles and the help of neighbors, or their grown up children,

if they needed to go to a recycling center with green garbage from their garden. That same family, as the only one among my interviewees, had also completely given up on flights and used trains instead to go on holidays in Europe, and rented bicycles locally wherever they stayed. Those choices were due to climate problems and the green movement.

Some people (mostly students and retired people) are using municipal public transport systems like buses and the completely new light rail.

None of my interviewees owned an electric car, but several would like to own one as their next car. The cost to buy one too high, at the moment, compared to cars running on diesel and petrol, and for some it is not possible to have an electric car because they are not compatible with car trailers, which are used very often to transport building materials, garbage and even new furniture, or going on vacation to a summerhouse.

Transportation is one of the areas where there is also a need to cut down CO<sub>2</sub> emissions of cars and planes. Interviewees were willing to consider switching to an electric car if there were economic incentives, if the batteries lasted longer, and if there were more places to charge their car.

Travelling by plane while on vacation is still considered a great way to enjoy oneself.

*“We have worked so hard! We really deserved this vacation to Thailand”  
(Woman 54)*

*“We would not want to miss out, there are so many places we would like to see and visit outside of Europe” (Man 26)*

*“For many years I did not travel by plane. I didn’t need to, I would go camping to play folk music (in Denmark) or take inner trips instead. But I would like to save some money and go to the United States once.” (Woman 40)*

*“We travel by plane while on vacation a couple of times each year. We have no plans to change this right now” (Man 52)*

*“We flew twice last year while on vacation. We also took the train to Berlin. We do not travel that much” (Woman 50)*

*“I fly maybe once a year. It is very cheap now. This year, I am going to Cuba”  
(Student 27)*

*“I fly at least once a year when I travel. I have taken my parents to Spain, France and Italy. I visited Afghanistan in 2007 for the first time. (Young woman, teacher 26 – child of refugees from Afghanistan)*

One interviewee told me that he was waiting for the technology for flights to be greener and better for the environment. Technology should solve the problem.

How did the habits of long flights while on vacation started and when did they become accessible to almost everyone? During the 1960's, people became richer in Denmark; a lot of new factories opened, allowing people to travel first by bus, and later by planes to Spain and Italy. Soon after, travelling to Greece while on vacation also became a possibility for many Danes. Before, flying abroad had been restricted to upper social classes only. Other Danes would go to southern Europe by car or train. Now, travelling abroad by plane is economically possible for most families. It has become a common practice that only a few would miss. All of my friends and neighbors travel too, why not me? Only one of my interviewees cited climate problems as a reason to stop travelling by planes. We know, from the media, that few other families do the same but the ideas and meanings attached to flying while on vacation have become too strong to ignore, no doubt relating to a feeling of freedom. Even though very few people consider flying a problem, some interviewees thought that revealing how many flights they have taken in one year was embarrassing.

### **Habits and practices summary**

How and to what extent is the correlation between habits and practices, and consumption of electricity and cleanliness passed down from parents to children? In order to understand the habits and practices, I would like to introduce the notion of “habitus” from Pierre Bourdieu (1984).

Bourdieu's concept of habitus is a way of understanding how children, through their childhood, are influenced by their parents' way of acting and thinking. Not necessarily because children are told how to act or think, but often much more indirectly, they learn what is appropriate to do in all the many different ways that humans interact. The concept of habitus thus includes how human beings take in the settings of the environment they are in. This way, habitus

becomes a practical sense, an acquired system of preferences of how the world should be perceived and divided. Because habitus is built into the body, so to speak, during childhood, you do not necessarily know why you behave and think as you do; you just do what you find normal and natural. People raised in other social environments however, may have learned different ways of behaving. According to Bourdieu, constitution of habitus is closely related to the social space where one grows up, and therefore related to the cultural and economic capital of parents. Habitus is also related to social class and becomes a way of expressing and sustaining social statuses in society.

This may explain the different ways of behaving with energy consumption. For example: the differences between a man from Ireland that grew up with open fire and a young gamer (student) using a large quantity of electricity and heat. The latter came from a modern home with underfloor heating where rooms were always warm and cozy. Others were used to wear warmer clothes during their childhood to stay warm since not every room in the house was heated. Notions and practices of cleanliness were also handed down from generation to generation. For example: washing and taking showers; if the parents' norms of cleanliness were not met, they intervene. This would also apply to telling their teenage daughter that a sweater does not need to be washed after having been worn for just one hour.

The habit of wanting to save energy by switching lamps off and buying low energy consumption machines are learned habitus in 2018. Forty years of campaigning to save energy has worked but there are still differences. Earlier in the 1950s and 60s, owning electric lights and many electric machines were symbols of high class and modernity. Today, parents and schools are teaching children ways to be green and care for the environment. Not all people care: it seems that most people care only if you can do something for the climate while saving money. Others have chosen to change their ways due to climate problems because they are afraid of what the future will be for themselves, their children and grandchildren. One interviewee chose to be a vegetarian after she left her parents to study. This was her way of contributing because she felt she needed to do something. She also chose to be a member of Young Energy, an organization for young people supporting sustainable energies and life.

Most of my interviewees were middle class or upper middleclass families with different social backgrounds. Some interviewees came from families with a single mother where habits of saving energy and money led children to be more

cautious with spending energy (wearing warm clothes and slippers inside the flat during winter time) and higher awareness of switching off electrical appliances, lights, and such. Students coming from richer families tend to cultivate habits of high consumption of energy (heat as well as electricity) because it has always been the normal thing to do, relating to their social background.

In conclusion, **eating practices and habits are changing in Aarhus**, which helps bringing CO<sub>2</sub> emissions further down. Traditionally, a full hot meal in Denmark would consist of meat, potatoes and brown gravy with a little bit of vegetables. A few interviewees still prefer that; they are mostly seniors or families with children who do not like to eat many vegetables because they only want mashed potatoes, or pasta and minced meat sauce with tomatoes, or roasted sausages with French fries and little raw carrots and cucumbers to go with it. Some of the younger males prefer all of their meals with meat. In the past, eating a lot of meat (steaks and roasts of cows) was associated to higher social classes, whereas the middle and lower classes were eating minces meat from pork mixed with flour, oatmeal and milk to be made into Danish meatballs or other dishes. Potatoes were eaten in great quantities as the sole vegetable available to most families. Sunday dinner would consist of roasted pork with crisp skin, potato sauce with pickled cucumbers and jelly of red currants. Therefore, some habits originated from our parents' generation since not every interviewee associated their eating habits and practices to climate change. The general consensus is that they eat vegetables because it is healthier and they choose their meals because of how they taste and what they like. Others have already changed, or claim that they would like to change, their habits. Some lack the required knowledge to cook good vegetarian meals, others have claimed not having the money to buy organic vegetables. Some interviewees practice fishing twice a week or days of soup as alternatives to eating meat. Actual practices are many and vary from one interviewee to the other; habits from childhood remain, but why and how to eat more vegetables, locally grown vegetables, and less meat, are becoming part of food culture. The concept the Nordic kitchen is fashionable and internationally known.

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