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Knowledge through Digitized Material? - Objects, Images, Perspectives

June 15-16, 2023

Research Depot of the German Maritime Museum/ Leibniz Institute of Maritime History, Bremerhaven | Haus der Wissenschaft, Bremen.

Together with the Center for Materials and Processes (MAPEX) and the Institute for Knowledge Media (IWM), the German Maritime Museum/ Leibniz Institute of Maritime History (DSM) is organizing the conference "Knowledge through Digitized Materials? - Objects, Images, Perspectives." On two consecutive days, the partners of the SAW transfer research project "Digital Materialities" will discuss with guests from science and culture the aesthetic dimension of digitized material, its evidential function and its barriers.

Digitization allegedly is occupied with a thorough visualization and analytical accessibility of objects. By revealing formerly hidden details and traces, it is intended to better express their 'true' form. At the same time, digitization has the potential for paving the ways for a worldwide exchange of knowledge about these objects, making them available on the web with little legal restrictions or technical access barriers. We illuminate, colorize, enlarge, look at details, and comment.

But what different materialities are actually produced in the digital objects? To what extend is a digital object an artifact in its own right, and therefore detached from its 'analogue' counterpart? Could it acquire any epistemic value at all without such a distance - be it in the sense of an abstraction or a concretion? And what intrinsic disturbances, distortions, artifacts and biases are haunting technical digitization processes – as 'ghosts in the machine' whose analysis, in turn, can unlock great epistemic potential?

Digital images – both in museums and exhibitions and in industry, medicine, or the natural sciences – have a fundamental heuristic function today: Information is derived from them that is decoupled form an empirical verifiability at an incremental rate.

However, still too seldom reflected seem the various processes and forms by which media techniques inscribe themselves into virtual objects. Different digitization media and methods are not simply extensions of our senses, but operate with their own specific media-technical

logics. These digitization media and methods in part generate quite 'non-human' sensory data which must first be 'translated' for the human senses. They imply (in a double sense) 'programmatic' decisions that influence the representation of objects and artifacts; and they actively shape our perspectives on them. As a consequence, they also guide the way knowledge is produced.

And last but not least, in museums as well as in scientific or industrial contexts, we have to ask on which levels digital and analog objects can (and should) function, interact and conflict with each other? How do spaces, situations and everyday practices influence the perception of digital objects, and which specific media-technical environments are constituted in these processes?

The conference will address these issues from an overarching perspective as well as through specific case studies from museum and industrial application areas. In doing so, it brings theory and practice from different disciplinary fields into close exchange.

Registration for face-to-face participation is open until April 30, 2023. Registration for virtual participation is open until Mai 31, 2023. Conference language is English.

Program:

June, 15th   Practice and Vision on Site at the Research Depot of the German Maritime Museum/ Leibniz Institute of Maritime, Bremerhaven

13:00-14:00   Arrival at the Research Depot and Informal Get-Together.

14:00-14:45   Opening Talk **Sebastian Vehlken** (DSM) and **Cornelius Borck** (Uni Lübeck):

I Calculate Something You don't See! Notes from the Universe of Technical Images
In a grand cultural historical gesture, the media philosopher Vilèm Flusser already in the 1980s sharply separated a dawning "universe of technical images" from all historically earlier processes of imaging: Computer-technical 'calculations' – in Flusser's words – let "experiences, cognitions, values and actions mutate"; they let humans "dive up into the zero-dimensional", from which any dimensionality becomes "projectable" or simulable. Dialogically and through a series of exemplary cases, Sebastian Vehlken and Cornelius Borck explore the heuristic and epistemic potentials of 'digital objects' in science and culture that populate Flusser's universe today. From euphorias about the most detailed 'digital twins' to the autonomously mutating dream image worlds of deep neural networks, they discuss their respective informational/material lifes of their own, and tap their ensuing not-quite-self-evident modes of appearance and knowledge production.

Sebastian Vehlken is Professor for Knowledge Production and Digital Media at the German Maritime Museum and Carl-von-Ossietzky University Oldenburg.
Cornelius Borck is Professor for History, Theory and Ethics of Medicine and Natural Science and Director of the Institute for the History of Medicine and Science, University of Lübeck.

Panel 1: Art Science Technology? The Aesthetic Dimension of Digitization as a Scientific Method Chair: DSM

The process of digitizing is a process of creation in its own right. Imaging, detailing, lighting, etc. could be used to control images and create unique image qualities. The panel brings perspectives of digitizing technology into a dialogue with creative art forms and shows the potential of scientific work on the digitized material.

14:45-15:20   **Jörg F. Wagner** (University of Stuttgart)

Digitization of Precision Mechanical Devices: The Case Study Gyrolog
Precision mechanical devices form a central area of the history of technology: Historically and didactically reprocessed, they allow insights into developments and objects that shape today's civilization worldwide. This is particularly interesting when the devices can be interpreted as mechanical computers, whose functionality is far less vividly realized by electronic means in modern times. Against this background, the Gyrolog project dealt with the digitization of technical gyro instruments in order to open up better historical and didactic access to the nowadays rather inconspicuous but significant and complex key technology of inertial navigation. Gyrolog's object of study was a joint gyro collection of the University of Stuttgart, the Technical University of Munich and the Johannes Kepler University Linz, which was transferred into a publicly accessible object catalog with two-dimensional representations and three-dimensional models. The talk will present methodological developments as well as selected results and findings of the Gyrolog project.

Jörg F. Wagner joined the University of Stuttgart as a professor for flight measurement technology in 2003. His fields of work are mechanics and mechatronics, navigation, and history of science.

15:20-15:55   **Roland Meyer, Simon Rothöhler** (Ruhr-University Bochum)

Virtual Image Archives
This paper presents the research project *Virtual Image Archives: Visuality, Operativity, Logistics*, which was started in fall 2022 within the framework of the Bochum SFB 1567 Virtual Life Worlds. The project, on the one hand, focuses on the imaging processes with which virtual objects, tools, and environments are acquired with archivological intent, preserved for the long term, indexed, and made accessible. On the other hand, it investigates interface visualizations that make large image archive datasets explorable and

navigable in the form of virtual image spaces. Based on concrete examples of current digital cultural heritage projects and museum collection interfaces, the SFB project – from a media and image studies perspective – asks about the epistemic status of archive collections which are generated by image-sensing technologies and virtually mobilized in digital image spaces,and inquires the specific entanglement of (meta-)imagery and data form in these virtual archives.

Roland Meyer works as a research associate at the DFG Collaborative Research Center Virtual Life Worlds at Ruhr-Universität Bochum. Most recently published: Gesichtserkennung (Wagenbach 2021).

Simon Rothöhler is Professor for Visual Culture and Media Infrastructures at the Institute for Media Studies at Ruhr University Bochum. Most recently published: Medien der Forensik (Transcript 2021).

Break

16:25-17:00   **Guided Tour through the Research Depot**

17:00-17:35   **Show Results from Prototyping for Exhibition in Digitization Lab**

18:00-19:00   **Conference Dinner**

June, 16ᵗʰ   Theory with a Reality Check at the Haus der Wissenschaft, Bremen

Panel 2:   Truth or Falsification? The Evidential Function of Digitized Material
                        Chair: MAPEX

Do objects only 'speak' if they are digitized? We often attribute the power to reconstruct lost contextual information to digitization. Digitized objects develop a character of evidence that need to be critically questioned, both in museums and in other areas of society. The panel combines perspectives from the museum with approaches from the natural sciences.

9:00-9:35   **Fauzia Albertin** (CNR-SCITEC, Italy)

Works of Art Digitization – Beyond Visible Light
The last years have seen significant development in digitization techniques designed for cultural heritage objects, from 2D and 3D imaging and 3D laser scanning acquisitions to 3D printed replicas. Nevertheless, the imaging of an object's surface do not come close to telling us its whole story. The execution techniques, the chemical nature of the materials, the hue and pigment mixing, and, more generally, what is invisible to the naked eye complete the picture and give both heritage professionals and the general public a comprehensive knowledge of works of art. Many analytical techniques and instrumentations have been

developed and improved in recent decades and, nowadays, in situ imaging techniques are predominating the field. Furthermore, the use of complementary methodologies such as Hyperspectral Imaging (HSI) in the visible and infrared range, Macro X-ray fluorescence (MA-XRF), and X-ray tomography, greatly enhance the capability of material characterization in complete safety for the works of art. The actual challenge is to thoroughly exploit the potentiality of these techniques and interpret them to obtain new insight into the objects. In this talk recent approaches to digitization, scientific imaging, evaluation of fused imaging data, their potential and their perspective will be presented and discussed.

Fauzia Albertin is physicist and specialist in scientific investigations for Cultural Heritage at the Giulio Natta Institute of Chemical Sciences and Technologies, Perugia, Italy.

9:35-10:10   **Tomas Sauer** (University of Passau)

Physical and Virtual Objects: There and Back Again
Digitization of museum artifacts can be done in various ways, most prominently X-ray tomography and photogrammetric techniques. Both of them come with advantages and difficulties, but the main question in the end is: what to do with the data. Using an enigma cryptography machine as an example, we will describe some of these challenges and show how the data can be handled, manipulated and even be (partially) returned to the physical world by means of additive manufacturing methods aka 3d printing.

Tomas Sauer is professor for Mathematical Image Processing at the University of Passau and Research Scientist at Fraunhofer EZRT.

10:10-10:45   **Jana Gelbrich** (EIPOS)

What Wood Can Tell if You Understand Its Language.
Wood has always been an important material for constructions or items of daily use. Therefore, many wooden objects from earlier times are of historical and/or archaeological significance, containing a lot of information about the earlier times. In this lecture, some examples will show the possibilities of investigation and the results that allow the wood to tell its story or the story of the object. Not all examinations are purely digital, but the advantages and disadvantages or limitations of these new examination techniques will also be discussed.

Jana Gelbrich is a certified expert in wood preservation (EIPOS), wood preservation research and wood heritage management,

Break

11:20-11:55   **Vincent Fernandez** (NHM UK)

Using X-ray Micro-Computed Tomography in Cultural and Natural Heritage
X-ray computed tomography (CT) is becoming a widely used technique in cultural and natural heritage, many museums and academic institute being equipped with laboratory X-ray CT systems. When these systems reach their limitations, Synchrotron based X-ray CT allows to push these limits, being able to reach higher energy and image denser specimen.

Vincent Fernandez is Beamline Scientist at ESRF - The European Synchrotron and Scientific associate of the Natural History Museum London.

11:55-12:30   **Pia Götz** (MAPEX)

Revealing the Secrets of Historical Navigation Instruments – A Story About old Instruments Brought to Novel Virtual Life
Sensitive museum objects safely locked behind glass. This is the impression that many people have of conventional museums. How can we use new technologies to make the objects more vivid and accessible? X-Ray Computed Tomography not only offers new possibilities when it comes to scientific material research questions. Especially in combination with historical background knowledge, new groundbreaking insights can be acquired. But what more can we expect from emerging technologies? Are we able to reanimate objects and give museum visitors the opportunity to travel back in time? At first glance, it seems like a paradox: The quest for new digital technologies to take mankind back to a time when digitalization did not exist. As with almost everything in life, there are drawbacks to digitalization. How we take advantage of the benefits and classify the drawbacks will be discussed in this talk.

Pia Götz studied Maritime Technologies and Environmental Physics. She is a PhD candidate currently working in a trans-disciplinary project on the digital materiality of maritime museum objects at the University of Bremen.

12:30-13:00   **Discussion of an Interim Status/Collection of Topics for further Discussion**

Lunch

Panel 3:   Visual Aid or Barrier to Knowledge?   Chair: IWM

The museum is an experimental space where we can experience and explore how digital objects are created, how they affect us, and how we learn with them. The panel will present approaches for methodically investigating the connection between knowledge processes and digital objects and its implications for the sustainability of knowledge processes. It also asks about the transferability of findings from museum visitor research to other informal and formal learning contexts.

14:00-14:35   **Werner Schweibenz** (University of Konstanz)

Digital Materialities – Virtual Contact with the Real Object in the Museum Space?
Traditionally, museums have been associated with collections of physical objects, the distinctive criteria separating museums from other memory institutions such as libraries and archives. While collections of the latter can be transferred into the digital sphere, physical aspects of museums and their objects resist digitization. However, this only holds true for physical dimensions but not for information dimensions of objects and collections. The latter can be digitized, adding virtual properties to the physical ones. This is important as museums are primarily visual institutions and "don't-touch places". Information technology offers possibilities to present digital representations of objects in contexts that are inaccessible for "real things", an aspect already mentioned in Walter Benjamin's essay "The Work of Art in the Age of Mechanical Reproduction". In this way, digital materialities establish contact with real objects in the museum space, both the physical and the virtual one.

Werner Schweibenz works as information specialist for MusIS - Museum Information System, Library Service Centre Baden-Wuerttemberg, University of Konstanz, Germany, supporting the State Museums of Baden-Württemberg in museum documentation, online exhibitions and cultural portals.

14:35-15:10   **Birgit Brucker** (IWM)

Learning about Dynamic Movement Patterns in Desktop and True Virtual Reality Environments: The Influence of Different Ways of Changing the Point of View and Learners' Visuospatial Ability
Virtual Reality (VR) applications offer various advantages for learning contexts. Dynamic virtual 3D-objects depict movements and can provide different perspectives. The effectiveness of different interaction formats and learners' visuospatial ability (VSA) on pictorial recognition, factual knowledge, presence, and motion sickness was investigated in two experiments (desktop vs. "true" VR). Participants controlled either the orientation of the 3D-objects (mouse interaction; interaction via controllers) or their own viewpoint (camera position; observer position). Results showed that high-VSA learners outperformed low-VSA learners. In exp. 1, high-VSA learners achieved better recognition performance by controlling the camera position, whereas low-VSA learners suffered from this format. In exp. 2, high-VSA learners achieved better recognition performance by controlling the objects, whereas low-VSA learners profited from moving around the objects. The true VR environment yielded more presence and higher motion sickness. In sum, the results from desktop VR environments cannot be transferred on a one-to-one bases into true VR environments.

Birgit Brucker is deputy head of Peter Gerjets' Multimodal Interaction Lab and she also coordinates the Mixed Reality Lab at the Leibniz-Institut für Wissensmedien, Tübingen.

15:10-15:45   **Manuela Glaser** (IWM)

Potentials of Digital Models of Exhibition Objects for Reception
Based on theoretical models (Ainsworth, 1999, 2006; Chi & Wylie, 2014; Dudley, 2010; Rau, 2020; Schweibenz, 2020), three studies about the potentials of X-ray-based digital models of exhibition objects complementing their original or photographic counterparts on the visitors' reception in presence and online exhibitions will be presented. The first exploratory study showed that although visitors see multiperspectivity, interactivity, depth of elaboration, and detailedness as potentials of digital models of exhibition objects, the mere provision of digital objects is not sufficient to significantly impact the cognitive, emotional, motivational, and behavioral aspects of the visitors' reception. Rather, didactic concepts are needed to integrate digital models of exhibition objects meaningfully into the exhibition and relate them to their original counterparts in order to produce significant impact. This was done in the second and third study, examining the effects of digital models on content-related focus setting, multiperspectivity, and knowledge acquisition. The data of both studies are currently analyzed, and results will be presented at the conference.

Manuela Glaser has been a researcher in the Realistic Depictions lab at the Leibniz-Institut für Wissensmedien in Tübingen since 2007. One of her research foci is on informal learning in museums.

15:45-16:30   **Concluding Discussion**

Project Partner:

How to get to the Research Depot   Eichstraße 13, 27572 Bremerhaven

How to get to the Haus der Wissenschaft   Sandstraße 4/5, 28195 Bremen