

New Media and Sound in Musical Instrument Collections: Observations from a Visitor Survey at the Deutsches Museum

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Abstract

Responding to the increasing public demand for physical and virtual interactivity in exhibitions, in recent years, several museums have begun to use a variety of new media, such as audio-visual installations, augmented reality systems, and computer-based interactives, in order to promote visitor agency and participation. This fashion is also having an influence on institutions that house musical instrument collections or music-related material, where sound is a crucial exhibition element. This article presents and analyzes the results of a visitor survey concerning the display of musical instruments at the Deutsches Museum in Munich, discussing the various challenges of integrating media and sound in the new permanent musical instrument exhibition with reference to various concepts that have been applied in recent exhibitions of popular music.

Neue Medien und Klang in Musikinstrumentensammlungen: Beobachtungen aus einer Besucherbefragung im Deutschen Museum

Mit dem zunehmenden öffentlichen Bedarf an physischer und virtueller Interaktivität in Ausstellungen zu Musik bzw. zu Musikinstrumenten während der letzten Jahre begannen einige Museen eine Vielzahl neuer Medien zu nutzen, um Besucher anzuziehen und ihre aktive Teilhabe zu steigern, darunter umfassende audio-visuelle Installationen, »hands-on«-Experimente und akustische Demonstrationen. Dieser Beitrag analysiert die Ergebnisse einer Besucherbefragung, die im Deutschen Museum durchgeführt wurde, um die Gestaltung der neuen Dauerausstellung Musikinstrumente zu verbessern, die verschiedenen Herausforderungen der Umsetzung von Besucherwünschen zu diskutieren und potenzielle Lösungen und Alternativen, die vorgeschlagen oder bereits in anderen Museen angewendet wurden, zu untersuchen.

»Did you miss anything in the current exhibition?«

»Sound – A silent exhibition of music is like paintings in a dark room.«

Anonymous visitor, Deutsches Museum, 15 May 2013

Introduction

Responding to the increasing public demand for physical and virtual interactivity in exhibitions, in recent years several museums have begun to use a variety of new media in order to attract visitors. Immersive audio-visual installations, augmented reality systems, and computer-based interactives, usually employing state-of-the-art equipment, are some of the latest methods through which museums nowadays aim to promote user agency and participation. This trend is becoming evident also in institutions that house musical instrument collections or music-related material, where sound is a crucial exhibition element. On the one hand, the rapid advance of innovative digital technologies has recently opened endless possibilities with which museums can enhance a visitor's perception of tangible and intangible musical heritage while protecting and respecting the original artefacts. On the other hand, even though new media are meant to inspire discovery and to foster creativity in exhibitions, there are no ways to predict with certainty a visitor's interaction with them. Moreover, despite the fact that visitor studies have examined the impact of sound in museums, including not only music but also all kinds of deliberate background noises, relatively little is known about sound in musical instrument exhibitions.

The present article discusses this significant issue by referring to examples of the latest media that have been applied in various new museum exhibitions of popular music. In addition, the article presents observations on new media and sound made in a visitor survey that was conducted at the Deutsches Museum in Munich before the closure of its permanent exhibition of musical instruments for renovation, intending to aid the preparation of a new permanent exhibition.

This survey was also important from a broader perspective as it was one of the first studies to consider the display of musical instruments in a museum of science and technology, such as the Deutsches Museum, one of the oldest and largest museums of this kind. The article describes and analyses the results of the survey in light of the socio-demographic profile of the visitors, their connection to musical instruments and music, as well as their remarks concerning the role of new media, especially those involving sound, in the contextualization and interpretation of the displayed artefacts. Finally, the article includes a brief description of the new musical instrument exhibition at the Deutsches Museum, outlining some of the challenges in implementing the visitors' demands in the design of the new exhibition.

Interactivity in New Music-Related Exhibitions

Ever since the last decades of the twentieth century, museums have been converted from places of passive observation to forums of active involvement. In their efforts to combine education with entertainment, museums today offer various forms of interaction and participation for the public – mainly through the use of new media. This growing tendency for interactivity in exhibitions can be observed particularly in museums of popular music, where the latest fashion has been to create immersive environments by using a combination of high-tech multimedia and narrative-based themes.¹ Apart from delivering content linked to the exhibits and thus constituting an integral part in the storytelling process, computer-based media such as portable guides, touchscreens, smartcards or hands-on interfaces have been used to stimulate exploration, emotional engagement, and social interaction in exhibitions.

For example, visitors of the MoPop (Museum of Pop Culture, formerly Experience Music Project, Seattle, opened 2000) can not only admire the sight and sounds of the massive art installation *IF VI WAS IX: Roots and Branches*, an

auto-playing sculpture that consists of more than 500 musical instruments, but they can also try out different instruments and recording equipment in a *Sound Lab*. The *Virtual Conductor* interactive installation at the Haus der Musik (Vienna, opened 2000) enables visitors to conduct the Vienna Philharmonic Orchestra virtually, by holding a baton which can control, for instance, the tempo of the performed music with the movement of their hand. In the British Music Experience (initially opened in London, 2009–2014; re-opened in Liverpool, 2017) visitors are provided with a *Smarticket* with which they can retrieve and share material that is stored during their visit. At the various showcases visitors can select and listen to audio content on headphones by sliding their fingers on haptic interfaces resembling a piano keyboard or guitar fingerboard. Additionally, in the *Dance the Decades* interactive booth they can choose from one of twelve classic popular music dances, such as Rock and Roll, Twist, Disco, etc. and dance solo or in a small group.

Several interactive areas in the *Time Tunnel* exhibition at Rockheim (Trondheim, opened 2010) incorporate historically reconstructed settings with surround video walls on which visitors can load audio-visual content on multiple screens through gestures and motion;² this blending of the physical and virtual world allows them to learn more about Norwegian pop and rock music while sitting, for example, in a 1960s living room or inside a 1970s tour bus (fig. 1).

According to Bjørnar Bruket at Rockheim: »since one major concept of the *Time Tunnel* is to inspire visitors to explore, engage and to be pro-active rather than re-active, the exhibits are immersive. Thus, the visitors are not told how (or where) to »push play«. None of the rooms are designed the same way with regards to sound or audio-visual media set up, which we've tried to hide or integrate as much as possible. The visitor is free to choose a story in every room except the 1960s room, where the stories are randomized. The devices in use range from projectors (and projector screens), touch screens, multi-touch screens and matrix screens; cameras detecting movement, laser pointers, speakers, and headphones. Everything is network driven from multiple servers and media players (portable hard drives). Various software is in use depending on the different set up in each room« (personal communication with the author, 14 August 2017).

1 Sarah Baker, Lauren Istvandity, Raphaël Nowak: Curating Popular Music Heritage. Storytelling and Narrative Engagement in Popular Music Museums and Exhibitions. In: *Museum Management and Curatorship* 31/4, 2016, pp. 369–371.

2 Gerald C. Cupchik: *The Aesthetics of Emotion. Up the Down Staircase of the Mind Body*. Cambridge 2016, pp. 244–246.



1 Interactive installation resembling a 1970s tour bus at Rockheim. © Rockheim, reproduced by permission

Likewise, the ABBA Museum (Stockholm, opened 2013) houses among various game-oriented spaces an interactive stage which permits visitors to perform alongside hologram images of the famous Swedish group ABBA. In the MuPop (Musée des Musiques Populaires, Montluçon, opened 2013) single visitors or groups can experiment with sounds and compose their own music on the *Reactable*, a collaborative electro-acoustic instrument developed by the Pompeu Fabra University in Barcelona. Built in the form of a round table that can be played by placing blocks on its touch-sensitive interface, the *Reactable* has been used in various museums and science centres already, as well as in live performances by artists such as Björk or Coldplay. The *Spin the Vinyl* installation at the Ragnarock, a museum for pop, rock, and youth culture (Roskilde, opened 2016) presents the evolution of recording formats and media through a gigantic record player on which

visitors are encouraged to lie down and spin around while participating in an interactive music quiz. A central feature at the National Music Centre (Calgary, opened 2016) is the *BMO Soundscapes* gallery, an immersive 360-degree audio-visual installation that showcases Canada's varied musical culture.

These are only a few of the examples that illustrate the turn towards experiential learning in museums of popular music, which is at present a common keyword in the museum community. For many of these new museums the use of interactive multimedia, which aims to provide both sensory and intellectual experiences for their public, plays an important role in the educational curriculum of their exhibitions as well as in their advertising and marketing agendas. Nevertheless, the visitors' dynamic and complex reaction to – and interaction with – media such as portable devices or stationary touch-screen systems has not been sufficiently understood or docu-



2 Installation shot of the David Bowie *Is* exhibition at the V&A. Courtesy of the David Bowie Archive © Victoria and Albert Museum, London, reproduced by permission

mented.³ In addition, the abundance of new media, especially those geared towards entertainment, in museum exhibitions challenges the museum's long-standing character as a temple of expert knowledge and scholarly study.

However, even some of the older, more established institutions have now begun to incorporate such elements in their exhibitions in an attempt to broaden their communication strategies and reach new audiences. For instance, in 2013 the Victoria and Albert Museum, London (hereafter referred to as the V&A), staged *David Bowie Is* (fig. 2), a temporary exhibition which focused on the biography and cultural output of the iconic English musician David Robert Jones, better known as David Bowie (1947–2016).

One of the essential ingredients of this artistically and commercially successful exhibition was the use of an integrated sound system with an audio guide which was triggered automatically depending on the visitor's location and movement within the various exhibition rooms, thus creating an immersive sound experience. The goal of this sophisticated system was »to present the music with the same distinction as the physical artefacts, and recreate the sound experience of a real performance«. ⁴ Two subsequent music-related exhibitions at the V&A titled *You Say You Want A Revolution: Records and Rebels 1966-1970* (2016)⁵ and *Pink Floyd: Their Mortal Remains* (2017)⁶ were based on the same immersive sound concept.⁷ The Philharmonie de Paris has used similar

3 Dirk vom Lehn: *Generating Aesthetic Experiences from Ordinary Activity. New Technology and the Museum Experience*. In: *Marketing the Arts. A Fresh Approach*. Ed. by Daragh O'Reilly and Finola Kerrigan. New York 2010, pp. 104–120.

4 Victoria Broackes, Geoffrey Marsh: *David Bowie Is*. London 2013, p. 17.

5 Victoria Broackes, Geoffrey Marsh: *You Say You Want a Revolution? Records and Rebels 1966-1970*. London 2016.

6 Victoria Broackes and Anna Landreth Strong: *Pink Floyd. Their Mortal Remains*. London 2017.

7 Broackes/Marsh 2016 (note 5). – Broackes/Landreth Strong 2017 (note 6).

immersive installations which combined sound and image in recent temporary exhibitions on popular music such as *The Velvet Underground – New York Extravaganza* (2016) or *Jamaica Jamaica! De Marley aux deejays* (2017).

Gradually, this shift to highly interactive and technologically immersive exhibitions is also having a strong influence on museums housing collections of historical musical instruments, where the emphasis has traditionally been on the material authenticity and scholarly authority of object-based exhibitions.⁸ For a long time musical instruments and music-associated material were commonly displayed in a rather conventional way according to their chronological, geographical, or typological classification in many of these museums, while the conceptualization of musical practices or sound were not prominent features of the exhibition design. Latest research in two major musical instrument collections in Paris and Leipzig has shown that exhibitions of this style often contradict visitor expectations.⁹ A panel session devoted to new media for musical instrument collections at the 2013 conference of the International Committee of Museums and Collections of Instruments and Music (ICOM-CIMCIM), and the following publication of its outcomes, revealed the complexities of this subject for museum curators, educators, and exhibition designers.¹⁰ Furthermore, it underlined the fact that among several museums which are currently redesigning their permanent exhibitions of musical instruments the use of new media and sound is of paramount importance and relevance, as will be described below for the Deutsches Museum.

The Case of Musical Instruments at the Deutsches Museum

The Deutsches Museum, Munich (hereafter referred to as the DM), is one of the oldest and largest museums of science and technology in the world. The DM houses a large and important

collection of about 1,900 musical instruments as well as numerous music-related artefacts and archives. The collection includes mainly instruments of European art music from the Renaissance to the present day, ranging from woodwind and brass,¹¹ keyboard,¹² plucked and bowed string instruments,¹³ to music automata and electrophones. Since its foundation as the »Deutsches Museum von Meisterwerken der Naturwissenschaft und Technik« in 1903, the driving concept behind the collection and exhibition of musical instruments at the DM has been to highlight the close connections between science, technology, and music, and to illustrate the implementation of the laws of acoustics in the manufacture and use of instruments. Focusing on aspects of technological evolution and function of musical instruments, and showcasing both historical and contemporary developments in instrument design and construction, the DM is thus different from several other museums, in which instruments have been typically displayed from the perspectives of fine arts, culture, or ethnography.¹⁴

From its early days the DM has been a pioneer in the use of experiential learning, combining original objects, replicas, models, experiments, and interactives, acting as a trendsetter for similar museums.¹⁵ This is not surprising because, for science and technology museums like the DM, interactivity has been linked to ideas of empowerment and participation, aiming to break down the boundaries between science, technology, and society.¹⁶ Additionally, a central feature of the DM's exhibitions are the daily guided tours by specialized

8 Baker/Istvandy/Nowak 2016 (note 1), p. 370.

9 Judith Dehail: Musealising Change or Changing the Museum. The Case of the Musical Instrument Museum from the Visitors' Perspective. In: *Museological Review* 18, 2014, pp. 53-59.

10 Silke Berdux, Sonja Neumann, Panagiotis Pouloupoulos: New Media for Musical Instrument Collections. Trend, Luxury or Necessity? In: *CIMCIM Bulletin* 1, 2013, pp. 5-7.

11 Heinrich Seifers: *Die Blasinstrumente im Deutschen Museum. Beschreibender Katalog*. Munich, Oldenbourg 1980.

12 Hubert Henkel: *Besaitete Tasteninstrumente. Exhib. Cat. Deutsches Museum. Musikinstrumenten-Sammlung*. Frankfurt (Main) 1994.

13 Bettina Wackernagel: *Europäische Zupf- und Streichinstrumente, Hackbretter und Äolsharfen. Exhib. Cat. Deutsches Museum. Musikinstrumenten-Sammlung*. Frankfurt (Main) 1997.

14 Panagiotis Pouloupoulos: *New Voices in Old Bodies: A Study of »Recycled« Musical Instruments with a Focus on the Hahn Collection in the Deutsches Museum (Deutsches Museum Studies 2)*. Munich 2016, pp. 52-53.

15 Wilhelm Füßl, Helmuth Trischler (Ed.): *Geschichte des Deutschen Museums. Akteure, Artefakte, Ausstellungen*. Munich 2003; see also Oskar Blumtritt, Ulf Hashagen, Helmuth Trischler (Ed.): *Circa 1903: Artefakte in der Gründungszeit des Deutschen Museums*. Munich 2003.

16 Marguerite Barry: *Please Do Touch. Discourses on Aesthetic Interactivity in the Exhibition Space*. In: *Participations. Journal of Audience and Reception Studies* 11 / 1, 2014, p. 220.



3 The permanent exhibition at the DM, Munich, before its closure in 2015. © DM, reproduced by permission

museum personnel, available to all visitors. The DM's long-standing tradition of »learning-by-doing« is also evident in the department of musical instruments, which from its very beginnings employed interactive devices, such as hands-on mechanical models or acoustic demonstrations along with texts, images, and graphics in its exhibition as a means of understanding and appreciating historical musical instruments and music. Over the years concerts, lectures, guided tours, and other special events, such as artistic projects which involved the museum staff or guest musicians playing on original instruments or copies, have been regularly offered

in the department's educational program. These are complemented by instrument-making and music-making workshops which have proved quite popular, especially with young audiences. However, despite being one of the DM's biggest attractions (on average more than 10,000 visitors take part in the guided tours and more than 1,500 attend the concerts every year), the exhibition of musical instruments (fig. 3), a large part of which had been designed in the early 1970s, had become rather outdated by the early 2000s – as much in terms of content as in terms of presentation and contextualisation.

The opportunity for a drastic transformation of the exhibition with the introduction of a new concept for media and sound came in 2010, as the result of a proposed »Masterplan« for the renewal of the whole museum until 2025. The renovation of most permanent exhibitions of the DM, including the exhibition of musical instruments, as part of this »Masterplan« provided the opportunity to rethink the museum's overall approach towards exhibition design and new media. However, due to the nature of its artefacts, the musical instrument exhibition faced special challenges which consequently called for special solutions. For instance, the fact that musical instruments are typically made of fragile materials in diverse sizes, shapes, and weights meant that effective showcase design had to be combined with measures for environmental monitoring in order to ensure their long-term preservation. Furthermore, a large number of instruments conceal complex mechanisms or electronic circuits that are difficult to describe or explain in a short text, resulting in exhibiting »black boxes« that require specialist information and knowledge to comprehend. Moreover, since most of the collection's instruments are maintained in non-playing condition for conservation purposes, the presentation and interpretation of their historical, technical, musical, or sociocultural aspects would be difficult to accomplish without the support of multimedia and demonstrations.¹⁷ Another, particularly important matter concerns the large number of visitors in the DM (about 1.5 million per year, including many school classes and families with children), as it creates several issues relating to the safety, sustainability, practicability, and compatibility of the selected equipment for the new permanent exhibition, especially since many visitors are prone to behaving differently at the DM than at an art museum or an archaeological site.

The Visitor Survey: Aims, Methodology, and Results

In order to improve the design of the DM's new permanent exhibition of musical instruments a visitor survey was conducted in 2013 before the old permanent exhibition's closure for renovation. The survey was conceived and designed by

the curatorial team of the DM's musical instrument department in collaboration with the department of museum pedagogics at the School of Education of the Technical University of Munich. The survey was carried out using a questionnaire with 31 questions, both multiple-choice and open, that was available in German and English. Apart from investigating the sociocultural background of the visitors, the survey also aimed to examine the visitors' connection with musical instruments and music as well as to record their demands regarding media and interactive exhibition elements. A further goal of the survey was to study the extent to which a stronger contextualization of the displayed artefacts could be achieved in the future exhibition by utilizing a variety of new media and interactives, especially those including sound.

A total of 246 visitors aged 14 to 80 from 36 countries took part in the survey which lasted two months, from 14 May to 16 July 2013. The total number and profile of participants in the survey was representative of the visitors at the musical instrument exhibition and also corresponded to the reference sample required for such a study. For comparison purposes, the survey was also circulated per email to a number of people who were familiar with the exhibition (such as regular concert attendees) and who were registered in the mailing list of the musical instrument department. The results were processed and summarized in a report which included statistical analyses of various data, such as the socio-demographic profile of the visitors, the circumstances of their visit to the exhibition and their general habits as museum visitors, their familiarity with musical instruments and music styles, as well as their comments concerning several important aspects of the exhibition, such as content, display, interpretation, and sound.¹⁸ The survey allowed the evaluation of the old exhibition of musical instruments, while also enabling the assessment of the current concept for the new permanent exhibition, taking into account the different personal backgrounds and interests of the visitors.

Although the survey was based on hypothetical assumptions given that some of the questions referred to the future and not to the existing exhibition, a fact known to all parties involved, the collected information about the visitor profile and visitors' answers on media and interactive elements pro-

¹⁷ Panagiotis Pouloupoulos, Sonja Neumann: Can »Sleeping« Instruments »Awaken« the Senses? The Complex Nature of Exhibiting Musical Instruments in the Deutsches Museum. Unpublished paper presented at the annual conference of ECSITE, Dreams: The Spirit of Innovation, Universeum, Gothenburg, 6 to 8 June 2013.

¹⁸ Silke Berdux et al.: Ergebnisse der Besucherbefragung in der Ausstellung »Musikinstrumente« im Juni/ Juli 2013. Unpublished Report. Deutsches Museum, Munich 2013.

vided concrete indications that helped further planning of the new exhibition. One of the survey's key results was that, compared to exhibitions in other departments of the DM that have been examined so far, the musical instrument exhibition has a different public in terms of age, gender, internationality, and subject or level of education.¹⁹ For example, in contrast to other departments, the visitors of the musical instrument exhibition were mostly adults with an average of 40 years, with more than half of them (57%) being female. Although about one out of two visitors (55%) originated from local (Munich), regional (Bavaria), or national (Germany) destinations, a considerable percentage (45%) came from abroad, representing different continents (Europe, Asia, America, Oceania). According to the recorded academic qualifications, most visitors had a high level of education, with almost one out of three (29%) holding a university degree. About one third of the participants were working in humanities and social sciences (28%), followed by professionals in technical or engineering fields (25%) and in natural sciences (13%). Therefore, the profile of the visitors in the musical instrument exhibition does not represent the typical public of the DM, which consists predominantly of a young, mostly male audience with an interest in technical and engineering sectors. As for their engagement with museums, more than a quarter of the survey's participants (28%) were habitual visitors, reportedly going to museums more than five times in a year, with one third of the total participants (31%) having already visited an exhibition of musical instruments in Germany or abroad, therefore allowing them to make comparisons. A significant result of the survey was that most visitors (85%) came to the exhibition in groups rather than alone, while about one fourth (27%) of the interviewees took advantage of the guided tours, suggesting that group-oriented activities should be given priority in the design of media and interactives for the new exhibition.

Regarding the visitors' musical taste, many diverse musical genres were mentioned in the survey, ranging from classical music, folk, and jazz, to pop, rock, heavy metal, hip-hop, blues, electronica, etc. Interestingly, more than two thirds of the participants (69%) were themselves musicians at an

amateur or professional level, since they stated that they played one or more instruments, mostly piano, guitar, flute, saxophone, trumpet, or drums. In addition, for the majority of participants the exhibition themes were connected to their personal interests (43%) or hobbies (38%), thus reflecting their strong ties with musical instruments and music. Another noteworthy fact was that one third of the interviewees (30%) attended the guided tours and live demonstrations with instruments played by the museum staff; these visitors also spent more time in the exhibition. Last but not least, two out of three visitors (67%) stated that they came to the musical instrument exhibition intentionally rather than by accident, with about one quarter (22%) naming this exhibition as the main reason of coming to the museum. This fact provided further evidence of the appeal of the DM's musical instrument collection and exhibition, especially considering that the museum consists of more than 50 different departments and thus offers a great, albeit daunting number of choices for visitors.

Concerning presentation and interpretation, although visitors found the exhibition generally satisfactory in terms of quantity and variety of the displayed instruments, particularly the historical specimens, their major criticism concerned the lack of opportunities for touching or playing on instruments as well as the limited information and explanation of the objects on display. Despite the generally positive attitude towards the guided tours and demonstrations, as well as the exhibition's overall arrangement, there were negative remarks about the absence of sound samples, the exhibition's rather old-fashioned ambience (literally and metaphorically), and the limited possibilities for interaction. It is worth mentioning that even though there was a clear demand among visitors for varied forms of presentation in the new exhibition, including sound samples from instruments or ensembles, interviews from instrument makers or musicians, or visual representations of acoustical phenomena or the function of instruments, there was also a slight preference for original objects over other proposed exhibition features, such as interactive elements, models, audio-guides, leaflets, films, multimedia kiosks, mobile devices, etc. Interestingly, for visiting families with children there were no clear preferences among the listed exhibition features. As had been anticipated, the presentation forms related to sound and interactivity proved to be the most popular options for the new exhibition. Furthermore, many visitors pointed out the importance of having

19 Annette Noschka-Roos: Evaluationsprojekte am Deutschen Museum. Besucherbefragung in der Ausstellung »Musikinstrumente«, URL: <http://www.deutsches-museum.de/forschung/forschungsbereiche/vermittlung/museologie/evaluationsprojekte/> [9. 8. 2017].

dedicated lounge areas where they could sit and relax while reading or listening to music. Equally notable was the willingness of many visitors (43%), particularly among foreign guests, to use their own multimedia devices (smartphones, tablets, etc.) in the exhibition. Finally, additional comments concerning the improvement of the exhibition related to the inclusion of more modern instruments, more sound samples and live demonstrations, more information on the historical and technical development of instruments, more interaction, and also to a general updating and modernization of the displays.

The Challenges of Integrating Sound in Musical Instrument Exhibitions

The visitor survey at the DM confirmed that sound is considered the most important element of a musical instrument exhibition.²⁰ At the same time sound imposes great aesthetic, didactical, and technical challenges for museums. As stated in the introduction to the catalogue for the *David Bowie Is* exhibition, »the use of sound in museums is relatively new, and we have much to learn about how to use it to its best effect«.²¹ Despite several visitor studies concerning the impact of sound in museums, to date little has been written specifically about sound in exhibitions of musical instruments. Moreover, first-hand experience from various museums has shown the complexities of the various options currently available for integrating sound in exhibitions. For instance, the most common method is to provide audio content at stationary speakers which run automatically or are activated by visitors e. g. by pressing a button. However, this option can result in constant and permanent sound, which can be irritating and confusing for both visitors and the museum staff when coming simultaneously from various sources and directions, particularly in crowded exhibitions. Advanced sound systems with directional speakers, sometimes referred to as »sound showers«, or sonic beams and hypersonic sound technology (HSS) that can offer a relatively localized sound of high fidelity have been applied as alternatives;²² however, these are expensive and

may not work efficiently for large groups. On the other hand, mobile devices such as multimedia guides with headphones have been criticized frequently for undermining opportunities of social interaction, which has led to the development of innovative flexible systems such as the *Sotto Voce*.²³ Nevertheless, research in museums has indicated that audio tours which employ mobile devices can enhance visitor experience more efficiently than other presentation formats, without necessarily constraining social interaction, even in exhibitions which do not focus on music or sound.²⁴ This observation may provide encouragement for musical instrument collections to start reassessing the »hierarchy of senses and knowledge«,²⁵ since it has been shown that the sense of hearing prevails over vision in exhibitions of musical instruments and that music is perceived by visitors as a process rather than as a complete artwork.

In the case of the new musical instrument exhibition at the DM, the integration of new media and sound corresponded to major changes to the existing exhibition design. From an early stage it was decided that the future display of musical instruments at the DM should move from a static, taxonomic presentation of the collection to a more fluid, narrative-based exhibition, involving a radical reduction of instruments on display to provide more room for context, the chronological arrangement in 12 thematic modules, and the selection of important instruments from the collection as highlights. Additionally, the new exhibition design should aim to offer not only improved security and environmental monitoring, but more physical and intellectual accessibility of the artefacts, by offering, for example, various levels of information and contextualization as well as better orientation through easily recognizable graphics, symbols, and colors. Furthermore, the exhibition design should include the parallel development of a new concept for media and sound, involving a mix of analog and digital elements.

20 Dehail 2014 (note 9), pp. 56-59.

21 Broackes/Marsh 2013 (note 4), p. 17.

22 Nikos Bubaris: Sound in Museums – Museums in Sound. In: Museum Management and Curatorship 29/4, 2014, p. 395.

23 Paul M. Aoki et al.: Sotto Voce. Exploring the Interplay of Conversation and Mobile Audio Spaces. In: Proceedings of the Conference for Human Factors in Computing Systems (CHI'02). Minneapolis 2002, pp. 431-438.

24 Jeffrey K. Smith, Pablo P.L. Tinio: Audibly Engaged. Talking the Walk. In: Digital Technologies and the Museum Experience. Handheld Guides and Other Media. Ed. by Tallo Loïc and Kevin Walker. Plymouth 2008, pp. 75-76.

25 Dehail 2014 (note 9), p. 59.

During the design of the new exhibition the DM's curatorial team visited numerous musical instrument or music-related exhibitions in order to explore some of the latest multimedia and to trial the various solutions for integrating sound that are currently available. This was a significant process as it indicated that, for example, systems that may have worked efficiently for a temporary exhibition may have certain limitations for a permanent one, particularly when combined with high visitor attendance.²⁶ After much consideration regarding sound in the DM's new permanent exhibition of musical instruments the use of mobile devices, such as audio-guides, smartphones or tablets, equipped with high-quality headphones was determined as the preferred solution. These can provide visitors with more freedom of movement, bringing them closer to the artefacts while preventing the cacophonous diffusion of sound in the exhibition, especially considering the large number of visitors at the DM. Apart from keeping the emphasis on the displayed objects, the main advantage of such devices is that they can offer very good sound quality as well as the possibility of connection to additional media (e.g. screens) thus allowing synchronization with images and film. On the downside, the maintenance, updating, or replacement of such devices can often be costly and problematic for museums – an important point that should be carefully considered when planning a permanent exhibition. The seemingly silent character of the new exhibition at the DM will be counteracted with various activities that involve live sound and can be targeted at diverse groups, such as families, school classes, or elderly visitors. For instance, several hands-on mechanical demonstrations will allow visitors to listen to the sounds they themselves produce. Furthermore, guided tours including live performances will continue to be offered twice a day and concerts will take place in the exhibition on a regular basis. The museum is also planning to acquire new musical instruments which can be used as hands-on objects for visitors as part of the guided tours, a practice that has been successfully implemented in other in-

stitutions.²⁷ It is expected that such measures will greatly improve the visitor experience at the exhibition, while conforming to space and budget restrictions.

Conclusions

It has been argued that »confronted with its incapacity to exhibit music itself, the museum exhibits musical instruments«. ²⁸ However, in order to exhibit music, museums have to find effective ways of dealing with sound. In the case of musical instrument exhibitions, where sound is essential for contextualizing the displayed artefacts, a variety of new media has been used to offer solutions, although more field research is needed in order to understand the degree of visitors' engagement with – and satisfaction from – such media. As shown in many of the museums that display popular music mentioned above, music-related exhibitions do not always rely or focus on instrument collections; in some cases, such exhibitions can function effectively even without objects, since storytelling and visitor agency is achieved with various sound-based media,²⁹ thus offering a different model to traditional instrument exhibitions. Nevertheless, music and sound are the connecting themes, and, technically as well as concerning storytelling, museums that house and display musical instrument collections can learn a lot from music-related exhibitions which are not based on artefacts. Furthermore, the experience from the DM's visitor survey showed that although there is no perfect recipe for a musical instrument exhibition, sound and forms of interaction should be given priority in the exhibition design. At the same time, it highlighted that even when inevitable compromises depending on the museum's available resources, infrastructure and personnel have to be made, it is important to take into consideration above all the profile and demands of its public.

26 Anna Landreth Strong: Sonic Innovation. Immersive Rock and Pop Exhibitions at the Victoria and Albert Museum. Unpublished paper presented at the Montagskolloquium of the Research Institute for the History of Science and Technology. Deutsches Museum, Munich 2017.

27 Dehail 2014 (note 9), pp. 57-58.

28 Ibid., p. 53.

29 Kathleen Wiens: Our Canada, My Story. The Canadian Museum for Human Rights, March – September 2017. In: CIMCIM Bulletin 2, 2017, pp. 33-34.

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