Critical Assessment of Media Stations in the Permanent Exhibition of the Natural History Museum Vienna: Prehistory and Palaeontology

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Digital media and technical equipment both in temporary (special) and permanent exhibitions media illustrate and enable deeper insights into the content on display. For exhibition designers, it is a small line between useful media inserts and use of media that dominate the display over the original objects. Here some case studies about targeted media design and factors for the use of specific media in a museum are presented, including the long term perspectives for maintenance.

In the permanent exhibitions on Palaeontology and Prehistory of the Natural History Museum Vienna media of different kind are in use: Non-interactive systems like monitors embedded into the display cases or large interactive stations. The focus of the present evaluation were the interactive systems with haptic and tactile interfaces, photo boxes, and virtual activities empowered by a Kinect® system.

We examine the interaction between museum visitors and media: How are the installations used? How are people interacting with the stations? How much time do they spend at individual stations? Do different age groups of users react differently? Is there a difference between originally intended use and real use by the visitors? The assessments of media stations have been carried out in collaboration with external specialists, using the sociological methodologies of observation research and survey research with questionnaires.

At the Natural History Museum Vienna, the typical life span of a permanent exhibition is 15 to 30 years, due to the large number of exhibition halls and departments and funding. In contrast, the technical equipment in most media station has a life span of only 5 to 10 years. Therefore, media in a museum need constant maintenance, funds, and human resources.

Key words: Exhibition, Natural History Museum Vienna, Media, Tactile and Haptic Interfaces, Evaluation.

CHNT Reference:

INTRODUCTION

The conference on Cultural Heritage and New Technology included a session about challenges and benefits of archaeological reconstructions in exhibitions, focusing on a controversial discussion on the advantages and disadvantages of digital media use.

This contribution discusses the view of the scientists involved and staff responsible for maintenance of the media installations of two permanent public galleries at the Natural History Museum Vienna: Palaeontology (opened in 2001–2011) and Prehistory (opened in 2015). The aim of this study is to review, how media stations are developed in collaboration between scientists, exhibition designers, and media companies. We also critically assess how they are used by the visitors. In line with the focus of the CHNT-conferences on the advantages of the latest types of modern media, the long term perspective of media stations in exhibitions is discussed here. This also includes costs for maintaining, ageing of media, problems with functionality in “over-use” (e.g., simultaneous use by large user groups, like school children or thousands of visitors during special events like the Long Night of Museums).
Context: The Natural History Museum Vienna and the exhibitions Palaeontology and Prehistory

The “Natural History Museum Vienna” (NHM Vienna) was built in the second half of the 19th century and houses the natural history collections of the Habsburg imperial family. Opened in 1889, the museum was deliberately designed as “palace of natural sciences”. One of the unique selling points of the museum is its historical ensemble. All aspects of visual art in the building – architecture, sculpture, painting – reflect the original conception as a museum and give reference to the collections originally intended to be exhibited in each room [Jovanovic-Kruspel and Schumacher 2017, 14–15, 128–185].

The earliest collections of the NHM Vienna are more than 250 years old [Jovanovic-Kruspel 2015, 13-22]. The NHM Vienna is home to more than 30 million objects (from botany, zoology, physical anthropology, mineralogy, paleontology, and archaeology). The museum’s exhibition rooms [Ott et al. 2016] cover 8,460 square meters and present more than 100,000 objects which are shown in 39 large galleries.

The central theme of the exhibition Geology and Palaeontology (Halls 6–10) [Harzhauser et al. 2004] is the evolution of life and its interaction with Planet Earth (Fig. 1). Only a small portion of the ca. 3.5 million specimens housed in the scientific collection of the department [Harzhauser and Kroh 2018, 516] are shown in the exhibition. Starting with the birth of the solar system the exhibit shows 4 billion years of Earth’s history and important steps in the evolution of life. Hall 6 [Harzhauser and Kroh 2009] is dedicated to the interaction between the lithosphere and the biosphere. The Volcano Pump allows visitors to explore effects of eruptions and the GaiaSphere allows a unique view on Earth from Space.

In Hall 7 early organisms from the Precambrian and Palaeozoic eras are shown, both as original fossils and in form of reconstructions and dioramas. An interactive station called “Time Machine” [Harzhauser and Kroh 2011, 92] visualizes the movement of continents through time and even allows a glimpse into the future of Earth. The Mesozoic Era, the age of the dinosaurs, is the topic of Hall 8, with the evolution of marine animals and terrestrial plants exemplified by exceptional fossils. Hall 9 presents Cenozoic fossil faunas and floras that visibly look more familiar to modern animals and plants than those shown in the previous halls. The “Hippo Lab” [Harzhauser and Kroh 2011, 92] illustrates the evolution of horses and the tight interconnection between changing environments and evolution.

In the Dinosaur Hall (Hall 10) original fossils, historical skeletal casts and live-sized reconstructions of dinosaurs and other Mesozoic reptile groups are displayed [Harzhauser et al. 2011, 2017]. An animated Allosaurus and the interactive Dinosaur Puzzle are magnets for the younger visitors.
The halls dedicated to Palaeontology and Geology were developed over the course of several years between 2001 and 2011 and opened successively. Exhibition and animation techniques have progressed considerably during that time. Most interactive stations and 3D animations in this part of NHM Vienna have been developed in collaboration with our external partners, checkpoint media and 7reasons.

The permanent exhibition of the Department of Prehistory (Halls 11–13, Venus and Gold Cabinet) [Grömer and Kern 2018] is the only one at the NHM Vienna with a main focus on human cultures.

Hall 11 traces the beginnings of human culture, starting with the Neanderthals and early modern humans who lived as hunters and gatherers. Further milestones in human development include the first farmers of the Neolithic, the earliest use of metal during the Copper Age as well as changes in society during the Bronze Age. Hall 12 is dedicated in its entirety to the UNESCO World Heritage Site Hallstatt in Upper Austria with its 7000 years of mining history and name-giving for the Early Iron Age in Central Europe with its famous salt mine and cemetery. Hall 13 is home to objects dating from the Late Bronze Age, the Early and Late Iron Age, as well as the first millennium AD – the two millennia of technological, cultural, and social changes during which the foundations of today’s Europe were laid. The Gold Cabinet contains several highlights including the gold discs from the Stollhof Hoard, which are amongst the oldest gold objects in the world, while the Venus Cabinet offers a home for two world-famous Stone Age exhibits: the Venus of Willendorf and “Fanny” the dancing figurine from Stratzing.

This permanent exhibition was opened in September 2015 and its media stations have been developed between 2013 and 2015 in cooperation with the media company 7reasons in Vienna.

Who is the audience?

The different disciplines present at the NHM Vienna – botany, physical anthropology, zoology, geology, palaeontology, mineralogy, and archaeology – enable to reach a wide audience of up to 750,000 visitors each year [Köberl and Kritscher 2017, 75-77]. Visitors come from various age groups and education levels, ranging from children to adults and from non-experts to scientists and academic groups.

Nevertheless, the museum is a classical “family museum” – more than half of the visitors are under the age of 19. The young visitors are on the one hand coming with their families – but more often in kindergarten and school groups, the latter mostly within the framework of school education.

CHALLENGES FOR MEDIA DEVELOPMENT

The exhibitions at the Natural History Museum are housed in a historic building and as consequence of heritage law and the policy of the museum, the historic ensemble is to be preserved (as it is part of the unique feature of the NHM). This creates unique chances, but also challenges. Where preserved, the historical show cases are re-used when renewing exhibition rooms (e.g. Halls 11 and 13). Dating back to the 19th century, these show cases were not designed to include electric light or ventilation necessary for dissipating the heat radiating from light bulbs or screens built into the show cases. Likewise, these show cases were designed for Victorian-area style of exhibitions that focused on presentation of large numbers of objects but did not necessarily provide space for explanatory texts or graphical information. This is in contrast to modern exhibition design which typically involves a reduction to a much lower count of representative objects that are accompanied by ancillary information, enabling story-telling in order to help the visitors understand the relevance of the exhibited objects. Preservation of the historical ensemble also dictates how and where modern media can be included in the exhibition, since we do not want them to dominate the design and thereby destroy the historical atmosphere of the galleries.

Here we are discussing the use of media in the galleries, which display Palaeontology and Prehistory: the evolution of the life and early cultures. Decisions about the display of objects and contents in those rooms are driven by various factors. The choice for certain types of media is an important factor in exhibition design (Fig. 2). The main factor revolves around objects and storytelling, followed by the needs of the users and the choice of external partners.
To exemplify this with the display for Prehistory [Kern 2018, 20-23]: Which objects and narratives should be presented to the public and what message should the exhibition convey? The aim was to show highlight objects such as the Venus of Willendorf, one master-piece of early art and 29500 years old and to inform about cultural and technological developments of mankind with facts that concern us till today like agriculture or bronze casting. There is also a need to address stories of contemporary significance such as identity, resource management, or migration. A key principle at the Natural History Museum of Vienna and one of its unique selling points is the “magic of the original”. That is to let the original artefacts speak for themselves, as such, specific care needs to be taken that the media stations do not “cover” or “override” the original objects. The decision for specific media design must therefore be selected according to the content and the “message”.

The assessment of user needs is vital for a successful museum. One consideration here is the issue of available space: how much space is necessary for a particular type of media station and the visitors using it? This has to be assessed in relation to the space available in the exhibition hall. Visibility is also an important factor: what are the needs of the visitors, the museum guides, or the scientists designing the exhibit? For targeted media design it is important to have a good assessment of user groups and user behaviour [see e.g. Sovis 2019].

When working with external partners, animation companies, software developers, and media designers, different aspects need to be communicated. Foremost, the external partners need to understand the narratives to be told. Consensus, furthermore, has to be reached on how to fill the “gaps” of knowledge for animations (e.g. the colour and structure of dinosaur skin; visual aspect of the prehistoric landscapes). It is also important to communicate the needs of both the scientists and the visitors to the external partners. Construction time and costs are further important factors that need to be taken into account.

Case studies: Media in permanent exhibitions at the NHMW (Palaeontology and Prehistory)

Combining real objects with state-of-the-art multimedia stations is an important focus for the permanent exhibitions at the Natural History Museum Vienna. Such an approach is expected to both give visitors new insights into the topic addressed and to bring objects to life. Depending on the message to be told in the exhibition, different media types are used [see Kern 2018, 23; Harzhauser and Kroh 2009, 44-48].
Types of media used (Palaeontology and Prehistory)

**Non-interactive systems:**
- Monitors embedded into the display cases
- Large projection on a 3D terrain model (model of the Hallstatt High Valley; Hall 12)
- Dome projection on a curved screen (GaiaSphere – simulating a view of Earth from Space; Hall 6)

**Interactive systems:**
- Tactile interfaces (touchscreens): Dinosaur Puzzle (Hall 10), Citation Show Cases (Halls 11–13), Migration Station (Hall 13)
- Photo box: Virtual Changing Room (Hall 13)
- KINECT system: Cave Monitor (Hall 11)
- Haptic interfaces: Volcano Pump (Hall 6), Time Machine (Hall 7), Hippo Lab (Hall 9), Highlight Finder (Halls 11 & 13)

Non-interactive systems like screens or projections have been among the first digital media types to be established in the NHM Vienna almost two decades ago, like also in other museums such as the Louvre, the Museum of London or the Museum of Scotland [Economou 1999, 2003; Copley 2010]. The clips shown at the NHM Vienna typically run in a permanent loop. The videos and animations are intended to show aspects no readily visible in the preserved and displayed object, and to support storytelling.

More recently, interactive systems were added when new exhibitions were created, which will be the focus of further discussion in this contribution. The interactive stations at the NHMW range from classical haptic interfaces where the visitors can push a button or turn a wheel to influence the display, to touchscreen interfaces. Both types of interfaces have advantages and disadvantages: the former are more expensive in development, but very sturdy in the long run, while the latter allow for more flexible interaction and are less expensive, but prone to malfunction from a variety of reasons.
Tactile interfaces with touchscreens are among the media widely found in numerous museums. In terms of handling they are more or less timeless, only the content (and presentation design) needs to be updated. In the exhibitions on Palaeontology an example can be found in Hall 10 (Dinosaur Hall). There a game called “Dinosaur Puzzle” (Fig. 3) allows visitors to test their skill in comparative morphology and assign bone to two different types of dinosaurs (a herbivorous Triceratops and a carnivorous Allosaurus). Completion of the game is rewarded by a virtual walking dinosaur model that can be turned and manipulated (switched from a life-like animation to a skeleton reconstruction) to further explore dinosaur morphology. More educative than playful are the tactile interfaces used in the exhibition on Prehistory. The so-called “Citation Displays” in Halls 11 and 13 use a classical touchscreen to inform about general outlines of important steps in mankind and provide an introduction into achievements of certain time periods. The Migration Station in Hall 13 shows the waning and waxing of cultures and peoples very clearly through animations, as well as the transience of empires and changes of borders over the millennia.

A special interface is used for the Virtual Changing Room in Hall 13 (Prehistory), a photo box station (Fig. 4). The design is intended to resemble an actual changing room. It includes a big screen, which enables visitors to virtually dress up (in one of 20 prehistoric costumes). They are able to select between costumes that have been reconstructed after original artefacts on display. Available are costumes for women, men, girls and boys from Bronze and Iron
Ages, Roman period and Early Medieval, covering a time-span from 2000 BC to AD 800 [Grömer and Kern 2018, 32–33]. A photo can be made of one’s own face and manipulated to replace the face of the virtual person presenting the costume. Once finished, the picture can be sent home via E-mail. It is accompanied by archaeological background information explaining details about the costume chosen.

A different type of interface was chosen for the Cave Monitor in Hall 11 (Prehistory) (Fig. 5). There a KINECT system enables visitors to explore Ice Age cave paintings from UNESCO world heritage sites like Lascaux, Altamira, and Grotte Chauvet [Antl 2018, 68–69] with a virtual torch. KINECT(R) systems are typically used for gaming consoles and allow interaction by gestures without actually touching the screen.

In contrast to the touchscreen and KINECT® system interfaces, haptic interfaces require sturdy design to survive thousands of interactions in real world usage. Such interfaces are employed to provide a direct tactile feedback to the visitors supporting the reception of the message to be conveyed by the respective interactive station and to provide for variety in the type of interactive station used. The haptic interfaces used in the Highlight Finders in Halls 11 and 13 (Fig. 6) represent an interactive navigation system allowing visitors to discover outstanding objects. Small accompanying video clips provide additional detailed information about the artefacts and the respective historical contexts. A major challenge for the development of these stations concerned the selection of the information (pictures, texts) included according to the level of the audience (small children, families, adults with some background knowledge).
In the exhibition Palaeontology, three different haptic interfaces are employed in the media stations on display. The Volcano Pump in Hall 6 (Palaeontology) visualizes local effects of volcanic events in a model of prehistoric Vesuvius and shows the global effect of volcanic ash injected into the atmosphere by such an event. The haptic interface used is a stainless steel pump where visitors can interactively increase the pressure in the magma chamber and experience the pressure drop as the volcano erupts (Fig. 9). The Time Machine in Hall 7 (Fig. 7) shows the continental movement and the changes of the appearance of the planet earth through time [Harzhauser and Kroh 2011, 92]. Visitors control the timeline of events by turning a large steering wheel designed to resemble an abstracted steering wheel of a ship. This design enables also the usage of the machine during guided tours, allowing the tour guide to turn the wheel while facing the group and explaining the events happening during the animation. The Hippo Lab (Hall 9) illustrates the evolution of horses and tries to convey the message that evolutionary changes are linked to external factors such as the environment or nutrition. Users can experience this by turning one of the cogwheels controlling e.g. vegetation, which causes the other cogwheels representing among else body size to change as well.

Fig. 7. Time Machine in Hall 7, overview and space needed (images: K. Grömer and A. Kroh)
When planning interactive stations, the positioning (visibility) and available space are crucial (Fig. 7-8). If a station is hidden from view behind other showcases, few visitors will notice and use it. Stations that are intended to be used during guided tours need special attention during planning. An example is the Time Machine in Hall 7 (Palaeontology). Despite its age (dating from 2004), it is one of the most popular media stations and is also extensively used during guided tours. This usage was anticipated during planning and room for 20 to 25 people (size of a school class) was left free in front of the station (Fig. 7). The haptic interface, a steering wheel, was designed in such a way that it can be controlled blindly by the guide while explaining.

Usage by large numbers of visitors, often simultaneously, constrains the type of interface used. It needs to be sturdy and able to cope with multiple input. Stations designed for the use by single visitors or small groups (families) need less space such as the Migration Station in Hall 13 (Fig. 8). Here the planners have more choices in terms of interfaces. Most touchscreen interfaces are limited to these types of stations because they usually cannot cope with conflicting input from dozens of users.

The Highlight Finders in Halls 11 and 13 (Prehistory) act a bit like first-person shooters, allowing visitors to trace a cross-hair across the room that lights up when it passes a particularly interesting object hidden in the museum displays, such as an elaborated belt hook from the Celtic sanctuary Roseldorf. When the cross-hair remains focused on these objects, the Highlight Finder displays additional information for that object, including short video clips (Fig. 6). Usage of these stations is intuitive for the majority of the visitors, but many expect an added touchscreen functionality that does not exist.

The Volcano Pump in Hall 6 (Palaeontology) is an unusual haptic interface (Fig. 9). Built like a tire inflator, it allows to build up pressure in the magma chamber of a volcano to make it erupt. The construction was a challenge, because we wanted the visitors to feel the increase of pressure. This was achieved by using industrial pneumatic components like they are used in assembly lines. How strong this effect can be was dictated by the "law of the lever" (Hebelgesetz). A compromise was needed between an effect that still can be felt by adults and force that children can still handle. Strong wear necessitate a complete re-design of the mechanics after only two years.

Assessments of media stations

Often visitors use media stations in a different way than planned by the exhibition designers. An interesting example for such a situation could be observed in the Moesgård Museum during a visit in 2018. The Moesgård Museum was recently re-built and features an excellent exhibition with numerous media stations. One of these is intended to
explain usage of different arrow head shapes, which depending on the prey and its use were differently shaped\(^1\). Visitors can select one of three different arrow types, pull and release it. After the arrow hits the animal there is a short animation, explaining, for example, that club shaped arrow heads were used for furry animals in order to not damage the hide. During our visit, however, few visitors seemed to pay attention to the information text displayed after the animation, eagerly pressing the Home button in order to shoot again.

In order to gain deeper insights into the usage of the interactive stations by the visitors of the Natural History Museum Vienna, assessments have been run. In these, we study the interaction between museum visitors and media, and assessed user group composition and user behaviour. The results support the planning of future media stations and decisions regarding refurbishment or replacement.

In the year 2018, two studies about media stations in the permanent exhibitions Palaeontology and Prehistory have been carried out [Plaß 2018; Sovis 2019]. Both have different research-settings, employing both qualitative and quantitative techniques of sociology research [Ashley and Orensten 2005; Macionis and Gerber 2010, 40–42]. The first [Plaß 2018] has been an assessment by students of a specialized college of Elementary Pedagogy, who did observation research on museum visitors (assessment by observing visitor behaviour without getting into direct contact with them). The second study [Sovis 2019] was run as a seminar for students of the Vienna University for Economics and Business. In the course of the seminar a questionnaire was developed and a study was carried out as survey directly contacting the museum visitors. Those two kinds of visitor assessment – observation and survey research – are common among sociological studies of museums [e.g. Baumann 2000].

Observation research of museum visitors

The assessment about visitor behaviour in observation research technique [Macionis and Gerber 2010, 40–42] by Sophie Plaß from Elementary Pedagogy and four students in August 2018 resulted in statistical data (300 data sets) about visitors use of modern media in the permanent exhibitions Prehistory and Palaeontology [Plaß 2018]. In a first step, for 2 weeks the museum visitors were observed by the researchers to study their behaviour with different media stations. User behaviour was documented using standardized data sheets and care was take to collect equally distributed data for the different media stations selected (Dinosaur Puzzle, Time Machine and Volcano Pump in Palaeontology; Citation Display, Migration Station, Highlight Finder and Changing Room in Prehistory). Data collected included:

- Who is using the station (age, gender, groups, single persons)
- How it is used; what people are doing?
- Is there a difference between originally intended use and real use by the visitors?
- Duration of stay: How much time visitors spend at the stations?

In a second step, the same group of researchers also assessed the frequency of use of certain media stations within a defined time-span. For this, the proportion of visitors using the station surveyed was counted in relation to the number of visitors in the exhibition hall.

Statistical analysis of this assessments highlighted that the user groups differ depending to the type of the media station surveyed (Fig. 10 left). Specifically, the Dinosaur Puzzle in Hall 10 and the Virtual Changing Room in Hall 13 turned out to be “fun stations” used by whole families. The Citation Displays and the Migration Station, in contrast, attracted more single users, probably due to the fact that they require a more intellectual approach and are rich in textual information. In case of these stations, the visitor behaviour observed at these stations match with the original intention by the scientists and exhibition designers during the design state. Occasionally, misuse of media stations could be observed: for example, the Highlight Finders in Hall 11 and 13, or the Time Wheel in Hall 7 sometimes are used as climbing device – to our surprise this behaviour was not restricted to the very young visitors only.

Results on the duration of stay show a distinct pattern (Fig. 10 right). Most visitors spend around 2 minutes at a station. This also applies to media stations that offer much more content than could be explored in this short period of time (e.g. the Citation Display).

\(^1\) [https://en.natmus.dk/historical-knowledge/denmark/prehistoric-period-until-1050-ad/the-mesolithic-period/the-stone-age-hunters-bow-and-arrow/]
Considering usage of the stations, the survey showed very clear results. Some of the stations are very popular, particularly the Changing Room and the Volcano Pump. These are stations with a high fun-factor and very limited amount of textual information and are apparently well used because they offer a welcome respite from the usually text-rich information presented in the traditional show cases.

Survey research with questionnaires

The survey research with questionnaires [Macionis and Gerber 2010, 40] by Wolfgang Sovis and his students from Vienna University for Economics and Business went in another direction [Sovis 2019]. The researchers gathered data using more than 300 interviews based on a questionnaire developed specifically for the survey of the usage and acceptance of the media stations in the NHM Vienna – exhibitions Palaeontology and Prehistory. To compare the results of the two different assessments, the same media stations have been in focus.

The questions included (next to basic demographic data) how often the particular visitor has been at the NHM Vienna and if a guided tour has been booked. According to the media stations it was asked about the visibility of the stations and their usability (is it understandable how to use it, is it interesting, entertaining, educative, visual appreciating and user-friendly?). The data sets have then be analysed statistically using cluster analysis methods as commonly used in sociology.

A clear result from the survey (Fig. 11) was that usage of some media stations are not well understood by the visitors. This is exemplified by the interaction with the Cave Monitor in Hall 11. Handling of this fascinating station turned out to be non-intuitive for many visitors and the station often remained unnoticed because people did not recognize it as an interactive station, but considered it simply as a backlight board with explanations. Another result is also that according to the comments by the visitors, some of the media stations would benefit from more extensive explanations on how to use them, e.g. the Highlight Finder.

Some of the questions also asked for the placing of media stations. The results show that both the Dinosaur Puzzle and the Migration Station have been missed by the visitors as they are placed on more or less hidden places in the room or not readily recognizable as interactive stations from afar. Media stations like the Volcano Pump, the Time Machine and the Changing Room have been voted by the visitors as the most popular ones – this is not only caused by their prominent placement in the rooms (good visibility), but also due to their content, their usability, and the “fun factor”.

The questionnaire also was aimed to assess acceptance of future trends by the visitors. For example, people were asked on their opinion on a possible Virtual Reality Apps. Many visitors were in favour of such an app and indicated that they would make use of it. They, furthermore, indicated that such an app would be a good way to visualize more complex objects (e.g. from Prehistory) and to clarify their function.
Long-term Perspectives

When planning exhibitions it is commonly forgotten that media stations do not represent a one-time investment only and need constant maintenance and resources, both human and monetary. Developing exhibition media is very time consuming and, therefore, expensive. The installations are developed using technology available at that specific point of time. Technical progress, however, is rapid. Specifically in the field of 3D animation, products age rapidly. Likewise, the media stations themselves are ageing and after a few years the software used may no longer be supported by the producers and replacement for hardware, as well as skilled technicians may be difficult to come by. Intended lifespan of permanent exhibitions at the NHM Vienna typically is 15 to 30 years. With few exceptions, media stations have a much shorter life cycle. In our experience, IT hardware of media stations typically needs to be replaced every five to ten years and 3D animations tend to appear old fashioned after at least ten years (even much earlier). This shorter life expectancy of media stations needs to be factored in when planning permanent exhibitions and both staff for maintenance as well as funds for replacement need to be set aside to guarantee long-term function.

Common problems that have been observed are:

- Wear and tear of mechanical components
- Ageing of electronic components
- Ageing of CGI effects (rapid progress in the field of 3D animation)
- Loss of manufacturer support (software and hardware)

Interactive stations in a big museum are typically employed in a highly stressful environment. Apart from normal ageing, long run times and increased levels of dust lead to heating up of electronic components and shorten the life spans than experienced in home or office use. Also misuse of mechanical components as observed in the assessments of media stations [Plaß 2018, 2–3] and over-use with touchscreens cause technical problems. Few touch interfaces can cope with the simultaneous input e.g. of a whole school class of ca. 25 children. At special occasions, e.g. Long Night of Museums in the beginning of October each year, 15.000 people visit the NHM between 6 pm and midnight [Köberl and Kritscher 2017, 32] 2. Such events represent a challenge for the media stations (and the technicians responsible).

Furthermore, 3D animations in media stations created with limited museum budgets, cannot compete with Hollywood productions or modern video games. Such museum 3D animations typically show their age quickly – an animation that looks good today, may look dated in 5 years – due to permanent technical advances graphics, animation or surface rendering employed in commercial film production and advertisements.

For future exhibitions where media stations with scientific content have to be developed, the insights gained from the visitor assessments are of interest [Plaß 2018, Sovis 2019]. The user needs and preferences, especially their mean duration of stay have to be taken into account. On media stations with a high load of scientific input in form of texts, clearly, few visitors make use of the full content offered. Such great effort spent on the creation of additional content for a single media station might not return the intended attention. Instead, it seems best to place a higher

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2 https://langenacht.orf.at/
effort on the quality and ease of access than on the sheer amount of information incorporated in a single media station.

Three examples from the museum furthermore serve to illustrate unexpected challenges. As mentioned before, due to unexpected wear, the mechanical system of the Volcano Pump had to be completely replaced after only two years of use. A complete re-design of the system was needed in order to mitigate wear in future usage.

The Dinosaur Puzzle was prone to crash or freeze from sensory overload when a whole school class tried to play the game at the same time. Bread crumbs dropped by visitors created fake touch input. Both issues could only be solved when the touch screen had to be replaced due to its end-of-life. The chance to a more resilient touch technology, however, necessitated complete revision of the software because tactile input is registered differently by different systems (some register an interaction when a finger is places on the screen, others when it is lifted from the screen, for example).

The Citation Show Cases, in contrast, may freeze when ambient temperature is high in summer and heat expansion causes loss of contact between the overlying glass surface and the touchscreen.

Each time a major problem arises, some careful evaluation is needed if a station can be repaired or should be replaced. In this decision making process, the results of the visitor assessments are very useful. This applies, for example, to the Volcano Pump, that had to be replaced to better technical standards several times. Identification as one of the most popular stations in the visitor assessments [Plaß 2018, 2; Sovis 2019, 17] supports the decision for continued updating of the station.

The assessments by the Vienna University for Economics and Business [Sovis 2019, 99–100] also argued for using novel media like Virtual Reality (VR) Apps with additional information, 3D animations, and augmented reality. These media, however, often require extensive investments both during installation and for continued operation. Many impressive VR systems are not suitable for unattended usage and require permanent supervision of the stations by personnel. In addition, like most visual digital content such media are prone to rapid aging and need constant updating to stay attractive.

In a future perspective, the NHM Vienna aims to include novel media for science communication [Hantschk et al. 2016] within the exhibition rooms. Ideally, content developed for these media can also be presented in World Wide Web (e.g. Google 360° view, online visit of the museum rooms: [Ott et al. 2017]), and form part of online exhibitions.

CONCLUSIONS

This study deals with modern media for permanent exhibitions. It discusses the perspective of the scientists involved and the staff responsible for maintenance. It also provides insights into the collaboration with external partners, the assessments of user needs and long-term perspectives gained from two decades of usage of media stations at the NHM Vienna.

To conclude, in the permanent exhibitions on Palaeontology and Prehistory the media stations are intended to support storytelling. They are designed in such a way that they do not dominate over the original objects. A critical assessment of media stations in use at the NHM Vienna shows the importance of accounting for their shorter lifespan in contrast to traditional museum exhibitions when planning permanent exhibitions. The planning stage is crucial for the later success of a station, although it is hard to predict how visitors will interact with any given station. Both, the observation data and the answers to questionnaires indicate that the attention span of the visitors is very limited. The amount of textual content included in an interactive station needs to be adapted to the typical short usage time by most visitors. Additionally, long-term perspectives need to be carefully considered during planning stage – media stations need constant support and resources, a factor commonly underestimated, which can cause issues to keep them functional over the whole lifetime of an exhibition.

A key conclusion of years of museum experience is that long-term maintenance costs for multi-media stations can be substantial. It is important therefore to account for his costs in annual budgets in order to insure operability of the stations for the lifetime of the exhibition.
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